

Original Research Article

Intra-family differences in nutritional status between pre-school children and women

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ABSTRACT

Background: National surveys have shown that in India even in families where women were normally nourished or over-nourished prevalence of under-nutrition in preschool children was high. The present study was taken up to assess the magnitude of intra-family differences in nutritional status between preschool children, their mothers and other women in the family and explore factors responsible for these differences.

Methods: Nutritional status of pre-school children (height for age, weight for age and BMI for age) their mothers and other women (BMI) in urban low middle income group families were assessed. Intra-family differences in mother child pairs (4102); mother other women pairs (816); other woman and child pairs (981) and child-child pairs (941) were computed.

Results: Stunting, underweight and wasting rates were higher in children of undernourished mothers as compared to normally nourished mothers. However even in children of over-nourished mothers stunting and underweight rates were high. If the elder child was stunted, underweight or wasted, the stunting, underweight and wasting rates in the younger children were higher. Prevalence of under-nutrition (BMI<18.5) in mothers was lower and over-nutrition was higher in other women. Over-nutrition rates in other women were higher if the mother was over-nourished.

Conclusions: In view of the substantial intra-family differences in nutritional status it is imperative to operationalize universal screening of all pre-school children and women for early detection of wasting and over-nutrition and initiate appropriate interventions.

Keywords: Intra-family differences in nutritional status, Over-nutrition, Preschool children, Under-nutrition, Women

INTRODUCTION

In the seventies of the last century, poverty and household food insecurity were experienced by over 70% of the families and over 70% of children and adults were undernourished.¹ India was a pioneer in initiating national programmes for improving household food security for families with income below poverty line; in addition food supplementation programmes to bridge the gap between the requirements and actual dietary intake in children and women were initiated.²⁻⁴ These programmes were initiated four decades ago and were designed to provide

interventions to identified families below poverty line without assessing nutritional status of the person.⁵

In the last three decades India is undergoing a relatively rapid socioeconomic, demographic and nutrition transition. There has been substantial reduction in poverty ratio, improvement in percapita income, household food security and health status of children. The coverage under Integrated Child Development Services (ICDS) programme is universal.⁷ Despite all these, data from National Family Health Surveys (NFHS) 1, 2, 3 and 4, District Level Household Survey (DLHS) 2 and 4, Rapid Survey of Children (RSOC), Clinical Anthropometric and

Biochemical (CAB) component of Annual Health Survey (AHS) and Comprehensive National Nutrition Survey (CNNS) showed that under-nutrition rates in preschool children continue to be high.⁸⁻¹⁶ Paradoxically the country has been witnessing a slow but steady rise in over-nutrition in adults. Data from NFHS3 has shown that even in families where women were normally nourished or over-nourished, prevalence of under-nutrition in preschool children was high suggesting that household food insecurity and low energy intake may not be the major factors responsible for under-nutrition in preschool children.¹⁰

With the emergence of dual nutrition burden across all segments of population the tenth five year plan recommended that all children and mothers have to be screened so that under-nourished and over-nourished persons could be identified and appropriate intervention based on their nutritional status initiated.⁶ This recommendation has not yet been operationalized in many states.

The present study was taken up to assess nutritional status of preschool children, mothers and other women from urban low middle income families, to find out the magnitude of intra-family differences in nutritional status between these four groups; explore factors responsible for the differences; and assess whether the time has come to fully operationalize the tenth plan recommendation for universal screening of preschool children and women for early detection of wasting and over-nutrition and initiation of appropriate intervention based on their nutritional status.

METHODS

The study was conducted in ICDS blocks in Nebsarai, Lado Sarai and Anderia Mod in South Delhi from 1st January 2015 to 29th December 2017. The study area was purposively chosen because our institution has been working in this locality during the past decade and we have built up a good rapport with the people and the ICDS personnel in the area.

The study design is given in Figure 1. Initially a household census was done and families with under-five children who were likely to stay in the area for at least one year were identified.

The details about the study were explained to these families and the Hindi version of study information sheet was provided to them. A week later families were revisited; those who were willing to participate in the study were given the consent form and their consent obtained.

Inclusion criteria

Family should be from low middle income group, family should have at least one under-five child, likely to

continue to reside in the area for at least 1 year, willing to participate in the study and allow anthropometric measurements in women and under-five children were included.

Exclusion criteria

Family not belonging to low middle income group, family not having at least one under-five child, not likely to stay in the area for 1 year, not willing to participate in the study and not willing for anthropometric measurements in women and under-five children were excluded.

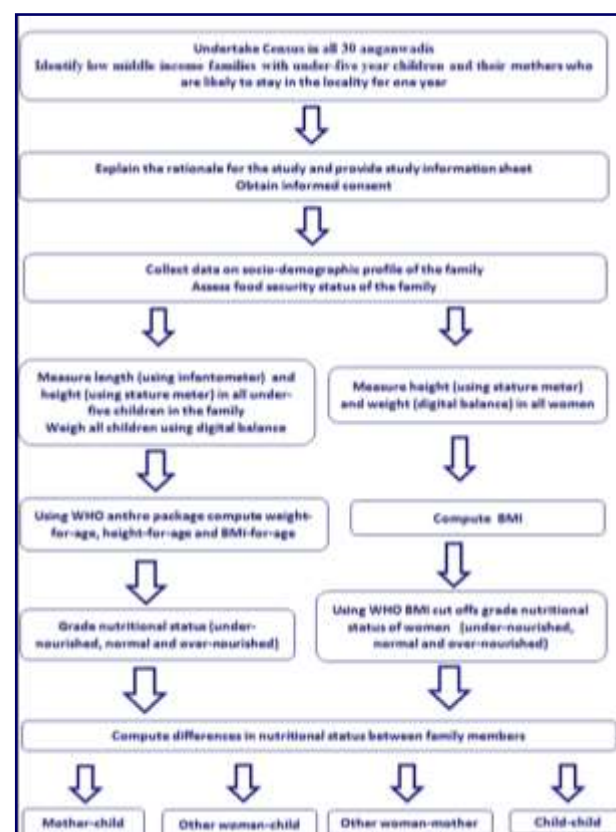


Figure 1: Study design.

All the families who had consented to participate in the study were enrolled. Socio-demographic details of the families were obtained in a pre-tested and pre-coded proforma. Not all members of the family were present at home in the same time. In some households during a visit children or mothers were ill and so anthropometric measurements could not be carried out. Repeated visits were carried out until anthropometric measurements could be taken in all under-five children and women in the family when the persons were well.

In all enrolled families anthropometric measurements were carried out in under-five children, their mothers and other women: length using an infantometer in infants and children who could not stand erect; height using stature meter in children who could stand erect and adult women;

and weight using a digital balance (with accuracy of 100 gm) in all women and children.

Nutritional status of the under-five children was assessed using WHO MGRS standards for length/height-for-age (stunted, normal or tall), weight-for-age (underweight, normal or overweight) and BMI-for-age (wasted normal or over weight). Women were classified as under-nourished (BMI<18.5), normally nourished (BMI 18.5 to 24.9) and over-nourished (BMI≥25).

Intra-family differences in nutritional status between preschool children (4102), mothers (3326) and other women (766) were computed. In all families mothers and pre-school children were there; in some families there were other women (grandmother, aunt). In some families the mother had two under-five children so there were more mother child pairs than total number of families. Nutritional status of under-five children was compared with the nutritional status of their mothers, the other women and other under-five children in their family. For comparison purposes pairs were made of: preschool children and mothers, preschool children and other women in the same family, two preschool children in the same family and mother and other women in the same family.

Sample size

Earlier study on morbidity nutrition interactions in the same community showed that the least intra-family difference in nutritional status of 10% was seen in wasting between two under five children in the same family. Sample size was calculated using 10% difference in wasting in under five children, margin of error of 5% confidence level at 95% and design effect of 2. Sample size was 1000 children.

This observational study was approved by the Institutional Ethics Committee. Permission to conduct the study was obtained from the Deptt of Woman and Child Development National Capital Territory Delhi.

Data entry cleaning and analysis

Data were entered and managed in Microsoft Excel 2013. Nutritional status of children was assessed using the WHO Anthro software. The data obtained from WHO Anthro software was exported to MS-Excel and the outliers in the data were checked and removed. The WHO has recommended a cut-off of ± 5 SD for removal of outliers. Median values of height and weight in Indian children were nearly -2 SD of the WHO standards.¹⁶ If the WHO cut-off of ≤ -5 SD from WHO standards is taken all children with values ≤ -3 SD of the Indian median will be excluded resulting in substantial reduction in the number of under-nourished Indian children available for analysis. Therefore for WAZ (z scores for weight-for-age) and HAZ (z scores for height/length-for-age) values ≤ -7 SD and ≥ 3 SD which were similar to ≤ -5 SD and ≥ 5

SD of the Indian children's median weight and height was used as the cut-off for identifying and removing the outliers; for BAZ (z scores for BMI-for-age) the cut-off used was < -5 SD and $\geq +5$ SD, because median BAZ of Indian children was near the median of the WHO standards. All values lying within the cut-off levels were taken for analysis. A similar procedure was followed for excluding outliers in the clinical anthropometric and biochemical component of the annual health survey.

Nutritional status of under-five children was assessed using the WHO MGRS standards. Nutritional status of women was assessed using the WHO norms for BMI (<18.5 undernourished; 18.5 to 24.9 normal and ≥ 25 over-nourished).

Statistical analysis

Statistical analysis was carried out using MS Excel and SPSS 24. Means and standard deviations were calculated for continuous variables; for categorical variables percent prevalence was computed. Prevalence of under-nutrition in pre-school children (stunting, underweight and wasting) was computed in relation to nutritional status of the mother and other women (under-nourished, normal, and over-nourished) from the same family and comparisons between groups were made. In families with two under-five children the nutritional status of the younger child was compared with the nutritional status of the elder child.

RESULTS

There were 3221 families with 4102 under-five children (some families had more than one under-five child), 3326 mothers (some mothers had more than one preschool child) and 766 other women (mostly grandmother and aunt). The family members were paired into four groups: mother child pairs (4102); mother other women pairs (816); there were more than one mother or more than one other woman in some households, other woman and child pairs (981) and child-child pairs (941) (Table 1).

Table 1: Persons investigated.

	Total
Children	4102
Mother	3326
Other women	766
Mother and child pairs*	4102
Mother and other women pairs	816
Child and other women) pairs	981
Child and child pairs	941

*Some mothers had more than one under-five child. Some families had more than one mother with an under-five child

Socio-demographic profile

Analysis of data on socio-demographic profile of the study households showed that majority were nuclear

families (66.5%) with five or less members. Majority of fathers (75.1%) and mothers (57.0%) had secondary school education. Majority of the fathers (20.5%) worked in white collar jobs; 55.6% were semiskilled workers. Over 94.8% of mothers were home makers. Over 78.3% of households lived in brick and mortar buildings; 37.4% owned their houses; the rest were mostly migrant labourers who lived as tenants in one or two room tenements. Over 80.3% had access to piped water supply at home or in the near vicinity and access to flush toilets either in their own home or shared with other households. For cooking almost all used Liquefied Petroleum Gas (LPG) and stainless steel utensils. Over 98.5% owned colour TV, which was their main source of entertainment. These families stated that they: belonged to low middle income group and were food secure; had adequate earning to meet the essential requirements of shelter, household possessions, education of children and health care but; because of urban housing constraints, they lived in one or two room tenements in over-crowded unhygienic localities.

The mean age of the under-five children was 23.4±16.20 months. Mean height weight and BMI of these children and mean z scores of height weight and BMI for these children are given in Table 2.

Table 2: Profile of pre-school children.

Number of children	4102
Age (months)	23.4±16.20
Height (cm)	77.8±13.93
Weight (kg)	9.7±3.32
BMI (kg/m²)	15.6±1.83
HAZ	-1.56±1.393
WAZ	-1.18±1.161
BAZ	-0.29±1.261

Nutritional status of children as assessed by WHO MGRS standards is given in Figure 2. Prevalence of stunting and underweight were high. However, only 8.2% of under-five children were wasted. Prevalence of over-nutrition in these children was very low.

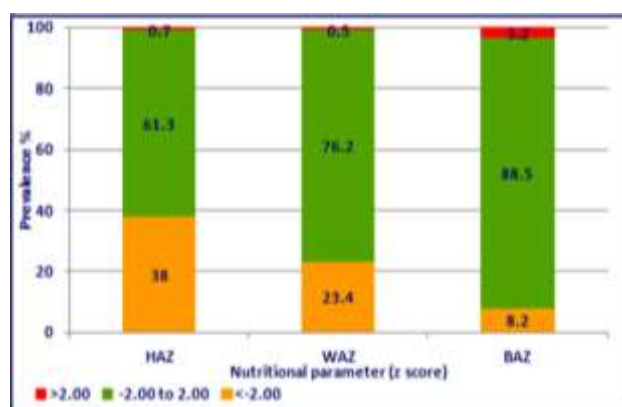


Figure 2: Nutritional status of pre-school children.

Table 3: Profile of the women.

	Age (years)	Height (cm)	Weight (kg)	BMI (kg/m ²)
Mother (n=3326)	26.3 ±4.57	151.3 ±6.31	53.7 ±11.28	23.4 ±4.52
Other women (n=766)	41.4 ±15.82	151.3 ±8.02	59.3 ±13.45	25.8 ±5.63
All women (n=4092)	33.8 ±7.96	151.4 ±5.93	56.5 ±12.32	24.6 ±5.06

Mean age of mothers was 26.3 years and that for other women was 41.4 years. Mean height, weight and BMI of the mothers and other women are given in Table 3. There was no difference in the mean height between mothers and other women. However other women were heavier (mothers' mean weight was 53.7 kg and mean weight of other women was 59.3 kg) and had a higher BMI.

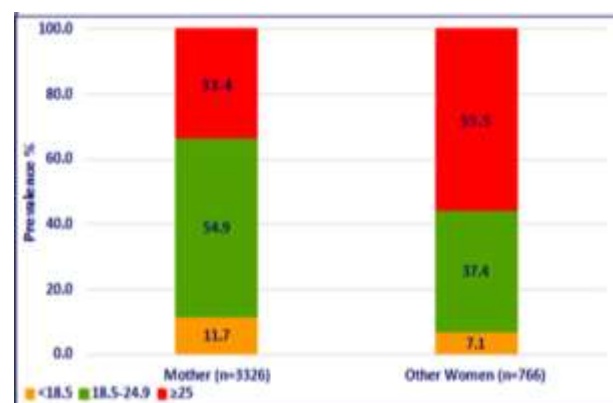


Figure 3: Nutritional status of mother and other women.

Nutritional status of mothers and other women is given in Figure 3. Prevalence of under-nutrition (BMI<18.5) in mothers was low (11.7%); among mothers one third were over-nourished. Prevalence of under-nutrition in other women was lower (7.1%) and over-nutrition was higher (55.5%).

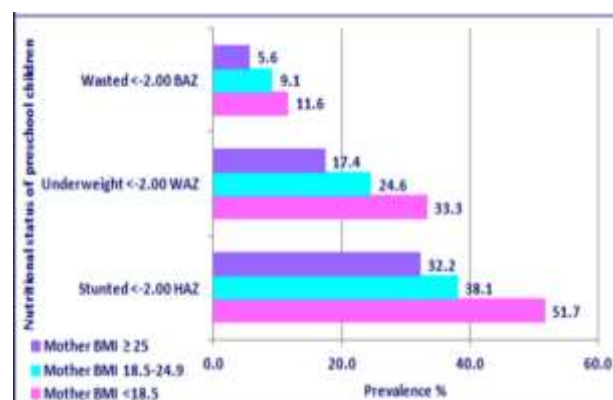


Figure 4: Nutritional status of children in relation to maternal nutritional status.

Comparison of nutritional status of mothers and their children is shown in Figure 4. There was a gradient in nutritional status of children as assessed by height-for-age, weight-for-age and BMI-for-age in relation to nutritional status of the mother as assessed by BMI. Stunting, underweight and wasting rates were higher in children of undernourished mothers as compared to normally nourished mothers. However even among children of over-nourished mothers stunting and underweight rates were high. All these differences were large and significant.

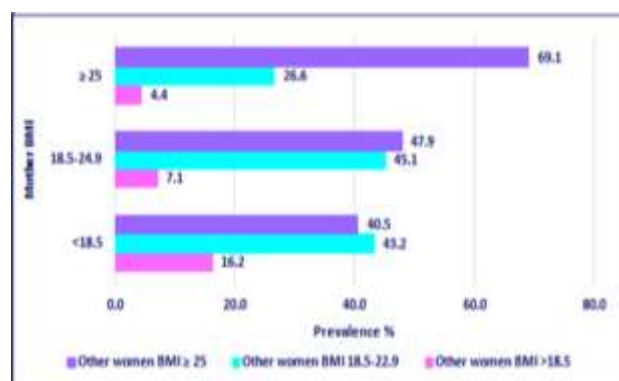


Figure 5: Comparison of nutritional status of mother and other woman in the same family.

Comparison of nutritional status of mothers and other women is shown in Figure 5. Under-nutrition rates in the other women were higher when the mother was under-nourished; however even when the mother was under-nourished 40.5% of the other women in the family were over-nourished. When the mother was normally nourished 45.1% of the other women were normally nourished and 47.9% of the other women were over-nourished. If mother was over-nourished, 69.1% of the other women were over-nourished. All these differences were large and significant.

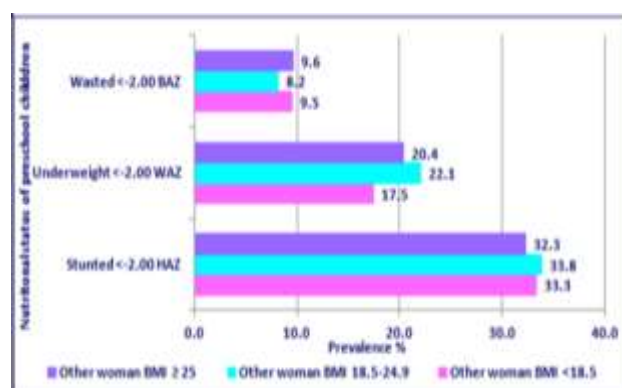


Figure 6: Comparison of nutritional status of preschool children and adult women in the family.

Prevalence of stunting in under-five children was 38%; underweight was 23.4% and wasting was 8.2%. Prevalence of under-nutrition in the other women is very

low and over 55% of the other women were over-nourished. Comparison of nutritional status of under-five children with nutritional status of other women in the same family is shown in Figure 6. In view of the large differences in nutritional status between the under-five child and the other woman in the family there were no significant trends in nutritional status of the child in relation to nutritional status of the other woman in the family (Figure 6).

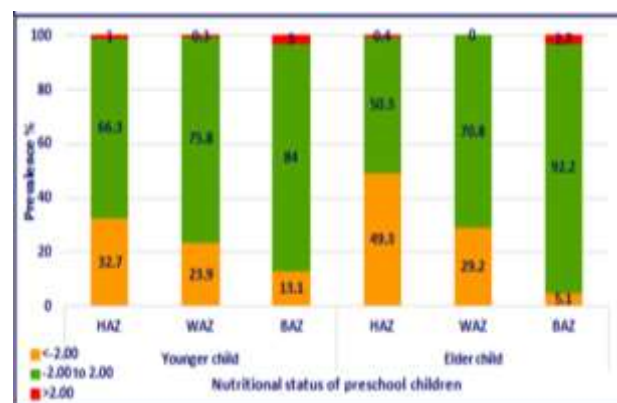


Figure 7: Nutritional status of younger and older preschool children in the same family.

In some families there were more than one under-five child. In these families the nutritional status of the younger child was compared with nutritional status of the elder child. Stunting and underweight rates were higher in the elder child but wasting rates were lower in the elder child as compared to the younger child (Figure 7).

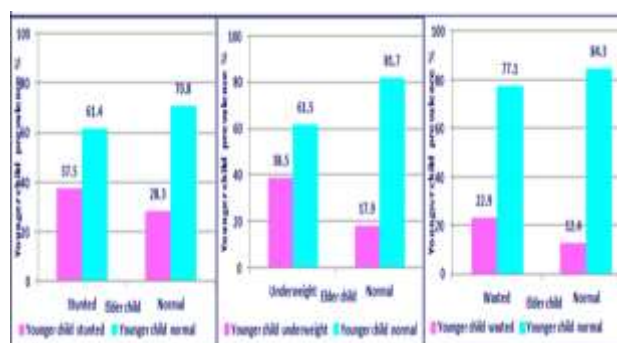


Figure 8: Comparison of nutritional status of the elder and younger preschool child in the same family.

Differences in nutritional status between the two children are shown in Figure 8. Both children share the same genetic and environmental factors at home and hence their nutritional status was essentially similar. Stunting rates, underweight rates and wasting rates in the younger children were lower when the elder child had normal height-for-age, weight-for-age and BMI-for-age. If the elder child was stunted, underweight or wasted, the stunting, underweight and wasting rates in the younger children were higher. All these differences were significant.

DISCUSSION

In the seventies of the last century poverty and food insecurity were the major factors responsible for under-nutrition and under-nutrition was seen in all members of the family. Most of the intervention programmes were aimed at identifying families below poverty line and providing them with goods (subsidised food grains, free food supplements through ICDS and Midday meal programmes) to improve energy intake and health services to treat infections.² Over decades there has been reduction in poverty and food insecurity; but the reduction in child under-nutrition has been slow.^{5,7} Simultaneously there has been a substantial increase in over-nutrition in adults among all segments of population including the poor.⁷ In the current dual nutrition burden era, it is expected that there will be intra-family differences in nutritional status.

Surveys carried out by the National Nutrition Monitoring Bureau documented that there were intra-family differences in dietary intake.^{17,18} If these differences were persistent they could result in intra-family differences in nutritional status. NFHS3 Nutrition Report showed that there were substantial differences in nutritional status of the mothers and their under-five children.¹⁹ Community based studies carried out in urban low middle income group families showed that while child under-nutrition rates were high, the over-nutrition rates in mothers and other women in the same families were high.^{20,21} The present study was carried out to assess nutritional status of under-five children, their mothers and other women in the family, to assess the magnitude of the intra-family differences in nutritional status between preschool children and the women in their families and to explore the factors responsible for the observed differences.

Prevalence of stunting (≤ -2 SD height-for-age) and underweight (≤ -2 SD weight-for-age) in preschool children were high and were comparable to the reported prevalence of these at national and state level.^{10,11,13-16} In these communities about a third of the infants weigh less than 2.5 kg at birth. Low birth weight infants have a lower trajectory for growth and this may be partly responsible for high stunting and underweight rates in under-five children.²² The observed wasting rate in these children is half of the reported national wasting rate.

Under-nutrition rates were low among mothers of under-five children and among other women in the family. This is partly because they were food secure and partly because physical activity was low because of ready access to water, availability of cooking gas, access to mechanised aids for household chores. Wasting rates in under-five children, mothers and other women were around 10% only. Data on food purchased by the family per consumption unit per month was sufficient to meet the energy needs of the family; but pulse, vegetable and milk consumption was low (unpublished data). The low wasting rates in all the three groups (preschool children,

mothers and other women) suggest that these families were food secure.

There was a gradient in nutritional status of children as assessed by height for age, weight for age and BMI for age in relation to nutritional status of the mother as assessed by BMI. Stunting, underweight and wasting rates were higher in children of undernourished mothers as compared to normally nourished mothers. However even over-nourished mothers had stunted, underweight and wasted children. These data suggest that maternal under-nutrition is not the major determinant of child under-nutrition in these urban low middle income group families.

Prevalence of stunting and underweight rates were higher in elder child as compared to the younger one (Figure 7) but wasting rates were lower in the elder child as compared to the younger child. It is well documented that stunting and underweight rates are higher and wasting rates are lower in the 3-5 year children as compared to 0-3 year children.^{10,11,13-16} The reduction in wasting rate is not due to improvement in nutritional status but due to increase in stunting rates with age beyond 12 months. The differences in nutritional status between the elder and younger child are mainly due to the age related changes in anthropometric indices in under-five children.

Prevalence of over-nutrition in under-five children was low despite the fact that physical activity levels in them were quite low. Over-nutrition rates in children might be low because the energy requirements for growth were being met. Over-nutrition rates in mothers were 33.4% and in other women was 55.5%. These families were food secure and habitually consumed home cooked cereal, pulse based diets; amount of vegetables consumed was low. By and large the families did not habitually consume energy dense, processed foods, fried food and sweets. The life style of these women was sedentary. Physical activity was low because these women lived in small single or two room tenements, had access to piped water and used LPG for cooking. Mothers had higher physical activity because they were involved in child care. Older women participated less in household chores and child care; they spent more time watching TV and talking to friends (unpublished data). Access to food with adequate energy and low physical activity appear to be the major factors responsible for over-nutrition in mothers. The higher prevalence of over-nutrition in older women appears to be related to further reduction in physical activity.

Policy and programme implications

Recognising the emergence of dual nutrition burden the tenth five year plan recommended that universal screening of children and adults should be undertaken to identify wasting and over-nutrition; wasted persons may have to be given food supplements; over-nourished persons require counselling for increasing physical

activity.⁶ Though accepted in principle these recommendations have not been operationalized.

In the study population, less than 10% of the under-five children were wasted. All anganwadis have weighing machines and many also have stature meters. All anganwadi workers have mobile phones with a calculator. Therefore weight and height measurements can be made and BMI for age computed in their mobiles. By plotting BMI for age in the WHO BMI for age chart it is possible to identify the wasted children as well as over-nourished children. By providing focussed nutrition and health care to wasted children and monitoring them once a month it might be possible to achieve and sustain wasting rate of <5% in this community. Nutrition counselling for higher physical activity can halt and later reverse the already low over-nutrition rates in children.

Over-nutrition rate in women from these families is high and increases with age. The major factor responsible for rising over-nutrition is low physical activity due to mechanisation of transport, occupational and household activities. Poor roads and sidewalks make it difficult for these women to go for brisk walk as discretionary physical activity. Over-nutrition increases the risk of non-communicable diseases. Women tend to accept weight gain with increasing age as normal and seldom seek care. Nutrition and health education to all women on the importance of monitoring weight gain and checking for hypertension and diabetes has to become a part of essential primary health care. Once they understand its importance, it is likely that they will comply, because they had undergone these screening procedures as a part of antenatal care.

Strength of the study

This is a community based study in urban low middle income families providing information on intra-family differences in nutritional status of under-five children and women.

Limitation of the study

The findings from this study may not be applicable to other families in urban and rural communities with varying levels of food security and access to health care.

CONCLUSION

Among food secure urban low middle income group families, prevalence of wasting (BMI in adult women and BMI for age in under-five children) in preschool children and women is low. In the current dual nutrition burden era, it is imperative to operationalize universal screening of all women and children for early detection of wasting and over-nutrition. Effective management of wasting with food supplements and health care can bring about substantial reduction in under-nutrition in women and preschool children. Prevalence of over-nutrition in

women is high mainly due to sedentary life style. Increasing discretionary physical activity can help in halting the rise and perhaps later reversing of over-nutrition in women and reduce the risk of non-communicable diseases.

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Conflict of interest: None declared

Ethical approval: This observational study was approved by the Department of Woman and Child Development National Capital Territory Delhi

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