5

SUMMARY AND CONCLUSION

Developing countries like India are currently undergoing economic, social, demographic, health and nutrition transitions. India has been facing dual nutrition burdenand consequent health problemsin the last two decades. Data from all the surveys indicate that prevalence of both under and over-nutrition is higher in women as compared to men. Over years severe under-nutrition with life-threatening complications have become rare but prevalence of moderate under-nutrition continues to be high in younger women and especially among the marginalised segments of population. Maternal under-nutrition has adverse health consequences for the mother-child dyad.

In the last two decades there has been a steady and progressive increase in over-nutrition and associated non-communicable diseases. Initially prevalence of over-nutrition was seen mainly in urban affluent families; however recent national surveysindicate that prevalence of over-nutrition is high even among poor especially in urban areas. Data from NFHS4showed that in Delhi a predominantly urban state prevalence of over-nutrition is high especially in women. A study was taken up to assess prevalence of under and over-nutrition in non- pregnant non-lactating women belonging to low middle income families in South Delhi. With these backdrops, a mixed longitudinal study was undertaken to assess nutritional status of urban women from low middle income families. Between January 2015 and December 2017, 4155 non- pregnant non-lactating women were enrolled for this observational study. The second part of the study assessed the impact of universal and prolonged lactation on nutritional status and adiposity in 2240 women in the age 18year and above from urban low middle income families. Approval to undertake the study was obtained from the Institutional Ethics Committee of Avinashilingam Institutional Human Ethics Committee, Coimbatore and Nutrition Foundation of India, New Delhi. Permission to conduct the study was obtained from Department of Women and Child Development, National Capital Territory, Delhi.

At the time of enrolment, socio-demographic data were collected using a pre-tested pre-coded questionnaire. Height ,Weight Mid upper arm circumference (MUAC), waist circumference (WC) and hip circumference (HC) were measured. From height and weight measurements BMI was computed and nutritional status of women was assessed using BMI and nutrition advice was provided taking into account of the nutritional status as .Based on circumferential measurements adiposity and its location were assessed. Attempts were made to follow up these women once in three months to collect information on compliance with nutrition advice and carry out anthropometric measurements. Data were analysed using Excel and SPSS 25 (Property of IBM Corp. Copy right IBM corporation and its licensors 1989-2017). Nutritional status of women was computed using BMI in the three age groups. Mean and SD of all anthropometric parameters were calculated in three age groups (18-29, 30-49 and ≥ 50 years) and BMI groups (<18.5, 18.5 to 24.9 and ≥ 25). Statistical significance of the differences in means in different groups was assessed using student t test. Prevalence of high waist circumference (≥ 80cm) and hip circumference (≥ 102 cm) in the three age and BMI groups were computed and statistical significance of the differences were assessed using chi square

Salient findings of the present study

A. Sociodemographic profile of NPNL Women

- Analysis of data on socio demographic profile of the study households showed that majority were nuclear families (75.8%) with five or less members (72.3%). Majority of men (68.5%) and women (50.2 %) had secondary school education. Majority of the men (70.6%) worked in white collar jobs; 22% were semi-skilled workers. Over 90% of women were home makers.
- The household possessions are considered, these households belonged to low middle income group. Because of urban housing constraints, these families lived in one or two room tenements in over-crowded unhygienic localities. These families stated that they were food secure; if needed they accessed subsidised food grains from Public Distribution System and availed ICDS supplementary feeding programmes. Most women were home makers; after completing household chores within the small room, they sat down and watched TV or chatted with friends using

mobile phones. When overweight women were counselled about increasing physical activity, many stated that they had no public places where they could walk or carry out discretionary physical activity.

B. Nutritional profile of NPNL Women

- NPNL women were relatively short (mean height was only 151.7 cm); mean weight was 57.7 kg. These women had relatively high mean BMI, MUAC, WC and HC. Prevalence of under-nutrition was relatively low (7.9%); 44.7% were normally nourished. Nearly half of these women (47.7%) were over-nourished; about 40% had high WC and 25% had high HC.

➢ **Changes in anthropometric measurement in relation to age**

The differences in the mean height between the three groups were very small (152 cm, 151.7 and 151cm). With increasing age there was a progressive increase in body weight (54.2, 60.6 and 62.6 kg), BMI (23.4, 26.3 and 27.4), MUAC, WC and HC. Even in the 18-29 year age group prevalence of under-nutrition was low (12.1%); there was a further fall in under-nutrition rate with increase in age. Prevalence of over-nutrition even in the under-30 year age group was high (33.9 %); there was a steep increase in prevalence of over-nutrition with increase in age; in the over ≥ 50 age group 68.4% of women were over-nourished

- Prevalence of adiposity as assessed by high WC and HC were seen right from 18-29 age group and increased with increasing age. In each age group prevalence of high WC was higher as compared to high HC. Three fourth of women aged 50 years and above, had high WC and 41.7% of them had high HC

➢ **Changes in anthropometric measurement in relation to nutritional status**

- Mean height, weight, BMI, MUAC, WC and HC in under-nourished, normally nourished and over-nourished women. The differences in the mean height in under-nourished, normally nourished and over-nourished women were small and were not of any physiological significance. There was a progressive increase in the mean weight, BMI, MUAC, WC and HC with increasing BMI. All these differences were substantial and were statistically significant.

- None of the under-nourished women had waist or hip circumference above the cut off levels; among normally nourished women only 8% had high WC and 1.4% had high HC. Among the over-nourished women78% had high WC and 51.3% had high HC

- Mean MUAC and HC increase with increase in BMI, but are similar across all age groups. In contrast mean WC increases both with increasing age and with increasing BMI. These data indicate older women are prone for abdominal adiposity (as assessed by WC) not only when they are over-nourished but also when they are normally nourished

- In concern with prevalence of high WC and HC in relation to age and BMI, for any given age and BMI, prevalence of high WC was higher as compared to high HC. High HC was seen in women with high BMI across all age groups. High WC was seen even normally nourished women in 30-49 year age; with increase in age and BMI prevalence of high WC increased; all women aged 50 and above who were over-nourished had high WC

- In the second aspect of the present study, Effect of Lactation on Nutritional Status in Urban Women from Low Middle Income Families was assessed. During the study period, families with lactating women (N=2240) who were likely to stay in the study area for at least one year were identified.

- Anthropometric and circumferential measurements were carried out by personnel who had been trained and were proficient in taking these measurements. During the first 12 months of lactation, women were weighed every month; in the 12-35 month period they were weighed once in three months. Circumferential measurements were taken once in three months. In winter months the circumferential measurements especially MUAC could be taken only when it was not very cold. Based on circumferential measurements adiposity and its location were assessed. Nutrition advice was provided to all women taking into account the nutritional status as assessed by BMI.

- Earlier part of study has shown that there were substantial differences in nutritional status in NPNL women in the 18-29 year age group and those who were beyond 30 years of age. Therefore data from lactating women from the two age groups - Group A and Group B - were analysed separately. The number of visits during which different anthropometric measurements was carried out. Weight was measured in the highest number of visits and MUAC in the least number of visits.

- In Nutritional profile of lactating women, the mean values for anthropometric indices in lactating women (Group A and Group B) were compared with corresponding mean values in NPNL women in the 18-29 and ≥30 year age group. The differences in the mean height between lactating women in Group A and Group B and corresponding groups in NPNL women were small and were statistically not significant (except in 18-29 year group), indicating that the groups were homogenous.

- In both age groups, lactating women weighed significantly less as compared to non-lactating women. Similar trends were seen in BMI, MUAC, HC and WC suggesting that for any given age, lactating women weighed less and had less adiposity as compared to their NPNL counterparts. All these differences were statistically significant.

- BMI and adiposity was assessed by WC and HC between lactating and NPNL women in the two age groups were compared.

- In both age groups, lactating women had higher under-nutrition and lower over-nutrition rates as compared to the NPNL counterparts. Similar trend was seen in relation to adiposity as assessed by WC and HC. Abdominal adiposity (waist circumference ≥80cm) rates were far higher as compared to truncal adiposity (hip circumference ≥102 cm) rates in lactating and non-lactating women in both the age groups. All these differences were substantial and were statistically significant.

- Changes in anthropometric indices in relation to duration of lactation revealed that, there were no differences in the mean height of lactating women either in Group A and Group B in relation to duration of lactation, indicating that they were a homogenous group.

- Mean weight of lactating women in Group A was lower as compared to Group B across all durations of lactation. These differences were substantial and statistically significant. There was a small reduction in the mean weight between 9 and 17 months of lactation in Group A. There was a 0.7 kg reduction in mean weight between 0-2 months and 30-35 months in Group A. This was not statistically significant.

- The lowest mean weight was seen in the 0-2 months of lactation in Group B. There was a small increase in the mean weight till 11 months; between 12-23 months the mean weight was similar; after 24 months there was further increase in the mean weight in Group B. There was an increase of 4.5 Kg in the mean weight between 0-2 months and 30-35 months in Group B and this was statistically significant.

- Mean BMI of lactating women in Group A was lower as compared to Group B across all durations of lactation. There was no change in BMI between 0 and 8 months of lactation in Group A. Thereafter there was a small reduction in the mean BMI till 20 months; subsequently there was a small rise. The mean BMI at 30-35 months was lower by 0.1 as compared to BMI at 0-2 months in Group A. This was not statistically significant.

- In Group B the lowest mean BMI was in the 0-2 months of lactation. Thereafter there was a progressive increase in the mean BMI till 30-35 months. The increase in the mean BMI between the 0-2 month of lactation and 30-35 months of lactation was 2. This substantial difference in the mean BMI was statistically significant.

- Changes in circumferential measurements in relation to duration of lactation revealed that, the mean MUAC across all durations of lactation was higher in women in Group B as compared to Group A.

- In Group A there was a small increase in the MUAC between 0 and 14 months of lactation. The increase in the mean MUAC at 0-2 months and 30-35 months was 0.4cm in Group A and this was not statistically significant. In Group B the lowest mean MUAC was seen in 0-2 months of lactation. There was a small increase in the mean MUAC till 11 months; thereafter it remained essentially unaltered. The increase in the mean MUAC between 0-2 month and 30-35 months of lactation was 1.8 cm in Group B and this difference was statistically significant.

- The mean WC across all durations of lactation was higher in women in Group B as compared to Group A. Subsequently there was a small reduction in the WC between 3 and 17 months of lactation. The reduction in the mean WC between 0-2 months and 30-35 months was 1.3 cm in Group A and this was not statistically significant. In Group B the lowest mean WC was seen in the 0-2 months of lactation. There was a progressive increase in the mean WC till 29 months. The increase in the mean WC between 0-2 months and 30-35 months was 2.7 cm this difference was statistically significant. The same trend was noted in HC and WHR.

- Changes in nutritional status and adiposity in relation to duration of lactation revealed that, in both groups A and B, there was a small increase in under-nutrition rates in lactating women 35 months (22.4%), and these differences were statistically significant. Even at 0-5 months about a quarter of the women in Group A were over-nourished. There was some reduction in over-nutrition up to 17 months; thereafter there was a rise in over-nutrition rates. The difference in the prevalence of over-nutrition between 0-5 months and 30-35 months was 1.9% in Group A. This difference was not statistically significant.

- In Group B under-nutrition rate was 8.2% in the 0-5 months, 14.5% in 18-23 months and 7.8% in 30-35 months. There was a reduction of 0.4% in under-nutrition rates between 0-5 months and 30-35 months. This difference was not statistically significant. In Group B 34.9% were over-nourished at 0-5 months of lactation. There was sharp rise in over-nutrition rates in the 6-11 month group; there was a plateau between 12-23 months and another sharp rise at 24-29 months which persisted; at 30-35 months 56.6 % were over-nourished.

- Over-nutrition rates increased by 21.7% between 0-5 months and 30-35 months and this were statistically significant.

- Prevalence of abdominal adiposity as assessed by high WC (≥80cm) as well as truncal adiposity as assessed by high HC (HC ≥102 cm) was higher in Group B as compared to Group A across all durations of lactation. In both Group A and B prevalence of abdominal adiposity was nearly twice that of truncal adiposity. These differences were statistically significant.

- Abdominal adiposity rates were nearly double that of truncal adiposity rates in both Group A and B; these differences were statistically significant.

Globally and nationally in India, the period between 1990 and 2015 witnessed the steepest fall in the prevalence of under-nutrition, morbidity due to communicable diseases and steep improvement in maternal and child health. But during this period there was concurrent, substantial increase in the prevalence of over-nutrition and non-communicable diseases in India. Over-nutrition rates in men and women have doubled in the last decade. Prevalence of over-nutrition in women in Delhi which is a predominantly urban state was very high. Data from research studies in Delhi have shown that under-nutrition in childhood can be a very risk important factor for over-nutrition in adult life.

Data from the present study showed that prevalence of under-nutrition was quite low in these urban women from small, predominantly nuclear, low middle income food secure families. Majority of them lived in small one or two room tenements; so sweeping, mopping and cleaning the house were neither very time consuming nor involving intensive physical activity. They had ready access to water and used LPG for cooking. As a result their physical activity in the household work domain was sedentary. They had relatively ready access to health care for infection. These favourable factors account for the low prevalence of under-nutrition in these women. This situation provides an opportunity for effective interventions by identifying the small number of under-nourished women, finding out factors responsible for under-nutrition and correcting it. As a part of the study these under-nourished women and their families were informed that correction of under-nutrition prior to pregnancy will improve nutritional status of the mother and her offspring

when she becomes pregnant; families were counselled to increase dietary intake and reduce physical activity in under-nourished women. The number of under-nourished women was too small to assess whether they followed the advice and whether their nutritional status improved prior to and during pregnancy.

About 50% of women were normally nourished. All these women were informed that they were normally nourished; they were encouraged to continue their current dietary habits and life style. They were also requested to keep watch on their weight recorded once in three months. If there was any persistent weight gain, factors responsible for it such as alteration in dietary intake or physical activity were identified. Nutrition counselling was provided to prevent further weight gain. During nutrition education and counselling, it was emphasised that prevention of over-nutrition is critical as weight reduction in over-nourished women is very difficult.

Data from the present study also showed that abdominal adiposity (waist circumference $\geq$ 80cm) increased with increasing age and increase in BMI. Abdominal adiposity was seen in one-fourth of the 18-29 year women; half of the 30-49 year and 3/4th of the women beyond 50 years of age. Three fourth of the over-nourished women had abdominal adiposity. The association between abdominal adiposity and increased risk of non-communicable diseases has been well documented[2-4]. It is essential to improve awareness of the woman and her family about adverse health consequences associated with abdominal adiposity and advice women with over-nutrition and/or abdominal adiposity to seek health care institutions and undergo screening for non-communicable diseases.

Assessment of nutritional status and early detection of under- and over-nutrition is an important component of public health. Ideally nutritional and health assessment should be carried out periodically in all individuals and more often in vulnerable segments of population. Currently neither nutrition and health services nor our population are geared for such routine periodic assessment and appropriate counselling for prevention, early detection and effective management of under or over nutrition before clinical problems arise. There are efforts to upgrade facilities in primary health centres, so that they function as health and wellness centres providing screening for early detection of problems and

providing appropriate care. In places where these centres are not yet functional, every effort should be made to assess nutrition and health status of every person as when they seek health or nutrition care.

By conclusion, data from the present study indicate that among the urban women from low middle income families, prevalence of under-nutrition was low. Efforts for early detection and effective correction of under-nutrition in pre-pregnancy period are therefore possible and will benefit mother-child dyad. Over 40% of these women were normally nourished. Efforts should be directed to ensure that these women continue their current dietary intake and lifestyle remain normally nourished and healthy. Nearly half the women were over-nourished and over 40% have abdominal adiposity. In these women rise in over-nutrition was not due to increase in energy intake but mainly due to steep reduction in physical activity and rest of there were in the category of under nourished and advised to have suitable dietary care and support. Promoting synergy between health and nutrition services can enable the state to achieve improvement in health and nutritional status of women.