2018

A quick study to evaluate feasibility of length/ height measurement by AWWs in an ICDS project of Delhi

Research Report

National Institute of Public Cooperation and Child Development

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A Report
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List of Abbreviations

AWC	Anganwadi Centre
AWW	Anganwadi Worker
BMI	Body Mass Index
CBGP	Community-Based Growth Promotion
CDPO	Child Development Project Officer
DLHS	District Level Household & Facility Survey
GMP	Growth Monitoring and Promotion
ICDS	Integrated Child Development Services
MUAC	Mid Upper Arm Circumference
MGRS	Multi-centric Growth Reference Study
MIMS	MediCiti Institute of Medical Sciences
MUW	Moderately Underweight
NFHS	National Family Health Survey
NIPCCD	National Institute of Public Cooperation and Child Development
NHM	National Health Mission
NNM	National Nutrition Mission
SD	Standard Deviation
SUW	Severely Underweight
TEM	Technical Error of Measurement
UNICEF	United Nations Children's Fund
UTs	Union Territories
VAV	Variable Average Value
WFA	Weight-for-Age
WHO	World Health Organization

Executive Summary

EXECUTIVE SUMMARY

Undernutrition does not only contribute to high levels of mortality but also threatens the future of many young individuals by adversely affecting their physical, cognitive and social growth. Undernutrition as a public health problem had been addressed in Millennium Development Goals in past and in post 2015 scenario, Sustainable Development Goal especially goal 2 "to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture" seeks to direct nations to tackle undernutrition in all its forms. Undernutrition manifests itself in a number of ways such as poor growth, increased susceptibility to infection, poor work capacity, mental retardation etc. It does not only alter the life of the individual affected by it but also disturb the economy at large. Preventing undernutrition is one of the key strategies to combat this menace, which requires regular monitoring of the nutritional status of the population especially the vulnerable ones (children, women, elderly).

Ministry of Women and Child Development through its ICDS Programme is contributing in identification of growth faltered children. At Anganwadi Centres growth monitoring and promotion is carried out based on weight for age growth indicator which enables Anganwadi worker to refer children at risk to medical facilities for early treatment of childhood illnesses or congenital diseases. However, extensive research has shown that stunting (low height/age) and wasting (low weight to height) indicators are also crucial for the healthy development of the child, which is also the main goal of ICDS mission. The consequences of stunting are serious, irreversible and life-long. The losses in physical growth and brain development associated with chronic under-nutrition during the first two years of life can never be regained. Furthermore, the children who survive undernutrition do not often meet their full human potential. Stunted children are more likely to have poor cognition and learning performance in childhood than their well-nourished counterparts.

Therefore, integrating height measurement with existing weight measurement for detecting growth faltering will provide a complete assessment of nutritional status of children as evident from the success of Maharashtra Rajmata Jijau Mother-Child Health & Nutrition Mission (2005-2010). Further, it will also provide comprehensive monthly data on the nutrition status of children in each habitation enabling timely action for correction of nutrition and health status of children. Therefore the current study was under taken to

assess the feasibility of height measurement as a part of the core services provided by AWWs under ICDS.

The major findings and conclusions of the study are presented below:

1. Profile of Respondents

- Overall, the sample comprised 30 AWWs, 450 children {300 children aged 2- 6 years and 150 infants (0-2 years)} of which 233 were females and 217 were males.
- The mean age of the AWWs was 38 ± 6.4 years. The mean age of children aged 2-6 years was 45 ±11.9 months and of infants was 7.2 ± 4.2 months.
- All AWWs were educated enough to meet the eligibility criteria for the position of AWW and completed high school. Forty percent of the AWWs were either graduate or intermediate.

2. Baseline Knowledge of AWWs regarding Growth Monitoring and Length Measurement

i. Importance of growth monitoring as reported by AWWs

- All the AWWs agreed that growth monitoring is one of the important services provided at AWCs under ICDS. They stated that growth monitoring helps assess growth and development of the child.

ii. Knowledge of AWWs about length/ height measurement as a method to assess growth

- 70 per cent of AWWs reported that growth of children can be assessed by measuring both length/height and weight whereas 30 per cent stated that weight is the only measure for assessing growth among children.
- Also, 46.7 per cent AWWs reported that weight measurement alone is sufficient to predict nutritional status of children.
- Further, over 85 per cent AWWs agreed that length/ height measurement for children can be carried out in same manner as we do in case of adults.

iii. Knowledge of AWWs about length/ height measurement

- Majority (96.7 %) were not aware of the difference between length and weight.
- Further, as anticipated none of the workers were aware of the instruments or the names of the instruments used for measuring length/ height.

iv. Knowledge of AWWs about indicators of growth

- It was heartening to see that majority (80 %) of AWWs were aware that low weight for age is termed as under-weight. However, low height for age is termed as stunting was known to fewer (13.3%) AWWs. Further majority (86.7 %) stated that it is not necessary that a child with low weight of age will also have low length/ height for age.

v. Perception of AWWs about inclusion in ICDS

- All the AWWs agreed that of Length/height measurement should be included in ICDS with above 70 per cent agreeing that it should be included for all children under 6 years. AWWs suggested that Length/ Height measurement will help them assess overall development as they will be able to assess vertical growth as well.

3. Impact of Training on Knowledge level of AWWs regarding Growth Monitoring and Length Measurement

- Knowledge of AWWs regarding growth monitoring and length / height measurement improved tremendously. The difference in responses obtained pre training and post training for most of the variables were found to be of statistical significance.
- Knowledge about the fact that length/ height measurement in addition to weight measurement to assess growth of children improved by 20 per cent.
- Further, responses to difference between height and length showed highly significant improvement as 26 AWWs (post training) in comparison to 1 AWW (pre training) were able to correctly state that height is a vertical measure and length is horizontal measure.
- Other variables for which the pre and post training difference was highly significant are names of instruments used for measuring height and length and growth indicator of stunting.
- The results also show that more AWWs were able to describe correct way of measuring length/height while child is crying and in case child is not able to straighten his/her legs, in the post training assessment

i. Perception of AWWs about inclusion of Length/height measurement in ICDS post training

- In comparison to pre training period, only 25 in comparison to 30 AWWs in post training agreed that it should be included. 5 AWWs who disagreed felt that it will be extra work load. However, they said that if an increment in honorarium is added they might as well do it.
- Majority of AWWs (88 %) stated that length/ height measurement should be included for all children under 6.

ii. Perception of AWWs about the training

- They found the training beneficial as it equipped them with skills to take height and length measurements. Moreover, it helped them clarify doubts with respect to growth monitoring.

4. Difficulties Faced by AWWs while Measuring Length

- Out of 30 AWWs who were given training in length measurement, 9 AWWs i.e. close to 1/3rd reported that they faced difficulty measuring length of infant. Main problems identified by AWWs while measuring length of infants includes child moving legs too frequently, child crying continuously and not relaxing despite all efforts, lack of practice etc.

i. Difficulties faced by AWWs while measuring height

- Out of 30 AWWs 7 AWWs reported that they faced difficulty measuring height of children 2-6 years. Main problems identified by AWWs includes setting the child in correct position (Frankfort Plane), inability to adjust child in same position which move the head plate even with the help of one assistant.

5. Impact of Training on Skills of AWWs to Take Length and Height Measurement

- It was interesting to note that relative TEM for height measurements taken by AWWs and trainer were <1%. This indicates acceptable variability in the accuracy of measurements taken by AWWs.). It is worth emphasizing that % TEM for almost all AWWs were lower than 0.5% suggesting greater accuracy.
- Relative TEM for length measurements taken by AWWs were found to be within acceptable limits for almost all AWWs except for 2 AWWs.

6. Adherence to Critical Points in Length and Height Measurement Technique

- AWWs observed the critical points carefully while taking most of the length and height measurements. However, it was noticed that AWWs faced problems in setting child' head in correct position i.e. Frankfort plane, due to which the measurement reading vary slightly between AWWs and research team.

7. Anthropometric Assessment of Children

- The mean weight of infants, children (2-5 years) and children (5-6 years) was 6.9 ± 1.7 kg, 12.9 ± 2.1 kg, 16.2 ± 2.3kg respectively. A sex wise comparison shows that male children weighed more than their female counterparts at all ages. Similarly for height, male children were taller than female children in all age groups.

i. Prevalence of under weight

- Majority of infants (86%) and young children (73.7 %) had normal weight for age. Further, the prevalence of moderate underweight and severe underweight among infants was 8 percent and 4.7 percent respectively. On the other hand close to 22 percent of young children aged 2-5 years were moderately underweight, the percent prevalence was found to be higher for females.
- Interestingly, a total of 5 children (2 infants and 3 young children) showed upward deviation from the median weight for age z -score and were falling in the category of overweight i.e. Z score >2 SD.

ii. Prevalence of Stunting

- The prevalence of stunting was high (42.4 per cent) among children age 2-5 years with approximately 16 per cent being severely stunted. However, among infants under 2 years of age, it was heartening to note that more than 87 per cent had normal length for age and stunting was observed in merely 13 per cent.

iii. Prevalence of Wasting

- Prevalence of wasting among infants and young children was 8 per cent and 4 per cent respectively. Surprisingly, wasting was far less prevalent among children under 5 in comparison to stunting or underweight.

iv. BMI for age

- BMI for age Z scores analysis showed that majority of infants (85.3 %) and young children (94.1) had normal BMI for age. About 10.7 per cent of infants were found to be thin out of which 2.7 per cent were severely thin. However among young children (aged 2-5 years) severe thinness was more prevalent affecting 4.2 percent.
- About 7.2 per cent males and 2.9 per cent of females in age category 2-5 years were found to be having BMI for age Z score > +1 SD.

v. Nutritional profile of children above 5 years

- About one fourth of the children were undernourished. Underweight and stunting was observed in about 24.4 per cent and 29.3 per cent of children respectively.
- Similar to infants and young children aged 2-5 years, more number of female were found to be underweight in above 5 years category.

8. Recommendations

Based on the results of the study, following recommendations have been drawn:

- In ideal situations, growth monitoring of children is suggested to be done by trained anthropometrists with formal health education however, such individuals may be difficult to find in resource-poor settings. As an alternative, community workers such as AWWs and ASHAs could be formally trained to measure weight and height on regular basis for growth monitoring.
- As per the findings of the study, all AWWs were able to measure height and most were able to measure length of children post one day training. However current study was a small scale study and therefore its results cannot be generalised for entire country. A multicentre study targeting AWWs from all States/UTs is recommended.
- In order for growth monitoring and promotion to be effective; training, supervision and support for AWWs must be improved in terms of frequency and quality.
- The study revealed that majority of AWWs was unaware about the indicators of growth other than underweight. Low height for age is termed as stunting was new for them. Therefore, it is recommended that special skill based training on anthropometry covering knowledge about various ways to detect growth faltering should be undertaken so that the knowledge of workers is improved.

- Shortage of quality, standardised equipment is one of the major hindrances to regular growth monitoring. Ensuring availability of good quality, standardised equipment will aid the process of growth monitoring.
- Since stunting is a chronic problem and influenced by nutrition and care during first 1000 days therefore growth monitoring and promotion activities should target infants and children under 2 years on priority basis to detect early growth faltering for the prevention of the same.
- Further the latest data of NFHS 4 shows that on one hand where prevalence of underweight and stunting among children under 5 is declining, wasting including severe wasting has shown an increasing trend across all states making height/length measurement on regular basis even more important.
- One of the activities envisaged under NNM is to record weight every month and height/length every 3 months. The training of AWWs may be done in a cascadal manner and thereby a pool of Master trainers can be created which can ultimately train ground level functionaries for taking height/length measurement. Therefore, it is suggested that AWWs should be formally trained in a phased wise manner to measure height of 0-6 year children under NNM.

Introduction

INTRODUCTION

Undernutrition not only contributes to loss of about 3 million young lives a year but also threatens the future of many young individuals by adversely affecting their physical, cognitive and social growth (UNICEF, 2016). India, one of the largest economy accounts for the highest number of Under 5 child deaths. Of these 50% of child deaths are attributable to undernutrition. Undernutrition as a public health problem had been addressed in Millennium Development Goals in past and in post 2015 scenario, Sustainable Development Goal especially goal 2 "to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture" seeks to direct nations to tackle undernutrition in all its forms.

Undernutrition manifests itself in a number of ways such as poor growth, increased susceptibility to infection, poor work capacity, mental retardation etc. It does not only alter the life of the individual affected by it but also disturb the economy at large. Preventing undernutrition is one of the key strategies to combat this menace, which requires regular monitoring of the nutritional status of the population especially the vulnerable ones (children, women, elderly). There are various ways to assess extent of undernutrition but for children, the easiest, quick and non- invasive way to assess undernutrition is by the way of assessing physical growth. Wasting (low weight for height), stunting (low height for age) and underweight (low weight for age) are the globally used indicators of growth that provides estimates of undernutrition among children under the age of 5 years and also help assess severity of the nutrition situation. Prerequisites to computing prevalence of wasting, stunting and underweight are a comparable standard/ reference data set, measures of weight, height/ length and correct age.

1.1 Nutritional Status of Children under 5 in India

As per the National Family Health Survey (NFHS-4) the prevalence of child underweight (0-5 years) stands at 35.7 per cent, stunting at 38.4 per cent and wasting at 21 per cent. However, on comparison with the estimates of NFHS-3 (2005-06), where in the prevalence of child underweight was nearly 43 per cent, stunting was 48 per cent and wasting was 19.8 per cent, a declining trend is observed for stunting and underweight which imply improvement in nutritional status of children since NFHS-3 (2005-06).

Despite this improvement, still India homes a large numbers (47 million) of stunted children suggesting that ample needs to be done to improve the poor state of children in our country (UNICEF, 2016). Further, an increasing trend has been observed in case of wasting, which in itself is a matter of concern for a country like ours which needs to further improve on structural, programmatic and managerial capacity to undertake regular growth monitoring of children in terms of measuring height/length.

1.2 Growth Monitoring and Promotion

Growth is a dynamic measure of health. It can be defined as a positive change in the size/ mass of a growing individual. It is a proven fact that optimal child growth occurs when optimal nutrition (exclusive breastfeeding, age appropriate complementary feeding), optimal environment (no microbiological contamination, no smoking) and optimal health care (Immunization) are ensured. Deprivation of any of the above mentioned factors may result in deviation (negative) from the optimal growth resulting in undernutrition (WHO, MGRS, 2006). The most cost-effective way to address child undernutrition is to prevent it. This imply ensuring that all the children who are born with a normal/ healthy weight continue within the normal range and those who had low birth weight are brought swiftly into a healthy growth range. Growth monitoring (a process of following the growth rate of a child in comparison to a standard by periodic, frequent anthropometric measurements in order to assess growth adequacy and identify faltering early) in most developing countries is done through monitoring weight primarily but other bodily measurements like length/height, mid upper arm circumference (MUAC) can also be included. The rationale for measuring growth for tracking child's health is based on the following assumptions:

- Growth is a good proxy for overall child well-being and its measurement serves as a robust indicator.
- Growth is a dynamic process that is made visible by monitoring changes in anthropometric indices and reflects current, not past, events.
- Adequate nutritional (anthropometric) status is dependent on meeting standards for growth velocity (Griffith and Rosso, 2007)

Further, growth monitoring can also be used as a tool to influence family-level decisions and individual child nutritional outcomes by increasing awareness about child growth, caring practices, by increasing demand for other services, as needed (UNICEF, 2008).

1.3 Growth Monitoring and Promotion as a service under ICDS

Growth Monitoring and Promotion (GMP) is one of the essential services provided under Integrated Child Development Services (ICDS). However, currently measurement of malnutrition through ICDS mainly focuses on measuring weight (underweight, i.e. weight for age), which no doubt is expedient at the village level. ICDS through GMP activities caters to young children where in weight for age growth cards are maintained for all children below six years at Anganwadi Centres (AWCs). As per the guidelines, weight of an infant registered at an AWC should be measured weekly in first month and thereafter on monthly basis for up to three years of age. Children from three to five years are required to be weighed on quarterly basis by Anganwadi Worker (AWW). This activity has proven to be useful in detecting early growth faltering and identification of Moderately Underweight (MUW) and Severely Underweight (SUW) children in a community.

However, stunting and wasting have been kept out of the ambit of ICDS. While wasting is still measured through mid-upper arm circumference in some states, stunting is only measured through periodic surveys like National Family Health Survey (NFHS), District Level Household & Facility Survey (DLHS) etc. Though 'underweight' is a composite indicator suggesting both chronic and acute weight loss, and may therefore be tricky to interpret. Low height for age (stunting) on the other hand is more indicative of long-term nutrition and reflects the cumulative effects of undernutrition and infections since and even before birth (WHO, 2010) and therefore providing a more concrete basis for planning appropriate and well targeted nutrition interventions to curb under nutrition. Further, wasting by itself is used as an indicator to detect Severe and Moderate Acute Malnutrition which is far more life threatening than SUW or MUW.

1.4 Strengthening of existing system to tackle child undernutrition

Despite witnessing tremendous progress in the area of agricultural production and industrialization, contributing to economic growth and improvement in health parameters, in general undernutrition continues to be a major public health problem in our country. One of the key reasons for it is that the problem of under-nutrition is complex and multi-dimensional and is affected by a number of factors including poverty, inadequate food consumption due to access and availability issues, inequitable food distribution, improper maternal infant and child feeding and care practices, inequity and gender imbalances, poor

sanitary and environmental conditions; and restricted access to quality health, education and social care services. A number of other factors including economic, environmental, geographical, agricultural, cultural, health and governance issues complement these general factors in causing undernutrition of children.

Considering the complexity of the nature of the problem and poor nutritional state of children in our country, there is a need to adapt innovations in the methods and systems used for assessing and addressing this problem for which political will be essential. Shifting the focus from merely undertaking growth monitoring using weight to height can be a step in right direction. There is enough evidence exist to show that height measurement is a "simple, feasible and relatively inexpensive indicator that can be effectively used to monitor the impact of our national programmes on the nutritional status of our people (Gopalan, 1987). Further, high levels of stunting among the poor have been cited as one of the main nutrition and health challenges faced by India time and again (Martorell, 2013). Studies have shown that the stunting in general is much widely prevalent than low weight-for-age. Therefore, assessing malnutrition using low weight-for-age may underestimate the true prevalence of growth retardation. A shift in the focus from weight-for-age to height-for-age and weight-for-height for assessing malnutrition and identifying populations at risk is the need of the hour (Reddy, 2006). Globally, this has been realised and stunting has been also been identified as a major global health priority gaining focus of several high-profile initiatives like Scaling Up Nutrition, the Zero Hunger Challenge and the Nutrition for Growth Summit. Reducing and preventing stunting is crucial to the six global nutrition targets adopted in 2012 by World Health Assembly for 2025 (WHO, 2012) and has been proposed as a leading indicator for the post-2015 development agenda. It would be of great relevance if our public health policy could be directed towards continuous assessment, monitoring and prevention of stunting along with underweight. In order to meet this monitoring of growth of children under 5 years at regular intervals will be a regular phenomenon under ICDS and will prove to be beneficial as suggested by many research studies (Griffiths and Rosso, 2007).

1.5 Rationale:

Child malnutrition is India's biggest public health challenge which needs to be tackled with careful and timely identification of growth faltering. ICDS with its wide network of AWCs and a trained cadre of AWWs are well contributing in identification of growth faltered children. AWWs maintain monthly weight records of under-five children and

monitor their growth progress which enables Anganwadi worker to refer children at risk to medical facilities for early treatment of childhood illnesses or congenital diseases. However, the focus in the ICDS system so far has been only on assessment of underweight among children under six years. Extensive research has shown that stunting (low height/age) and wasting (low weight to height) indicators are also crucial to the healthy development of the child, which is also the main goal of ICDS mission. The consequences of stunting are serious, irreversible and life-long. The losses in physical growth and brain development associated with chronic under-nutrition during the first two years of life can never be regained. The 2013 Lancet nutrition series (Black et al, 2013) estimated that stunting causes about one million child deaths annually world-wide, due to weakened immunity. Furthermore, the children who survive undernutrition do not often meet their full human potential. Stunted children are more likely to have poor cognition and learning performance in childhood than their well-nourished counterparts.

Therefore, integrating height measurement with existing weight measurement for detecting growth faltering will provide a complete assessment of nutritional status of children as evident from the success of Maharashtra Mission. Further, it will also provide comprehensive monthly data on the nutrition status of children in each habitation enabling timely action for correction of nutrition and health status of children. Therefore the current study was under taken to assess the feasibility of height measurement as a part of the core services provided by AWWs under ICDS.

1.6 Objectives:

The study was carried out keeping in mind the following objectives:

1. To assess the feasibility of conducting length/ height measurement by AWWs at AWCs.
2. To assess skills of AWWs for measuring length/height of children upto six years of age.
3. To evaluate the effect of training in improving the knowledge of AWWs regarding length/height measurement.
4. To identify bottlenecks and problems faced by AWW related to height assessment of children upto six years of age at AWCs.
5. To assess the nutritional status of infants (0-2 years) and young children (3-6 years).

Review of Literature

REVIEW OF LITERATURE

Ministry of Women and Child Development through its largest programme ICDS offers regular growth monitoring as one of its essential services for children upto 6 years of age. Following a national level workshop on the new World Health Organization (WHO) Growth Standards, consensus has emerged for adoption of Weight-for-Age (WFA) in Integrated Child Development Services (ICDS). However, growth monitoring in community setting using length/ height for age or weight for height as an indicator is as important as using weight for age and therefore a beginning has to be made for adoption of all the standards i.e. height, weight and Body Mass Index (BMI) within ICDS and the National Health Mission (NHM). Height measurement is not only a simple to measure but also it can be used as an index to assess overall development (Gopalan, 1987). In this section an attempt has been made to review studies which have focused on the nutritional status assessment using length/ height assessment in community settings and its benefits.

2.1 Prevalence of Stunting and Wasting

Most commonly used indicators of growth are underweight, stunting and wasting. However, estimates of stunting often goes unrecognized due to difficulty in visually identifying stunted children and the lack of regular monitoring of linear growth in community setting. Also estimation of wasting is only limited to diagnosis of Severe Acute Malnutrition/ Moderate Acute Malnutrition in high burden areas. Few studies have shown that the prevalence of stunting is way more than low weight for age and thus a nutritional status assessment based low weight-for-age may underestimate the true prevalence of growth retardation (Reddy, 2006).

A study was conducted by Mukherjee (2014) to understand the knowledge, attitude and practices of mothers with respect to nutrition of their under five children and to measure the extent of malnutrition among under five children (n=300) in Turbhe stores urban slums in Navi Mumbai. The study used the WHO guidelines for measuring malnutrition. The results showed that stunting was highly prevalent affecting 157 children (52.3%). Severe stunting was found among 91 children (30.3%) and moderate stunting among 66 children (22%). About 133 (44.3%) were underweight with 57 children (19%) being severely underweight and 76 (25.3%) being moderately underweight. Also severe wasting was observed among 36 (12%) children and moderate wasting among 49 children (16.3%).

Another study was carried out to assess the magnitude of growth faltering among 0-6 years children in an adopted village of MediCiti Institute of Medical Sciences (MIMS) and to study their nutritional status. A total of 60 children were enrolled from three Anganwadis of the village and they were studied for growth faltering episodes, breast-feeding and dietary practices by interviewing their mothers through a predesigned and pre-tested proforma. Anthropometric measurements taken showed that about 47% of the children were underweight, 57% were stunted, and 25% were wasted. The author concluded low socio economic status, poor breastfeeding, dietary and care practices to be responsible for increased frequency of growth faltering among young children leading to such high prevalence (Enakshi and Sudha, 2012).

Shamanewadi and Kondagunta, 2016 conducted a study among children below 6 years residing in Field Practice Area of Department of Community Medicine, Kamineni Institute of Medical Sciences Narketpally, Nalgonda district, Telangana to estimate the prevalence of malnutrition in children below 6 years and to examine the influence of socio- demographic factors on children's health. A total of 933 children (493 females and 440 males) participated in the study. In the study the prevalence of underweight, stunting and wasting was found to be 56.6 %, 62.6% and 25.7% respectively suggesting tremendous need for health and nutritional education among the parents.

A study was conducted to study the feeding practices, dietary intake and growth pattern of children, 9-36 months of age, in an urban slum ICDS project in Delhi. The anthropometric analysis revealed that the children were grossly undernourished. Seventy five per cent children were underweight (<–2 SD), while 35% severely underweight (<–3 SD). Approximately, 74% children were having short stature (chronic malnutrition) with 39% severely stunted. Nineteen per cent children were excessively thin (wasted) (Kapur et al, 2005).

2.2 Growth, Growth monitoring and Promotion

Growth can be defined as an increase in the size/mass of a growing individual. Growth is dynamic in nature and thus provides best measure of health and nutritional status (Lotfi, http://archive.unu.edu/unupress/food/8F104e/8F104E02.htm). The trajectory of growth in childhood and adolescence and stature in adult life is set during crucial first 1000 days of life (Martorell, 2013).The growth patterns of an individual or population are sensitive to adverse

conditions, genetic predispositions and environmental changes and despite the body's adaptive mechanisms it may result in life-long consequences if not detected in time (Preedy, 2011). Regular Growth monitoring thus becomes really important.

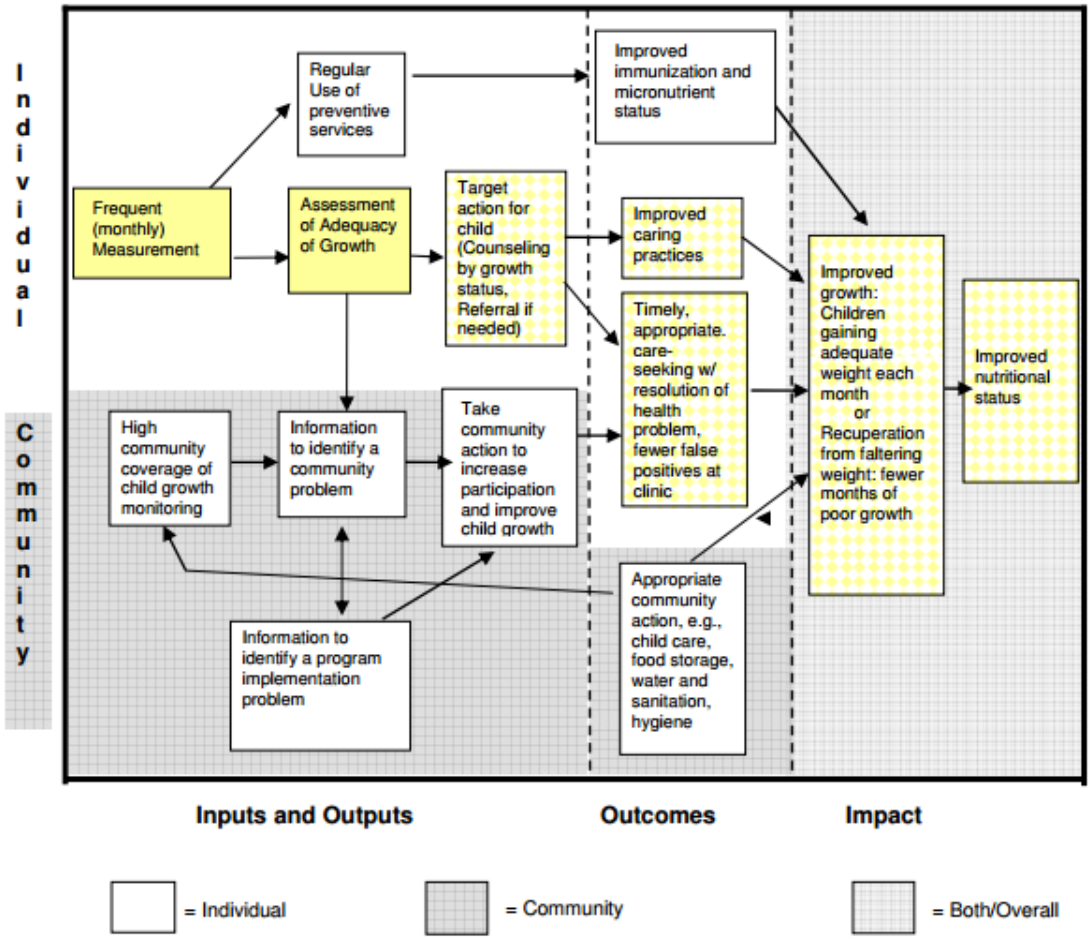
Growth monitoring is not a new concept. Its history dates back to 1850s where regular weighing of infants was advocated by Guillot in the1850s for assessing the adequacy of lactation in neo-nates, and later in the 1870s infants were weighed systematically beyond the perinatal period for the first time by Cnopf in Nuremberg (Ashworth et al, 2008). Growth Monitoring is the process in which growth rate of a child is followed and in comparison to a standard by frequent anthropometric measurements at regular intervals in order to assess growth adequacy and identify early faltering. However, it is often confused with nutritional status surveillance which involves measuring the anthropometric indices of a child once a while or in frequent intervals (Griffiths and Rosso, 2007).

Another term commonly used in this context is "Growth Monitoring and Promotion (GMP)". The World Health Organization (1986) defines GMP as a nutritional intervention that measures and charts the weight of children from 0 to 5 years of age and uses this information to counsel parents so that they take actions to improve child's growth. GMP is a prevention activity carried out with a purpose to increase awareness of caregivers about child growth, improve caring practices, increase demand for other services, as needed and serves as the core activity in an integrated child health and nutrition program, when appropriate and may contribute to reductions in child malnutrition, morbidity and mortality on a public health scale.

Community-Based Growth Promotion (CBGP) is an upcoming strategic approach that takes the concept of GMP a step further and addresses the multiple causal factors impacting on a child's growth and development. It focuses on involving entire community in the process of decision making regarding health and nutritional status of children. It provides evidence for improving child's growth enabling environment and stimulates activities in the community to achieve it. CBGP is a relevant complementary activity for many nutrition and health related actions (Griffiths and Rosso, 2007).

The concepts of growth monitoring, growth monitoring & promotion, and community-based growth promotion are interlinked and can be best explained with the diagrammatic representation given below. While GM remains the foundation upon which improved growth and improved nutrition status can be achieved, CBGP takes into account the child's broader

environment, which may also affect his or her growth. Thus, keeping growth monitoring and promotion at the centre of a wide range of prevention projects and programs may prove to be a cost effective approach in lowering malnutrition rates (Melville et al, 1995).



Community-Based Growth Promotion Conceptual Framework **(Source: Griffiths and Rosso, 2007)**

2.3 Role of Community Workers in Growth Monitoring

Growth Monitoring and Promotion services are provided for children in the district by peripheral workers with different professional backgrounds, such as health extension workers, voluntary community health workers, maternal and child health and nutrition experts all across the globe (Bilal et al, 2014). According to the healthcare plan of the Ethiopian Federal Ministry of Health, health extension workers are given the responsibility to provide GMP through measuring weight, height, MUAC and educating mothers about breastfeeding, complementary feeding, and other health-related issues (Ethiopia Nutrition Programme, 2008). Whereas in India, GMP is promoted as one of the key activities of ICDS programme, operating under Ministry of Women and Child Development. Under this

programme, AWWs performs growth monitoring for children under 6 years using weight measurement on monthly or quarterly basis and provide counselling to mothers about infant and young child feeding, hygiene and sanitation, early child development etc. (www.icds.nic.in).

However, existence of merely a growth monitoring programme itself does not ensure attainment of goals of curbing malnutrition. The success of growth monitoring and promotion depends on the knowledge and expertise of the community workers. A number of studies have been conducted in India to evaluate the knowledge and skills of Anganwadi Workers in implementing growth monitoring and it was observed that AWWs had poor knowledge regarding growth monitoring and it was concluded that the low level of knowledge can be attributed to the lack of quality training (NIPCCD, Delhi, 2016; Thakare et al, 2011; Bhasin et al, 1995; Bhardwaj et al, 2016). In-service training on growth monitoring emphasizing on using growth monitoring as a tool to detect early growth retardation and intervene at an early stage to prevent subsequent problems (Kapil et al, 1991).

2.4 Role of Training in Improving Growth Monitoring related Knowledge and Skills

Growth monitoring is a specialised technique which requires sufficient knowledge and training for its proper implementation. In this section, a review of literature is presented to show effect of training in improving growth monitoring related knowledge and skills. Since growth monitoring is one of the important functions of AWWs, it would be interesting to see if training results in a positive change.

Prabha et al, 2016 conducted a study with the objective to evaluate the changes in knowledge of Anganwadi workers regarding growth monitoring through knowledge up-gradation training in Chiraigaon (intervention) and Cholapur (control) blocks of Varanasi district. A total of 66 AWWs participated in the study and it was observed that the mean score of knowledge improved from 19.7 (max. Score was 30) to 25.3 in the intervention group suggesting knowledge and skill up-gradation being effective in improving the knowledge status of AWWs with regard to growth monitoring.

Ayele et al, 2012 conducted a study where 6 individuals without prior anthropometry experience were selected from a community in Ethiopia and trained to perform weight, height, and MUAC measurements on children. The trained community drawn volunteers

were divided into two teams and dispatched to 18 communities in rural Ethiopia to perform anthropometric measurements on 606 consenting pre-school children. The data thus obtained was used to calculate several metrics of measurement reproducibility, including the Technical Error of Measurement (TEM) and relative TEM. The results of the study showed that intra-anthropometrist TEM (and relative TEM) for height was 0.35 cm (0.35%), for weight was 0.05 kg (0.39%) and for MUAC 0.18 cm (1.27%). Corresponding values for inter-anthropometrist reliability were found to be 0.67 cm (0.75%) for height, 0.09 kg (0.79%) for weight, and 0.22 kg (1.53%) for MUAC. Thereby, concluding that community-drawn anthropometrists were capable of providing reliable measurements for height and weight that could be used to assess the impact of interventions for childhood undernutrition. However the reliability measures for MUAC were below the acceptable value.

Knowledge and practices of teachers on growth monitoring were improved by nutrition education in 6 months after intervention (Mandiwana et al, 2015). The results also showed an improvement in skills, such as the procedure to take anthropometric measurements.

All the above studies suggest that training can be effective in improving the knowledge level and skill set of any individual irrespective of the knowledge level, if imparted adequately and appropriately.

2.5 Limitations with Respect to Assessing Length and Height in Community Setting

Assessment of height and length of children on regular basis at community level have not been tried out. This is not because assessing linear growth is difficult or highly technical, but it requires strict adherence to steps listed in its technique and attention to minute details. Further, the accuracy and reliability of length and height measurements are highly dependent on the robustness, precision, calibration, standardization and maintenance of the anthropometric equipment; the measurement technique used and the built-in data quality procedures (de Onis et al, 2004).

At community level main factors that may affect the quality of length and height measurements may include the

- Setting where measurements are taken i.e. inadequate light facility or unavailability of flat surface to place height measuring equipment
- Behaviour and cooperation of the child and caregiver

- Accuracy and precision of the instruments
- Skill level of person taking measurement (anthropometrist's technical capability)
- Data recording methods

Adequate and appropriate skill training and adherence to standardized methods and procedures are thus essential to reduce measurement error and minimize bias (de Onis et al. 2004).

A recently published report of Riddhi Foundation, which is engaged in providing support to the Government of Kerala in partnership with UNICEF for improving child nutrition and survival in Attappady block of Palakkad district, has clearly pointed out the need for proper equipment to measure length and height of children. The finding was based on the pilot study aimed at tracking every child living in the block and monitoring their nutrition status as well as growth from birth till the age of 5 years for appropriate interventions. The responsibility of providing anthropometric data (weight and height/length) was laid on AWWs. However, after the first evaluation report AWWs were able to provide only weight data for monitoring. They observed that it was difficult for the ICDS functionaries to accurately measure the height/length at the AWCs because of lack of proper equipment. (http://www.riddhifoundation.org/reports/prj_nsak.pdf)

Further, when Ministry of Women and Child Development adopted the new standards they highlighted a few concerns and challenges. One of them was regarding the process of using infantometers to measure the length of infants, which most respondents felt was rather intricate to do on a regular basis as they found out that even nurses and post- graduate students were often not very comfortable measuring the length of infants using infantometers. Other challenges mentioned were difficulty in holding baby in one posture in the first few weeks after birth, babies moving around (not cooperating) on the meter and mothers not allowing their babies to be placed on the infantometer. Another concern cited was regarding the accuracy of height measurements taken by grassroots level ICDS workers, and the issue of having to repeat measurements to get an accurate reading among small children (Solution Exchange for the Maternal and Child Health, 2008).

Methodology

METHODOLOGY

3.1 Locale of the study

The study was conducted in an ICDS Project of South Delhi – Mehrauli. The CDPO of the Mehrauli ICDS project was contacted for the number of Anganwadi Centres operating under the project from which a total of 30 AWCs were selected randomly for the study.

3.1.1 Criteria for locale selection

- Due to limitation of time, a nearby locale was considered for the study as an important criterion in order to complete the study in time.
- Further, the working hour for AWCs is 9:00 am to 2:00 pm and the nature of data that we intend to obtain is highly technical. A distant study site would have influenced the quality of data as more time would have lapsed commuting.
- Also it was convenient for the research team to carry heavy anthropometric equipment on daily basis to the study site.

3.2 Study population and sample size

It was a cross sectional study aimed to evaluate feasibility of height/ length measurement by AWWs, therefore the study population included AWWs and young children aged 0-6 years coming to AWCs.

A total of 30 AWWs, one from each AWC was selected for the study. All of them were given a formal training on carrying out anthropometric measurements on infants and children. It was decided that each AWW will measure the height of 10 children in age group of 3-6 years and the length of 5 infants in the age group of 0-2 years.

The sample selection for the study is as follows:

Study population	Participants from each AWC	Total participants from 30 AWCs
AWWs	1	1*30 =30
Children from age group (0-2 years)	5	5*30=150
Children from age group (3-6 years)	10	10*30=300

3.3 Study design

The study was planned to be carried out in two phases:

1. Training Phase

2. On- Field Assessment Phase

3.3.1 Training Phase

During this phase, AWWs were called at National Institute of Public Cooperation and Child Development (NIPCCD), Headquarters at Hauz Khas, New Delhi between 22-24th November, 2016 and were given formal hands on training by research team. One day training cum workshops was conducted for Anganwadi Workers in batches of 10 functionaries and therefore a total of 3 trainings were conducted for 30 AWWs. The primary objective of the training was to introduce height/ length as one of indices for growth monitoring and build in capacity among AWWs to be able to carry out height/ length measurement in a community setting. Prior to the training, a pre training questionnaire was administered to assess knowledge of AWWs about growth monitoring and length/ height measurement. The training was imparted as per the programme schedule enclosed (Annexure 1) and the participants were given reading material explaining techniques of anthropometric measurements. Impact of training on the knowledge level of AWWs was reassessed on field during data collection phase.

3.3.2 On- Field Assessment Phase

This phase was predominantly marked by data collection, wherein a research team constituting two Project Assistants visited each AWC. The data for the study were collected between 2.12.2016 to 17.1.2017. During the visit, weight and height/ length measurements were carried out on young children (0-6 years) firstly by AWW followed by Project Assistants. While the AWWs were carrying out the measurements, it was the responsibility of the research team to observe if the current technique is being followed, which was recorded in the observation schedule. For the study, one Project Assistant was in charge of measuring height and weight of children 3-6 years and other for measuring length and weight of infants 0-2 years. Once the measurements for all 15 children were completed by both AWWs and research team, questionnaire was administered to AWWs to assess their post training knowledge.

3.4 Tools and Technique

In the present study, data were elicited using a varied set of tools and techniques. Qualitative data assessing knowledge and skills of AWWs were collected using questionnaire cum interview schedule and observation schedule (Annexure 2) whereas quantitative data (anthropometric data) were collected using anthropometric instruments. The details of tools and techniques used are as follows:

SNo.	Participants	Method/ Mode of data collection	Tool Description	Parameter
1.	AWWs	Questionnaire cum Interview schedule	Composed of both open and closed ended questions	• Profile of the respondents • Knowledge of AWWs about growth monitoring • Knowledge and perception of AWWs about height/ length measurement • To assess feasibility and problems in measuring length/ height
2.	AWWs	Observation Schedule	A checklist of critical points in an anthropometric technique	• Skills of AWWs in carrying out anthropometric measurements (weight, length and height)
3.	Children (0-6 years)	Digital Weighing Scale (Salter)	Range Min. : 5 Kg Max : 150 Kg Least count : 0.1 Kg	• Weight
4.	Children (3-6 years)	Stadiometer (SECA)	Range Min. : 0 cm Max : 215 cm Least count : 0.1 cm	• Height
5.	Infants (0-2 years)	Infantometer (SKYTECH)	Range Min. : 0 cm Max : 90 cm Least count : 0.1 cm	• Length

3.5 Ethical Committee Approval

The ethical committee approval was taken for the research study from the Institutional Review Board committee, constituted by the Institute. The children were included into the study based on the willingness of their parents and after taking an informed consent from them.

3.6 Field Testing

Prior to data collection, the tools proposed for the study were field tested. The tools were pre-tested with 5 AWWs, 10 children (3-6 years) and 5 infants (0-2 years). Necessary modifications in the questionnaire were done based on the results of pre-test.

3.7 Data Processing & Analysis

- Data was collected, the quantitative and the qualitative data were entered and coded separately in excel and analysed using STATA statistical package.
- Anthropometric data were entered in WHO Anthro V 3.2.2 software and Z score for weight for age, height for age, weight for height, BMI for age were calculated for children (0-5 years).
- For children above 5 years of age, data were analysed in excel based on WHO reference standards for 5- 19 years (MGRS, 2006).
- Technical error of measurements were computed for length and height measurements taken by AWWs and researcher in order to assess feasibility of measuring length/ height measurement by AWWs at AWCs using formula given below

$$\text{Absolute TEM} = \sqrt{\frac{\sum_{i=0}^{n} Di^2}{2n}}$$

where,
ΣD^2 = summation of deviations raised to the second power
n = number of volunteers measured
i = the number of deviations

$$\text{Relative TEM} = \frac{TEM}{VAV} \text{ X } 100$$

where,
TEM = Technical error of measurement expressed in %
VAV = Variable average value

- The most common way to express the error margin in anthropometry is by means of the technical error of measurement (TEM), which is an accuracy index and represents the measurement quality and control dimension. The TEM index allows anthropometrists to verify the accuracy degree when performing and repeating anthropometrical measurements (intra-evaluator) and when comparing their measurement with measurements from other anthropometrists (inter-evaluator). The

TEM index, which is the standard deviation between repeated measures, is used for the calculation of the intra-evaluator variability – variation of repeated measurements of the same person (or a group of persons) performed by the same anthropometrist – and inter-evaluator – variation of measurements performed by different anthropometrists in the same group of persons (Perini et al, 2005). The tables for the report were produced on the basis of identified indicators.

- Apart from using simple statistical measures such as frequencies, percentages, averages and ranges, an attempt has also been made to show a significant association between the two variables via chi-square test.

3.8 Limitations of the Study

- Locale of the study was restricted to merely one ICDS project due to time constraint.
- A greater sample size (both AWWs and Children) could not be included due to time as well as fund constraint.

Results
&
Discussion

RESULTS & DISCUSSION

4.1 Profile of the Projects

The study was conducted in Mehrauli ICDS project of Delhi. The project is established in an urban setting with a total of 138 AWCs spread over a vast area of South Delhi. For the current study a total of 30 AWCs were selected using random sampling technique. Thirty Anganwadi Workers (AWWs) operating AWCs in areas of Andheria more, Chattarpur, Chattarpur Pahari, Mehrauli, Kishanganj, Mahipalpur, Saidullah jab, Aya Nagar, Sultanpur, Ghittorini were selected to participate in the study.

4.2 Profile of Respondents

Overall, the sample comprised 30 AWWs, 450 children {300 children aged 3- 6 years and 150 infants (0-2 years)} of which 233 were females and 217 were males. The mean age of the AWWs was 38 ± 6.4 years. The mean age of children aged 3-6 years was 45 ±11.9 months and of infants was 7.2 ± 4.2 months. Table 1 summarises profile of children based on sex.

Table 1: Profile of the Children

Profile Parameters	**Male No. (%)**	**Female No. (%)**
Infants aged 0-2 years	82 (54.7%)	68 (45.3%)
Children aged 3-6 years	135 (45%)	165 (55%)
Age of children	**Male**	**Female**
Age of Infants 0-2 years (mo)	6.9 ± 4.5	7.6 ± 3.4
Age of Children 3-6 years (mo)	46.7 ± 11.8	45.4 ± 11.9

4.2.1 Distribution of AWWs by Educational Status

As it can be seen in Table 2, majority (40 percent) of the AWWs were either graduate or intermediate. A few (5 AWWs) were educated enough to meet the eligibility criteria for the position of AWW and were High School pass. One AWW reported that she had post graduation degree.

Table 2: Educational Status of AWWs

Educational Qualifications	AWWs No. (%)
High school (10th)	5 (16.7)
Intermediate (12th)	12 (40.0)
Graduate	12 (40.0)
Post graduate	1 (3.3)

4.3 Baseline Knowledge of AWWs regarding Growth Monitoring and Length Measurement

4.3.1 Importance of growth monitoring as reported by AWWs

Knowledge of AWWs regarding growth monitoring being an important component of ICDS program was assessed. It was observed that all the AWWs agreed that growth monitoring is one of the important services provided at AWCs under ICDS. They supported their response by stating reasons listed in Table 3. The various reasons stated by AWWs highlight one key point that growth monitoring helps assess growth and development of the child.

Table 3: Percentage Distribution of AWWs about Importance of Growth Monitoring

Perception about importance of growth monitoring	AWWs [No. (%)]
To identify and take care of underweight children	5 (16.7)
To assess physical growth and treat malnutrition	2 (6.7)
To monitor weight and prevent under nutrition	11 (36.7)
To monitor the growth and counsel the parents on the same	2 (6.7)
To assess the overall development of the child as per age	10 (33.3)

In another study, where knowledge and practices of pre-school teachers on growth monitoring were evaluated, it was observed that most participants responded that growth monitoring was important for assessing weight, disease risk and immunization (Mandiwana et al, 2015).

4.3.2 Knowledge of AWWs about length/ height measurement as a method to assess growth

Knowledge of AWWs about ways of measuring growth was assessed and 70 per cent of AWWs reported that growth of children can be assessed by measuring both length/height and weight whereas 30 per cent stated that weight is the only measure for assessing growth among children. Additionally, over 85 per cent AWWs agreed to the statement that length/ height measurement can also be carried out for children as we do in case of adults. Rest workers reported that they were not aware if length/ height can be measured for children 0-6 years.

4.3.3 Knowledge of AWWs about length/ height measurement techniques

Baseline knowledge of AWWs regarding length/ height measurement and instruments used for the same was assessed so that content of training programme can be aligned accordingly. AWWs were asked if they understand the difference between height and length and as anticipated majority (96.7 %) were not aware of the difference. Only one AWW correctly stated that height is measured in standing position i.e. it is a vertical measure whereas length is measured by placing a child in supine position i.e. it is a horizontal measure. Further, none of the workers were aware of the instruments or the names of the instruments used for measuring length/ height. Additionally, a few more general questions pertaining to length/ height measurement were asked like if a child is crying then how will the measurement be carried out. To this 73 per cent AWWs correctly reported that child will be made to calm down first with the help of toys or assistance of mother and then the measurement will be taken. It was also asked what if child is unable to straighten both his/ her legs while measurement. For this, just about 1/3rd of the total participants reported that the knees can be pressed slightly to straighten the leg and thereafter measurements can be taken or measurement can also be taken with one straighten leg .

4.3.4 Knowledge of AWWs about indicators of growth

Knowledge of AWWs about indicators of growth like under-weight and stunting was assessed in order to see if they are aware of the correct terminology for defining growth faltering. Table 4 shows the responses of AWWs regarding growth indicators. It was heartening to see that majority (80 %) of AWWs were aware that low weight for age is termed as under-weight. However, low height for age is termed as stunting was known to

fewer (13.3%) AWWs and similarly only 13 percent of the AWWs were aware of the fact that child who has low height/length for age will also have low weight for age.

Table 4: Knowledge of AWWs about Growth Indicators

Knowledge of AWWs about indicators of growth	**AWWs [No. (%)]**
Underweight (Low weight for age)	24 (80.0)
Stunted (Low height for age)	4 (13.3)
Child with low length/ height for age will also have low weight for age	4 (13.3)

4.3.5 Perception of AWWs about inclusion of Length/height measurement in ICDS

AWWs were asked if length/ height measurement should be included in ICDS for growth monitoring along weight measurement. All the AWWs agreed that it should be included and suggested that Length/ Height measurement will help them assess overall development as they will be able to assess vertical growth as well. Additionally, they were asked if length/height measurement should be included for all children under 6 years, 0-3 years or 3-6 years; For this, majority of AWWs (73.3 %) stated that length/ height measurement should be included for all children under 6 and seven (23.3%) AWWs wanted inclusion of length/ height measurement for children in age group 3-6 years. Moreover, it was encouraging to note that 100 per cent of AWWs were optimistic and opined that if they are given proper training, they will be able to take length as well as height measurement of children without any difficulty.

4.4 Impact of Training on Knowledge level of AWWs regarding Growth Monitoring and Length Measurement

As planned in the study, a one day training on growth monitoring and anthropometric assessment of children with special reference to length/height measurement was imparted to selected AWWs. The improvement in knowledge of AWWs post training period was evaluated during field visits for anthropometric data collection using same set of questions as asked previously. Table 5 presents difference in the knowledge level of AWWs.

Table 5: Pre and Post Training Comparison of Knowledge of AWWs regarding Growth Monitoring and Length measurement

Knowledge of AWWs regarding Growth Monitoring and Length Measurement	**Pre training [No. (%)]**	**Post training [No. (%)]**	**p value**
Both weight and height measurement can be used to assess growth of children	21 (70.0)	27 (90.0)	**0.01**
Length/ height of children under 6 years can be measured as it is done for adults	26 (86.7)	29 (96.7)	0.161
Height is a vertical measure and length is horizontal measure	1 (3.3)	26 (86.7)	**<0.001**
Instruments			
Stadiometer is used for measuring height	0 (0.0)	19 (63.3)	**< 0.001**
Infantometer is used for measuring length	0 (0.0)	20 (66.7)	**< 0.001**
Growth Indicators			
Underweight is Low weight for age	24 (80.0)	22 (73.3)	0.542
Stunted is Low height for age	4 (13.3)	26 (86.7)	**0.001**
Weight measurement alone is sufficient to predict nutritional status of a child	14 (46.7)	13 (43.3)	0.795
Measuring Length/Height in Specific Situations			
Correct ways of measuring length if child is crying continuously	22 (73.3)	30 (100.0)	**0.002**
Correct ways of measuring length if child's legs are not straighten	9 (30.0)	29 (96.7)	**< 0.001**

It can be inferred from Table 5, that knowledge of AWWs regarding growth monitoring and length / height measurement improved tremendously. The difference in responses obtained pre training and post training for most of the variables were found to be statistically significance ($p<0.01$). Knowledge about the fact that length/ height measurement in addition to weight measurement to assess growth of children improved by 20 per cent. Further, responses to difference between height and length showed highly significant improvement as 26 AWWs (post training) in comparison to 1 AWW (pre training) were able to correctly state that height is a vertical measure and length is horizontal measure. Other variables for which

the pre and post training difference was highly significant are names of instruments used for measuring height and length and growth indicator of stunting. In the post training period, 63.3 per cent (19 AWWs of 30) were able to tell that Stadiometer is used for measuring height and 2/3rd (20 AWWs) stated that length of children under 2 can be measured using Infantometer. Knowledge of AWWs regarding correct term used to describe low height for age i.e. stunting improved from 13.3 per cent to 86.7 per cent.

The results also showed that more AWWs were able to describe correct way of measuring length/height while child is crying and in case child is not able to straighten his/her legs, in the post training assessment. Thus, it can be concluded that training has a positive impact on the knowledge level of the AWWs. Similar results were observed in the study conducted by Mandiwana et al, 2015, where training helped improved knowledge about growth monitoring. A study by Prabha et al, 2016 also concluded that the knowledge and skill up-gradation intervention was effective in improving the knowledge status of AWWs with regard to growth monitoring.

4.4.1 Perception of AWWs about Inclusion of Length/height Measurement in ICDS Post Ttraining

During the post training assessment, AWWs were again asked if length/ height measurement should be included in ICDS for growth monitoring along weight measurement. In comparison to pre training period, 5 AWWs amongst them did not agree, thereby 25 in comparison to 30 AWWs agreed that it should be included. Five AWWs who disagreed felt that it will be extra work load; however they said that if an increment in honorarium is added they might as well do it. Additionally, they were asked if length/height measurement should be included for all children under 6 years, 0-3 years or 3-6 years. Pre training, about 73 percent felt that length/ height measurement should be included for all children under 6. However, post training, majority of AWWs (88 %) stated that length/ height measurement should be included for all children under 6. Whereas, out of those who agreed, a total of 3 (12%) wanted inclusion of height measurement for children in age group 3-6 years.

4.4.2 Perception of AWWs about the training

All the AWWs were really happy with the training. They found the training beneficial as it equipped them with skills to take height and length measurements. Moreover, it helped them

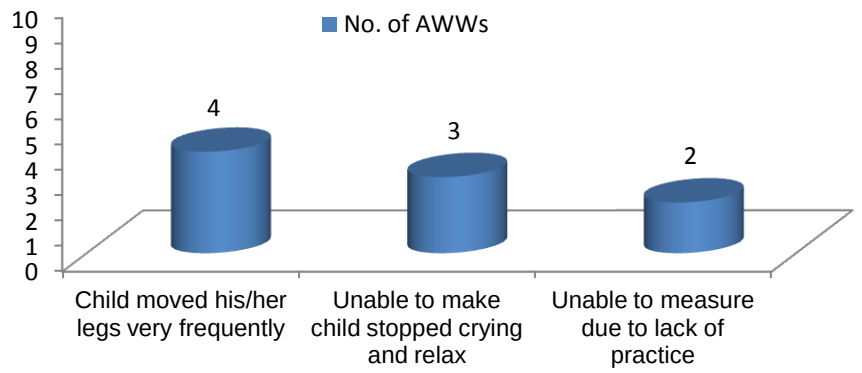
clarify doubts with respect to growth monitoring. They felt that the training was adequate and a great learning experience.

4.5 Difficulties Faced by AWWs While Measuring Length/ Height

4.5.1 Difficulties faced by AWWs while measuring length

Out of 30 AWWs who were given training in length measurement, 9 AWWs i.e. close to 1/3rd reported that they faced difficulty measuring length of infants. Figure 1 displays difficulties in measuring length. Main problems identified by AWWs while measuring length of infants includes child moving legs too frequently, child crying continuously and not relaxing despite all efforts, lack of practice etc.

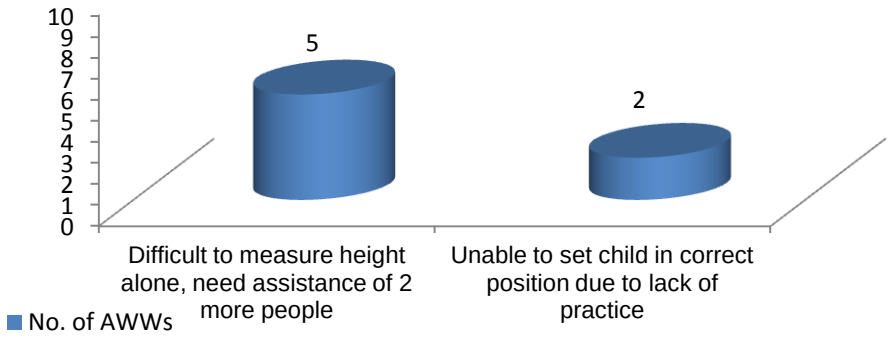
Fig 1: Difficulties faced by AWWs while measuring length



4.5.2 Difficulties faced by AWWs while measuring height

AWWs felt height measurement was easier than length measurement. Out of 30 AWWs 7 AWWs reported that they faced difficulty while measuring height of children 3-6 years. Figure 2 displays difficulties faced by AWWs in measuring height. Main problems identified by AWWs includes setting the child in correct position (Frankfort Plane), inability to adjust child in same position while moving the head plate even with the help of one assistant.

Fig 2: Difficulties faced by AWWs while measuring height



4.6 Impact of Training on Skills of AWWs to Take Length and Height Measurement

4.6.1 Technical error of measurement for length and height

One of the key objectives of the study was to assess the feasibility of length/ height assessment by AWWs at AWCs, therefore the performance of all the 30 AWWs who had received training in measuring height and length of the young children was tested by computing inter observer technical error of measurement.

Technical error of measurement is the most common way to express the error margin in anthropometry. It is an accuracy index and represents the quality of measurements and control dimension. TEM index allows one to verify the accuracy with which measurements are obtained by means of comparing measurements taken by 2 people in same setting. Table 6 represents the acceptable classification of % TEM (relative TEM). It is important observing that the lower the TEM obtained, the better is the accuracy of the evaluator to perform the measurement (Perini et al, 2005). In this study, only inter evaluator values were obtained and calculated thereof.

Table 6: Acceptable classification of relative TEM

Type of analysis	**Measurements**	**Beginner**	**Skilful**
Intra evaluator	All except skin folds	1.5%	1.0%
Inter evaluator	All except skin folds	2.0%	1.5%

Source: WHO, MGRS group, 2006

Using the formula given below inter evaluator absolute and relative TEM were computed to verify if AWWs were trained adequately to take length and height measurements independently.

$$\text{Absolute TEM} = \sqrt{\frac{\sum_{i=0}^{n} Di^2}{2n}}$$

where,

ΣD^2 = summation of deviations raised to the second power

n = number of volunteers measured

i = the number of deviations

$$\text{Relative TEM} = \frac{TEM}{VAV} \text{ X } 100$$

where,

TEM = Technical error of measurement expressed in %

VAV = Variable average value

It was interesting to note that relative TEM for height measurements taken by AWWs and trainer were <1%. This indicates acceptable variability in the accuracy of measurements taken by AWWs (Table 7). It is worth emphasizing that % TEM for almost all AWWs were lower than 0.5% suggesting greater accuracy. **Another inference that can be drawn from this result is about the adequacy and quality of training as AWWs with just one training and no practice, were able to perform so well.**

Table 7: Acceptable Variability in the Accuracy of Height Measurements

Evaluators	**Relative TEM (%)**	**Classification**
Trainer and AWW 1	0.19	Acceptable
Trainer and AWW2	0.2	Acceptable
Trainer and AWW 3	0.11	Acceptable
Trainer and AWW 4	0.22	Acceptable
Trainer and AWW 5	0.41	Acceptable
Trainer and AWW 6	0.2	Acceptable
Trainer and AWW 7	0.27	Acceptable
Trainer and AWW 8	0.25	Acceptable
Trainer and AWW 9	0.17	Acceptable
Trainer and AWW 10	0.32	Acceptable
Trainer and AWW 11	0.17	Acceptable
Trainer and AWW 12	0.12	Acceptable
Trainer and AWW 13	0.29	Acceptable
Trainer and AWW 14	0.19	Acceptable
Trainer and AWW 15	0.16	Acceptable
Trainer and AWW 16	0.22	Acceptable
Trainer and AWW 17	0.23	Acceptable
Trainer and AWW 18	0.12	Acceptable
Trainer and AWW 19	0.16	Acceptable
Trainer and AWW 20	0.25	Acceptable
Trainer and AWW 21	0.6	Acceptable
Trainer and AWW 22	0.14	Acceptable

Trainer and AWW 23	0.37	Acceptable
Trainer and AWW 24	0.18	Acceptable
Trainer and AWW 25	0.15	Acceptable
Trainer and AWW 26	0.19	Acceptable
Trainer and AWW 27	0.28	Acceptable
Trainer and AWW 28	0.24	Acceptable
Trainer and AWW 29	0.16	Acceptable
Trainer and AWW 30	0.23	Acceptable

Similarly, relative TEM were also calculated for length measurements. The result was found to be within acceptable limits for almost all AWWs except for 2 AWWs (Table 8). A relatively higher % TEM of 1.8 and 2.49 suggests that the measure obtained by AWWs was inaccurate when compared with the measurements taken by the trainer herself. This is indicative of the further need of training and practice for refining of skills of AWWs to undertake length measurements on infants. However, overall the reliability estimates in our study were comparable to those found in previous studies in a variety of settings, suggesting that after appropriate training, AWWs have the capacity to perform highly reliable measurements (WHO, MGRS group, 2006).

Table 8: Acceptable variability in the accuracy of length measurements

Evaluators	**Relative TEM (%)**	**Classification**
Trainer and AWW 1	0.21	Acceptable
Trainer and AWW2	0.39	Acceptable
Trainer and AWW 3	1.17	Acceptable
Trainer and AWW 4	1.41	Acceptable
Trainer and AWW 5	0.56	Acceptable
Trainer and AWW 6	1.31	Acceptable
Trainer and AWW 7	0.5	Acceptable
Trainer and AWW 8	1.8	**Not Acceptable**
Trainer and AWW 9	0.93	Acceptable
Trainer and AWW 10	0.85	Acceptable
Trainer and AWW 11	0.43	Acceptable
Trainer and AWW 12	0.72	Acceptable
Trainer and AWW 13	0.79	Acceptable

Trainer and AWW 14	0.46	Acceptable
Trainer and AWW 15	0.87	Acceptable
Trainer and AWW 16	2.49	**Not Acceptable**
Trainer and AWW 17	0.52	Acceptable
Trainer and AWW 18	0.57	Acceptable
Trainer and AWW 19	0.51	Acceptable
Trainer and AWW 20	0.74	Acceptable
Trainer and AWW 21	0.4	Acceptable
Trainer and AWW 22	0.45	Acceptable
Trainer and AWW 23	0.74	Acceptable
Trainer and AWW 24	0.81	Acceptable
Trainer and AWW 25	0.99	Acceptable
Trainer and AWW 26	0.23	Acceptable
Trainer and AWW 27	0.6	Acceptable
Trainer and AWW 28	0.82	Acceptable
Trainer and AWW 29	0.63	Acceptable
Trainer and AWW 30	0.56	Acceptable

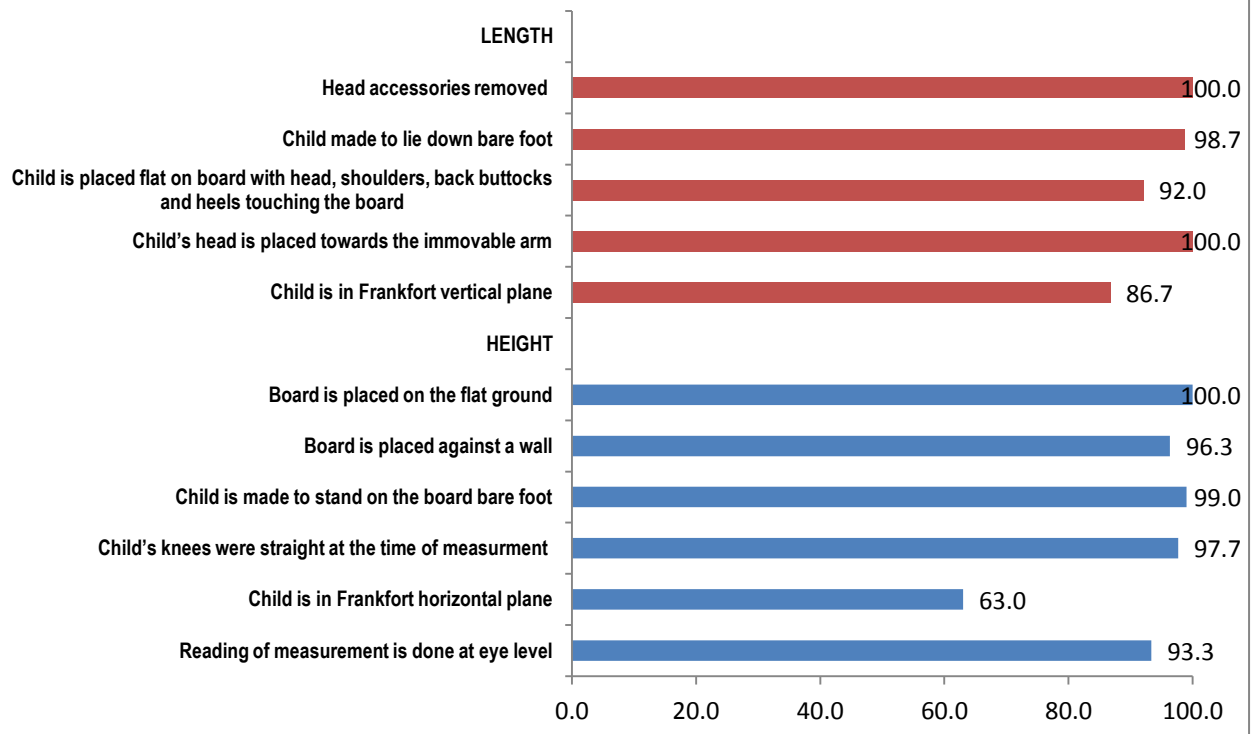
Also consistent with the findings of our study, Ayele et al (2012) also concluded that community-drawn anthropometrists can provide reliable measurements for weight and height if trained adequately, that could be used to assess the impact of interventions for childhood undernutrition.

Further, Mandiwana et al, 2015 also reported drastic improvement in skills of taking weight and height in the post training period. The study showed 100% participants mastered the skill of taking weight and about 80 % were able to take height measurements accurately 6 most post intervention.

4.6.2 Adherence to critical points in length and height measurement technique

Details regarding whether AWWs adhered to all the critical points in length and height measurement technique were collected with the help of an observation schedule which was filled separately for each child participant. Figure 3 presents adherence of AWWs to critical points of length and height measurement technique while taking measurements.

Fig 3: Distribution of AWWs w.r.t adherence to critical points in length and height measurement technique



As it can be clearly seen from the Figure 3, AWWs observed the critical points carefully while taking most of the length and height measurements. However, it was noticed that AWWs faced problems in setting child' head in correct position i.e. Frankfort plane, due to which the measurement reading vary slightly between AWWs and research team. Therefore it can be concluded that although the skill training was effective in improving the knowledge and skills of AWWs in taking height and length measurements but further practice is desirable to attain perfection in the techniques learnt during training session.

4.7 Anthropometric Assessment of Children

As a part of data collection, a set of anthropometric measurements including weight and length/height were carried out by research team. The anthropometric data, thus obtained are used to illustrate nutritional status of children 0-6 years in the following section.

Raw data for weight and length/ height were compared with the age specific median values of WHO growth standards and deviation from the median was recorded in terms of Z score for weight for age, height for age, weight for height, BMI for age were calculated for children (0-5 years) using WHO Anthro V 3.2.2 software. For children above 5 years of age, data were

analysed in same manner in MS- Excel based on WHO reference standards for 5- 19 years (WHO, MGRS, 2006). Table 9 presents the anthropometric profile of children and infants.

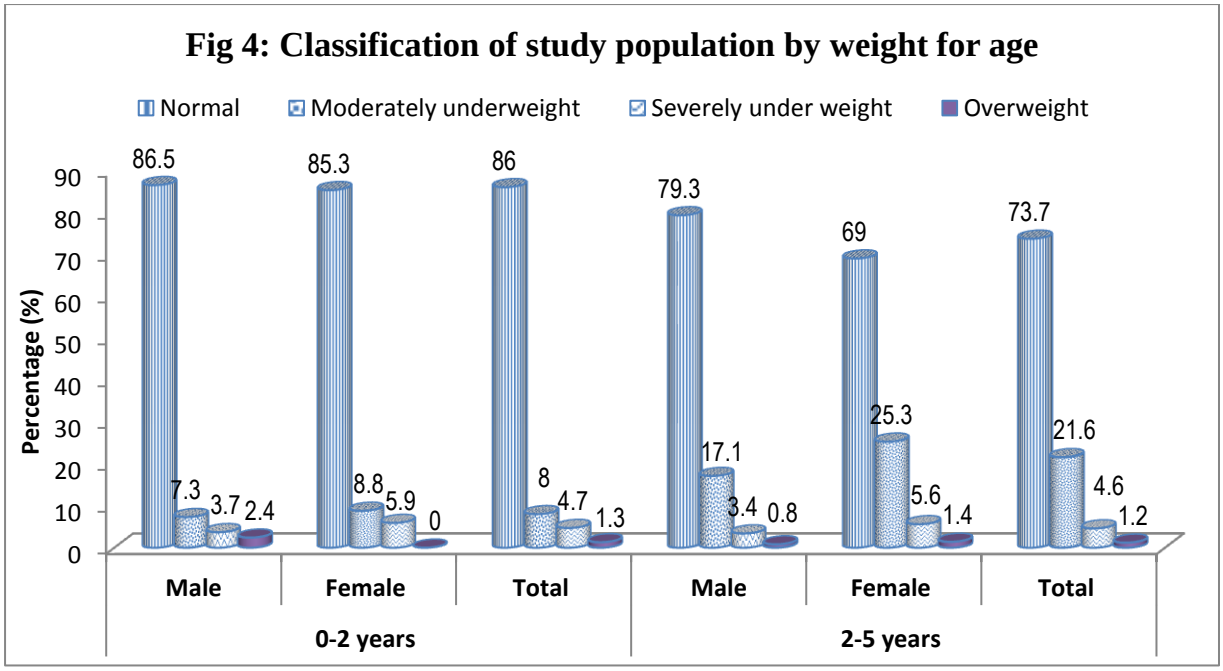
Table 9: Anthropometric Profile of Infants and Children

Age category	Weight in Kg (Mean ± SD)			Length/ Height in cm (Mean ± SD)		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
0-2 Years (n=150)	7.2 ± 1.9	6.7 ± 1.4	**6.9 ± 1.7**	66.2 ± 7.6	64.9 ± 5.8	**65.7 ± 6.9**
2-5 years (n=259)	13.4 ± 2.1	12.5 ± 2.1	**12.9 ± 2.1**	94.1 ± 7.7	91.3 ± 6.9	**92.6 ± 7.4**
5-6 years (n=41)	17.4 ± 2.2	15.3± 1.8	**16.2 ± 2.3**	108.5 ± 5.2	102.9±4.4	**105.4 ± 5.5**

The mean weight of infants, 2-5 years old children and 5-6 years old children was 6.9 ± 1.7 kg, 12.9 ± 2.1 kg, 16.2 ± 2.3kg respectively. A sex wise comparison shows that male children weighed more than their female counterparts at all ages. Similarly for height, male children were taller than female children in all age groups.

4.7.1 Prevalence of Under weight

Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition. Children whose weight-for-age is below minus two standard deviations from the median of the reference population are classified as underweight. Children whose weight-for-age is below minus three standard deviations (-3 SD) from the median of the reference population are considered to be severely underweight. It is evident from the Figure 4 that majority of infants (86%) and young children (73.7 %) belonged to normal category which means that their weight for age z score were between -2 SD to +2 SD. Further, the prevalence of moderate underweight and severe underweight among infants was 8 percent and 4.7 percent respectively. On the other hand close to 22 percent of young children aged 2-5 years were moderately underweight, the percent prevalence being higher for females. The present study recorded the prevalence of underweight (0-5 years) as 39 per cent approximately, however, data from NFHS 4 Delhi state factsheet showed that 27 per cent children under 5 years were found to be suffering from underweight. Interestingly, a total of 5 children (2 infants and 3 young children) showed upward deviation from the median weight for age z -score and were falling in the category of overweight i.e. Z score >2 SD.

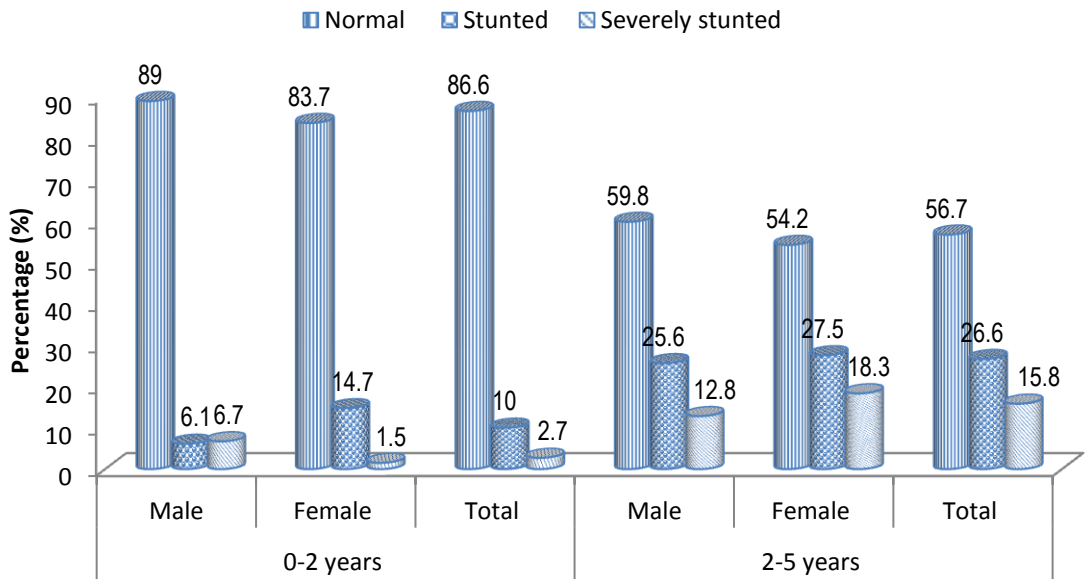


4.7.2 Prevalence of Stunting

A measure of linear growth retardation is indicated by height-for-age index. It represents long term effects of malnutrition. Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered short for their age (stunted) and are chronically malnourished. Children below minus three standard deviations (-3 SD) from the median of the reference population are considered to be severely stunted.

In the present study, the prevalence of stunting was high (42.4 per cent) among children age 2-5 years with approximately 16 per cent being severely stunted. Overall, 36.6 percent children are stunted in 0-5 years of age group. This result is consistent with the NFHS 4 data which shows that close to 32.3 per cent children suffer from stunting in state of Delhi. However, among infants under 2 years of age, it was heartening to note that more than 87 per cent had normal length for age but still stunting was observed in 13 per cent of infants which suggest focused interventions in the community for optimal results. Further, similar to distribution of underweight, stunting was also more prominent among females across all age groups (Figure 5).

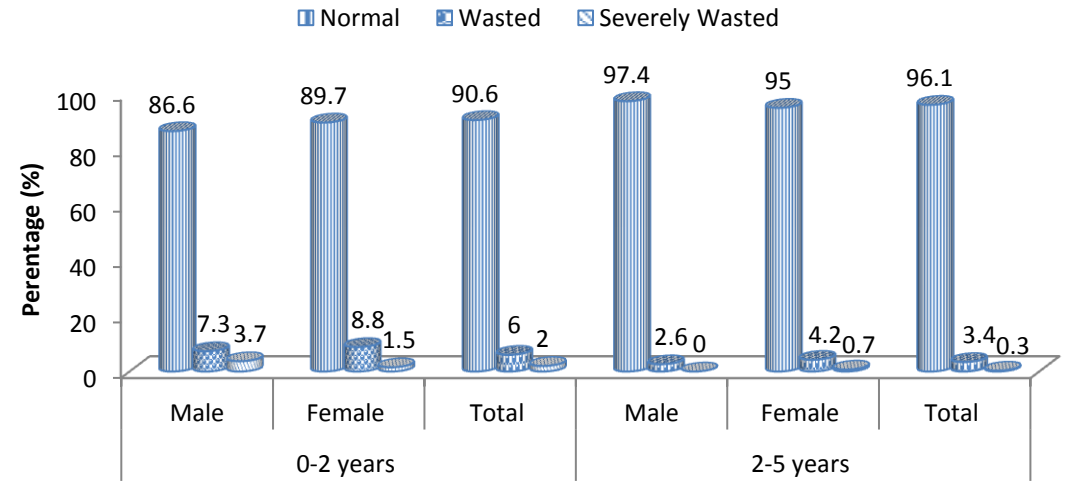
Fig 5: Classification of study population by length for age



4.7.3 Prevalence of Wasting

The weight-for-height index measures body mass in relation to body length and describes current nutritional status. Wasting represents the failure to receive adequate nutrition in the immediate period. Children whose Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered thin (wasted) for their height and are acutely malnourished. Children whose weight-for-height is below minus three standard deviations (-3 SD) from the median of the reference population are considered to be severely wasted.

Fig 6: Classification of study population by weight for length/ height

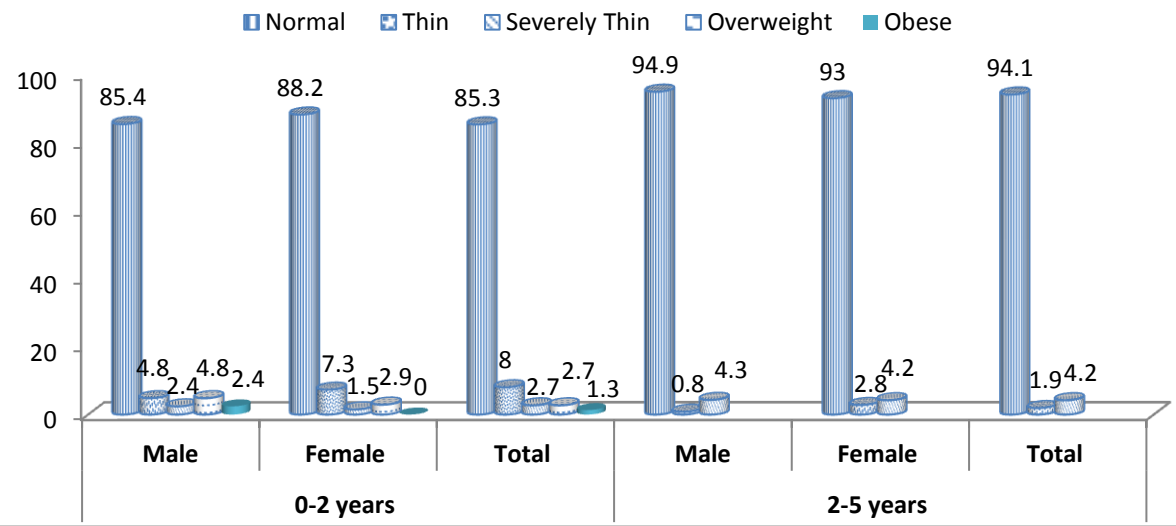


As it can be seen from Figure 6, prevalence of wasting among infants and young children was 8 per cent and 4 per cent respectively. Surprisingly, wasting was far less prevalent among children under 5 in comparison to stunting or underweight. Low levels of wasting also suggests that poor nutritional status of children in general is not because of poor feeding, care practices or incidence of infection in recent past but it can be attributed to poverty, food insecurity and ignorance leading to long term imbalance in nutritional intake and requirement.

4.7.4 BMI for Age

BMI is computed from current weight and current height of children and thus, reflects current energy deficit. An early detection of low BMI for age and efficient correction of it is considered to be the most effective intervention for preventing stunting. A Z-score of below minus two standard deviations (-2 SD) from the median of the reference population is an indicator of thinness. Children whose BMI for age is below minus -3 SD from the median of the reference population are considered to be severely thin. Further, Z score of greater than +1 SD indicates overweight and +2 SD marks obesity. Thus, use of BMI for assessment of current nutritional status in Indian children is essential in all settings where length/height measurements are possible. Figure 7 displays distribution of infants and children (2-5 years) by BMI for age growth indicator.

Fig 7: Classification of study population by BMI for age



In the present study, BMI for age Z scores analysis showed that majority of infants (85.3 %) and young children (94.1) had normal BMI for age. About 10.7 per cent of infants were found to be thin i.e. they had BMI for age Z score below -2 SD out of which 2.7 per cent

were severely thin. However among young children (aged 2-5 years) severe thinness was more prevalent affecting 4.2 percent. BMI for age Z score of > +1 SD was observed only in case of infants and not young children. About 7.2 per cent males and 2.9 per cent of females were found to be having BMI for age Z score > +1 SD.

4.7.5 Nutritional profile of children above 5 years

The nutritional profile of children above 5 years is presented in Table 10. It can be seen from Table 10 that about one fourth of the children were undernourished. Underweight and stunting was observed in about 24.4 per cent and 29.3 per cent of children respectively. Similar to infants and young children aged 2-5 years, more number of female were found to be underweight in above 5 years category. Overweight was observed to be affecting 1 male and 2 females out of those whose anthropometric assessment was carried out.

Table 10: Nutritional profile of children above 5 years

Growth Indicators	Males no. (%) n = 18	Females no. (%) n = 23	Total no. (%) n = 41
Underweight	4 (25)	6 (24)	10 (24.4)
Severely Underweight	0 (0)	1 (4)	1 (2.4)
Stunted	6 (37.5)	6 (24)	12 (29.3)
Severely Stunted	1(6.2)	1 (4)	2 (4.9)
Overweight	1(6.2)	2 (8)	3 (7.3)

Conclusion
&
Recommendation

CONCLUSION

The current study was a pilot study conducted with the primary objective of evaluating the feasibility of length/ height assessment by AWWs in the community setting. However, during the course of study, data was also collected on nutritional status of children, effect of training on knowledge level regarding growth monitoring. The findings of the study were found to be supporting the premise that integrating height measurement with existing weight measurement for detecting growth faltering will provide a complete assessment of nutritional status of children as stunting was found to be more prevalent among children. Measurement of length for infants under 2 years and height for children 2-5 years by AWWs was observed to be feasible in community setting. The technical error of measurement computed by comparing the measurements taken in repetition by trainer researcher herself and AWWs was found to be within acceptable limits of accuracy. On one hand where baseline findings highlighted the fact that length and height measurement was relatively a new concept for majority of AWWs and only a few of them had seen Infantometer and Stadiometer but have never used them. In post training period almost all AWWs were able to carry out linear growth measurement at AWCs with greater precision while observing all the critical points in the measurement technique. Further, training was proved to be beneficial in improving the knowledge level of the AWWs regarding growth monitoring. Overall it can be said that training had a positive impact both on knowledge and skills.

Thus, in the view of the above research findings it can be concluded that use of height for age or weight for age as an indicator for growth monitoring can be included in the ICDS system on pilot basis. This addition will not only aid in early identification of under nutrition in children but will also prove to be useful in curbing undernutrition in all its form and will contribute to attainment of World Health Assembly target of reducing stunting by 40% among children under 5years and Sustainable Development Goals. However, inclusion of length/ height measurement for growth monitoring at community level without proper training of AWWs or health workers is not suggested. Further, multicentre, large scale studies evaluating the feasibility of length/ height measurement in different community setting is warranted.

Based on the results of the study, following recommendations have been drawn:

- In ideal situations, growth monitoring of children is suggested to be done by trained anthropometrists with formal health education however, such individuals may be difficult

to find in resource-poor settings. As an alternative, community workers such as AWWs and ASHAs could be formally trained to measure weight and height on regular basis for growth monitoring.

- As per the findings of the study, all AWWs were able to measure height and most were able to measure length of children post one day training. However current study was a small scale study and therefore its results cannot be generalised for entire country. A multicentre study targeting AWWs from all States/UTs is recommended.
- In order for growth monitoring and promotion to be effective; training, supervision and support for AWWs must be improved in terms of frequency and quality.
- The study revealed that majority of AWWs was unaware about the indicators of growth other than underweight. Low height for age is termed as stunting was new for them. Therefore, it is recommended that special skill based training on anthropometry covering knowledge about various ways to detect growth faltering should be undertaken so that the knowledge of workers is improved.
- Shortage of quality, standardised equipment is one of the major hindrances to regular growth monitoring. Ensuring availability of good quality, standardised equipment will aid the process of growth monitoring.
- Since stunting is a chronic problem and influenced by nutrition and care during first 1000 days therefore growth monitoring and promotion activities should target infants and children under 2 years on priority basis to detect early growth faltering for the prevention of the same.
- Further the latest data of NFHS 4 shows that on one hand where prevalence of underweight and stunting among children under 5 is declining, wasting including severe wasting has shown an increasing trend across all states making height/length measurement on regular basis even more important.
- One of the important objectives under National Nutrition Mission (NNM) is to bring down stunting of children in the age group of 0-6 years from 38.4 percent to 25 percent at National level (by 2022). The mission also states that measurement of height of children at the Anganwadi Centres (AWCs) will be introduced in the districts that will be covered under NNM. Therefore, AWW should be formally trained in a phased wise manner under NNM to measure both height and weight of 0-6 year children. The training may be done in a cascadal manner and thereby a pool of Master trainers can be created which can ultimately train ground level functionaries for taking height/length measurement.

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Annexure

Annexure 1

Progrmamme Schedule

WORKSHOP ON ANTHROPOMETRIC ASSESMENT OF CHILDREN IN THE COMMUNITY SETTING

Duration: 1 Day; Period of workshop : 3 days

9:15am-9:30 am	**Welcome address**
9:30am- 10:00am	Administration of Pre- Training questionnaire
10:00am- 10:30am	Introduction to Growth Monitoring , Anthropometry and Equipment • Growth Monitoring at ICDS • Anthropometry (Body Measurements) • Equipment for measuring weight, height, length
10:30am-10:45am	Tea Break
10:45am -11:00am	Techniques of Weight Measurement • Standardization of salter scale • Weight measurement for children using salter scale • Weight measurement of infants by subtraction method using salter scale • Video and Demonstration
11:00am-11:45am	Techniques of Length and Height Measurement • Standardization of Infantometer and Stadiometer • Height measurement for children using Stadiometer • Length measurement of infants using Infantometer • Video and Demonstration
11:45 am – 1:00pm	Practice Session – weight, length, height measurement
1:00pm- 2:00pm	Lunch
2:00pm- 2:30pm	Question and Answer Session
2:30pm – 3:30pm	Briefing about their role in Research study, Feedback and Conclusion

Annexure 2

National Institute of Public Cooperation and Child Development
5, Siri Institutional Area, Hauz Khas

A quick study to evaluate feasibility of length/ height measurement by AWWs in an ICDS project of Delhi

Pre Questionnaire- To be filled by Researchers

Date survey is applied			
AWW code			
AWC code			
Name of AWW			
Aadhar Number of the Worker			
Age (years)			
Address			
Mobile no.			
Educational status	Middle school pass (8th)		1
	High school (10th)		2
	Intermediate (12th)		3
	Graduate		4
	Post graduate		5
Knowledge, Attitude and Perception of AWW			**Codes**
1. Do you feel growth monitoring is important in ICDS?	Yes	No	
State reason if Yes/No			
2. How can we assess growth of children?	1. By measuring Weight		
	2. By measuring Height/Length		
	3. Both		
3. Do you know if length/ height of children under 6 years can be measured as we do in case of adults?	Yes	No	
4. Do you understand the difference between height and length?	Yes	No	
If Yes, then elaborate			
5. Can you tell the name of instrument used for measuring height?			

6. Can you tell the name of instrument used for measuring length?			
7. What do we call a child whose weight is low for age?			
8. What do we call a child whose height/ length is low for age?			
9. Is it necessary that child who has low height/ length for age will also have low weight for age?			
10. Do you think weight measurement alone can predict nutritional status of the child?	Yes	No	
11. Do you feel that length/height measurement should be included in ICDS for growth monitoring along with weight measurement?	Yes	No	
State reason if Yes/No			
11b. If 11 is Yes, then how height measurement should be placed in the ICDS?	1. For all children under 6 years		
	2.Only for children 3-6 years		
	3. Only for children 0-3 years		
	4.Any other, please specify		
12. If length/height measurement will be included in ICDS, do you feel that with adequate training you will be able to measure the length/height of the child?	Yes	No	
13. If a child is crying continuously, how will you take the height/length measurement?			
14. If a child is unable to straighten his/her legs, how will you take the readings on infantometer?			

Post Training (To be asked after the training during field visit for data collection)

Knowledge, Attitude and Perception of AWW			Codes
1. Do you feel growth monitoring is important in ICDS?	Yes	No	
State reason if Yes/No			
2. How can we assess growth of children?	1. By measuring Weight		
	2. By measuring Height/Length		
	3. Both		
3. Do you know if length/ height of children under 6 years can be measured as we do in case of adults?	Yes	No	
4. Do you understand the difference between height and length?	Yes	No	
If Yes, then elaborate			
5. Can you tell the name of instrument used for measuring height?			
6. Can you tell the name of instrument used for measuring length?			
7. What do we call a child whose weight is low for age?			
8. What do we call a child whose height/ length is low for age?			
9. Is it necessary that child who has low height/ length for age will also have low weight for age?			
10. Do you think weight measurement alone can predict nutritional status of the child?	Yes	No	
11. Do you feel that length/height measurement should be included in ICDS for growth monitoring along with weight measurement?	Yes	No	
State reason if Yes/No			
11b. If 11 is Yes, then how height measurement should be placed in the ICDS?	1. For all children under 6 years		
	2.Only for children 3-6 years		
	3. Only for children 0-3 years		
	4.Any other, please specify		
12. If length/height measurement will be included in ICDS, do you feel that with the kind of training you received you will be able to measure the length/height of the child?	Yes	No	

13. Did you face any difficulty while measuring length of the child?	Yes	No	
State difficulty if Yes			
14. Did you face any difficulty while measuring standing height of the child?	Yes	No	
State difficulty if Yes			
15. If a child is crying continuously, how will you take the height/length measurement?			
16. If a child is unable to straighten his/her legs, how will you take the readings on infantometer?			

Observation Schedule for Researchers			
Activities to be performed by AWW while taking measurements			
Weight Measurement			
Scale set at zero	Yes	No	
Calibration of scale using dead weights before starting the measurement of the children	Yes	No	
Weight measurement done after allowing only minimal clothing	Yes	No	
Placement of child's feet at the centre of the scale	Yes	No	
Length Measurement			
Length measurement was done after removing head accessories (hat, band, clips)	Yes	No	
Removed shoes of the child before measurement	Yes	No	
Child is placed flat on board with head, shoulders, back buttocks and heels touching the board	Yes	No	
Child's head is placed towards the immovable arm	Yes	No	
Child is in Frankfort horizontal plane	Yes	No	
For small children a cloth or paper is put on infantometer to ensure hygiene in case panty is not used by the child			
Height Measurement			
Board is placed on the flat ground	Yes	No	
Board is placed against a wall	Yes	No	
Child is made to stand on the board bare foot	Yes	No	
Checked if child's knees are straight	Yes	No	
Checked if child's heels are together with slightly separated toes	Yes	No	
Child is in Frankfort horizontal plane	Yes	No	
Reading of measurement is done at eye level	Yes	No	

Anthropometric data collection form – To be used by AWW & Research Investigator/s

Age category: **I__I 0 – 2 years** **I__I 3 – 4 years** **I__I 5 – 6 years**					
Name of the child:			**Sex:**		
Date of birth (as in records):			**AWC no.:**		
Birth weight (Kg) (if available):			**Birth length (cm) (if available):**		
Name of the Mother :			**Name of the Father:**		
Anthropometric Measurements					
Weight (Kg) (by AWW)			***By Researcher***		
Weight of the child + mother* (Kg)	**Weight of the mother* (Kg)**	**Weight of the child (Kg)**	**Weight of the child + mother* (Kg)**	**Weight of the mother* (Kg)**	**Weight of the child (Kg)**
Length[#] (cm) (by AWW)			***By Researcher***		
Standing Height[##] (cm) (by AWW)			***By Researcher***		
**** To be used in case child is not able to stand on the weighing scale***					
[#] ***To be used for children less than 2 years, who cannot stand straight or in case height is taken, add 0.7 cm***					
## ***To be used for children more than 2 years who can stand straight or in case their length is taken, subtract 0.7 cm***					