
RESULTS AND DISCUSSION

A mixed longitudinal study was undertaken to assess nutritional status of urban non pregnant non lactating women (NPNL, N= 4155) and to assess the impact of lactation on nutritional status of lactating women (N= 2240) from low middle income families. Anthropometric and circumferential measurements were recorded during the study period of three years (January, 2015 – December, 2017). The outcomes of the present study are presented and deliberated under the following headings:

- A. Total number of Non Pregnant Non Lactating(NPNL)and Lactating women enrolled**
- B. Socio demographic profile (SDP) of NPNL and Lactating women**
- C. Nutritional profile of NPNL women**
- D. Changes in Anthropometric and Circumferential Measurements in relation to Age**
- E. Nutritional Status of NPNL women in various age groups**
- F. Prevalence of Waist and Hip Circumference in relation to age**
- G. Changes in Anthropometric and Circumferential Measurements in Relation to Nutritional Status**
- H. Prevalence of Adiposity in Relation to Nutritional Status (BMI)**
- I. Mean Mid Upper Arm, Waist and Hip Circumference in Relation to Age and BMI**
- J. Anthropometric and Circumferential Measurements During Different Duration of Lactation**
- K. Impact of Lactation on Nutritional Status**
- L. Changes in Nutritional Status and Adiposity in Relation to Duration of Lactation**
- M. Comparison of anthropometric and circumferential measurements between lactating and NPNL women.**

A. Total number of Non Pregnant Non Lactating (NPNL) and Lactating women enrolled

Table I and II depicts the number of women and number of times anthropometric measurements were recorded.

Table I NPNL Women Enrolled and anthropometric and circumferential measurements.

| Year | Number of women | Number of times anthropometric measurements carried out | | | | |
|--------------|-----------------|---|--------------|-------------|-------------|-------------|
| | | Height | Weight | MUAC | WC | HC |
| 2015 | 841 | 841 | 2689 | 1689 | 2317 | 2317 |
| 2016 | 784 | 784 | 2419 | 1434 | 1983 | 1983 |
| 2017 | 2530 | 2530 | 6107 | 3617 | 3606 | 3606 |
| Total | 4155 | 4155 | 11215 | 6740 | 7906 | 7906 |

Table II Total Number of Women and Visits of Lactating Women

| Number of Women and Visits with Anthropometric Measurements | | | | | | | |
|--|----------------------|-----------------|-------------|-------------|-------------|-------------|-------------|
| Number of women in 18-29 years (Group A) with duration of lactation <36 months | | | | | | | |
| Year | Number of households | Number of Women | Height | Weight | MUAC | WC | HC |
| 2015 | 715 | 736 | 736 | 3400 | 2226 | 3196 | 3196 |
| 2016 | 515 | 538 | 538 | 1790 | 1034 | 1550 | 1550 |
| 2017 | 277 | 596 | 596 | 2509 | 805 | 807 | 807 |
| Total | 1807 | 1870 | 1870 | 7699 | 4065 | 5553 | 5553 |
| Number of women in ≥30 years (Group B) with duration of lactation <36 months | | | | | | | |
| Year | Number of households | Number of Women | Height | Weight | MUAC | WC | HC |
| 2015 | 141 | 141 | 141 | 685 | 438 | 633 | 633 |
| 2016 | 98 | 99 | 99 | 343 | 189 | 290 | 290 |
| 2017 | 130 | 130 | 130 | 572 | 181 | 183 | 183 |
| Total | 369 | 370 | 370 | 1600 | 808 | 1106 | 1106 |
| Grand Total | 2176 | 2240 | 2240 | 9299 | 4873 | 6659 | 6659 |

Total count of weight obtained for lactating women was 9299, MUAC was 4873, and WC and HC were 6659.

Total count of weight obtained for NPNL women was 11215, MUAC was 6740, WC and HC were 7906. For NPNL, as showed in the Table ___ Weight was measured in 11215 visits (2.7 measurements/ year). The numbers of circumferential measurements were lesser as circumferential measurements could not be taken in winters due to heavy woolens. Mid-upper arm circumference was measured in total 6740 in all three year, while the WC and HC were taken in 7906 visits. NPNL women were divided in to three groups, based on their age group of 18-29, 30-49, and ≥ 50 year this study. The analysis of data was done by using Excel and SPSS 25 (Property of IBM Corp. Copy right IBM corporation and its licensors 1989- 2017).

B. Socio Demographic Profile (SDP) of NPNL and Lactating Women

- Majority were nuclear families (75.8%) with five or less family 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 and 22% were semi-skilled workers. Over 90% of women were home makers
- Over 95% of households lived in brick and mortar buildings and 29.5% owned their houses and rest of them were mostly migrants, lived as tenants.
- Over 95% had access to piped water supply at home or in the vicinity and access to flush toilets either in their own home or shared with other households.
- For cooking almost all households used Liquefied Petroleum Gas (LPG) and stainless steel utensils.
- Over 98% owned colour TV, which was their main source of entertainment.
- If 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.

Analyses of lactation data on socio demographic profile of the study households showed that majority were nuclear families (Group A 70.1%, Group B 63%) with five or less members (Group A 63.6%, Group B 61.4%). Majority of women (Group A 54.7%, Group B 52.2%) had secondary school education. Majority were home makers (Group A 85%, Group B 91.9%). Over 95% of families in both the groups lived in brick and mortar buildings; 40.8% of Group A and 37.3% of Group B women lived in their own houses; the rest were mostly migrants who lived as tenants. Public tap was the major source of water (Group A 86.7%, Group B 79.7%); tankers supplied drinking water in times of water scarcity. Access to flush toilets either in their own home or shared with other households was available to almost all families (Group A 98.8%, Group B 98.4%). For cooking, almost all households used Liquefied Petroleum Gas (LPG) and stainless steel utensils. Over 90% owned color TV, which was their main source of entertainment; after completing household chores within the small tenement, women sat down and watched TV or chatted with friends using mobile phones. The families stated that they belonged to low middle income group and this was confirmed when household possessions were considered. Majority of families lived in one or two room tenements (Group A 63%, Group B 65.7%), in over-crowded unhygienic localities because of urban housing constraints. These families stated that they were food secure; they accessed subsidized food grains from Public Distribution System and if needed availed ICDS supplementary feeding programmes.

C. Nutritional Profile of NPNL women

a. Number of weight measurements of NPNL by Age and BMI

Enrolled women were divided in to three age groups. For NPNL that was 18-29, 30-49 and ≥ 50 . Women were also classified in to age group in relation to the WHO BMI classification. With increase in age, the numbers of under-nourished and normally nourished women were falling, while the numbers of over-nourished women were

increasing. In the age group of 18-29 years, maximum women were in normally nourished and in contrast, in the age group of 30-49 and 50 and above, maximum number of women falls under the category of over-nutrition (Table III).

Table III: Number of Weight Measurements in age/BMI Groups

| Age/BMI | <18.5 | 18.5-24.9 | ≥25 | Total |
|-----------|-------|-----------|------|-------|
| 18-29 yrs | 663 | 2959 | 1858 | 5480 |
| 30-49 yrs | 156 | 1517 | 2332 | 4005 |
| ≥50 yrs | 56 | 457 | 1109 | 1622 |
| Total | 875 | 4933 | 5299 | 11107 |

b. Anthropometric and circumferential Profile of NPNL Women

In the Table IV, Mean and SD of all anthropometric and circumferential parameters were calculated in relation to three age groups (18-29, 30-49 and ≥ 50 years) as well as in relation to BMI.. 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 groups and BMI groups were computed and statistical significance of the differences were assessed using chi square test.

Table IV: Mean & SD of Anthropometric and circumferential Profile of NPNL Women

| Parameter | Mean±SD |
|---|--------------------|
| Height* | 151.7±5.88 (4155)* |
| Weight | 57.5±12.71 (11141) |
| BMI | 25.1±5.20 (11133) |
| MUAC | 26.5±4.06 (6718) |
| WC | 78.1±11.85 (7835) |
| HC | 96.1±10.13 (7835) |
| *height does not change in adult women; hence taken only at the time of enrolment | |

The mean and SD of the anthropometric and circumferential parameters in the study population is given in Table IV. These women were relatively short (mean height was only 151.7 cm); mean weight was 57.5. Mean BMI, MUAC, WC and HC were relatively high among these women.

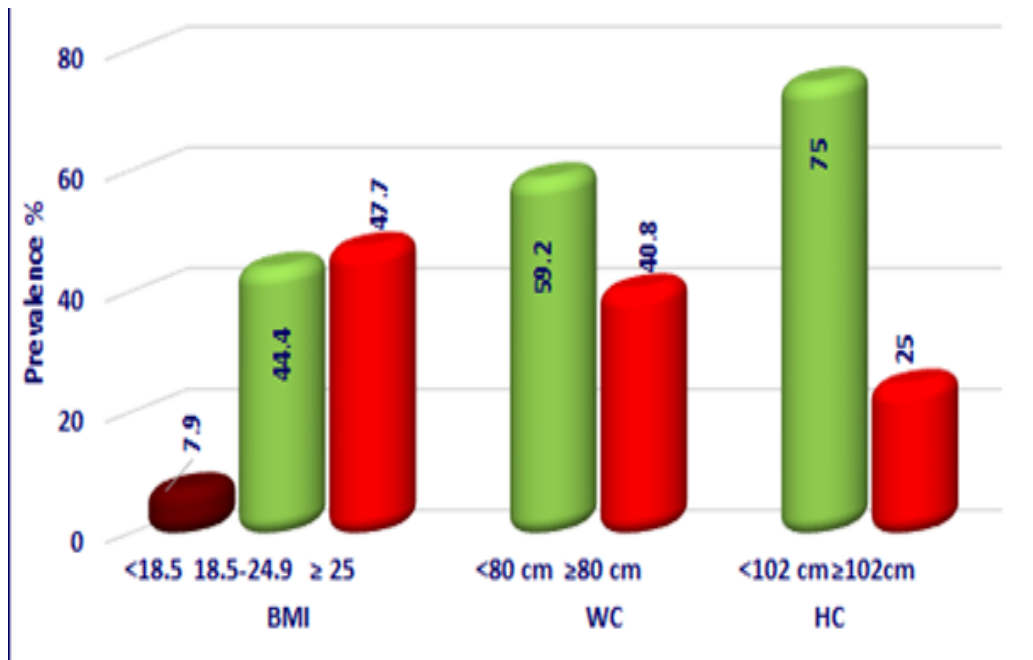


Figure 18: Prevalence of UN, NN, ON, Abdominal and Truncal Adiposity among Women

As shown in Figure 18, Prevalence of under-nutrition was relatively low at 7.9%; while 44.7% were normally nourished. Nearly half of these women (47.7%) were over-nourished. More than 40% of women had abdominal adiposity indicated by a WC of ≥ 80 cm while about one fourth had truncal adiposity marked by a HC of ≥ 102 cm.

D. Changes in Anthropometric and Circumferential Measurements in Relation to Age

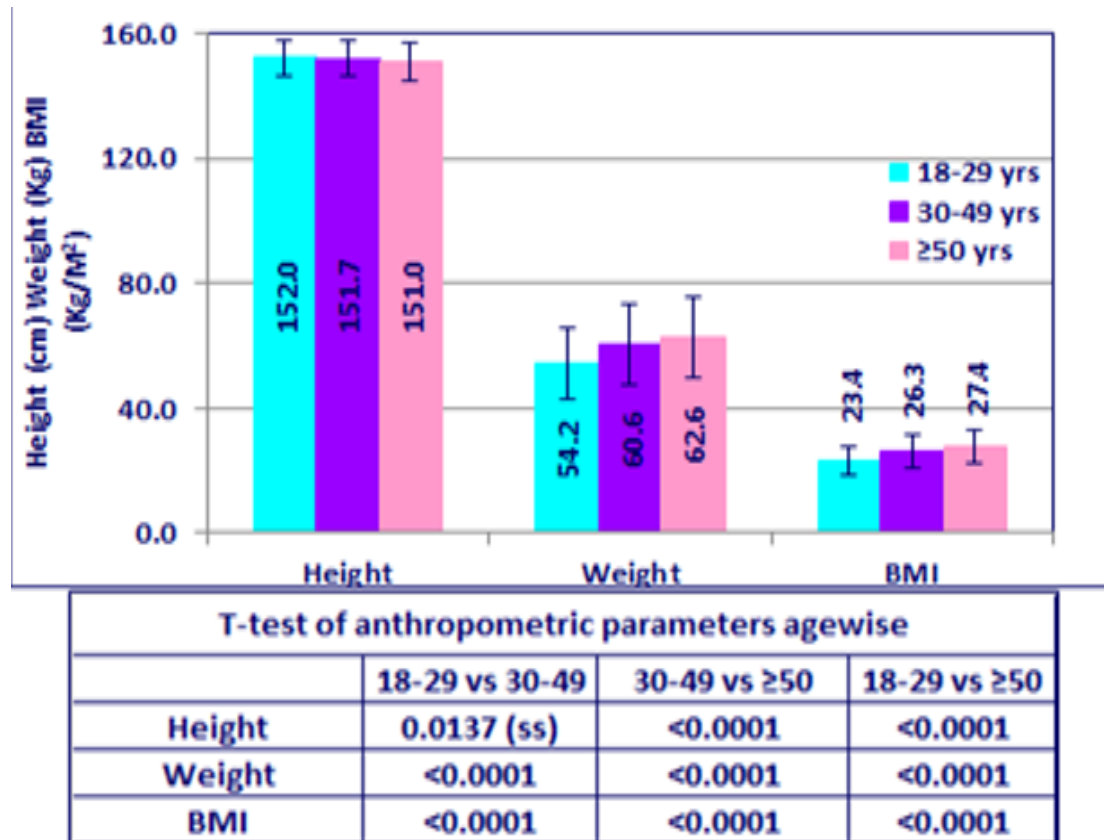


Figure 19: Anthropometric Measurements in Relation to age (Mean & SD)

Mean height, weight, BMI, MUAC, WC and HC in three age groups (18-29, 30-49 and ≥ 50 years) is shown in Figures 19 and 20. The differences in the mean height between the three groups were very small (152 cm, 151.7 and 151cm). With increasing age, there were a progressive increase in body weight (54.2, 60.6 and 62.6 kg), BMI (23.4, 26.3 and 27.4). The progressive increase in MUAC, WC and HC were also observed.

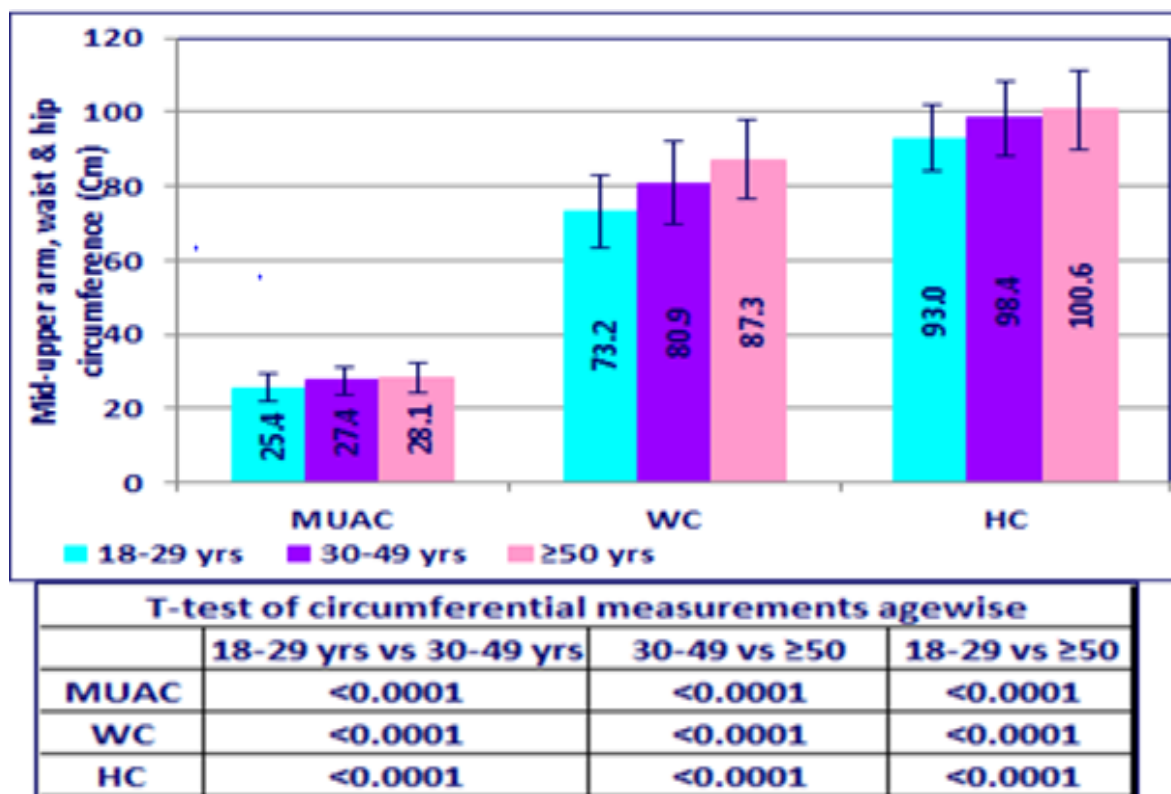


Figure 20: Circumferential Measurements in Relation to age (Mean & SD)

Among all circumferential measurements, Changes in Mean WC was observed at a greater extent as compare to MUAC and HC. (Figure 22).

E. Nutritional Status of NPNL Women in Various Age Groups

In the 18-29 years age group prevalence of under-nutrition was low (12.1%); there was further fall in under-nutrition rate with increase in age. In the age group of 30-49 prevalence of under nutrition was only 3.9% and 3.5% in 50 and above. Prevalence of over-nutrition in the under 30 year age group was 33.9 %; there was a steep increase in over-nutrition in 30-49 years (58.2%) and in ≥ 50 age group 68.4% of women were over-nourished. More than 50% were normally nourished in the age group of 18-29 and the percentages of normally nourished women were decreasing with increasing age. (Figure 21)

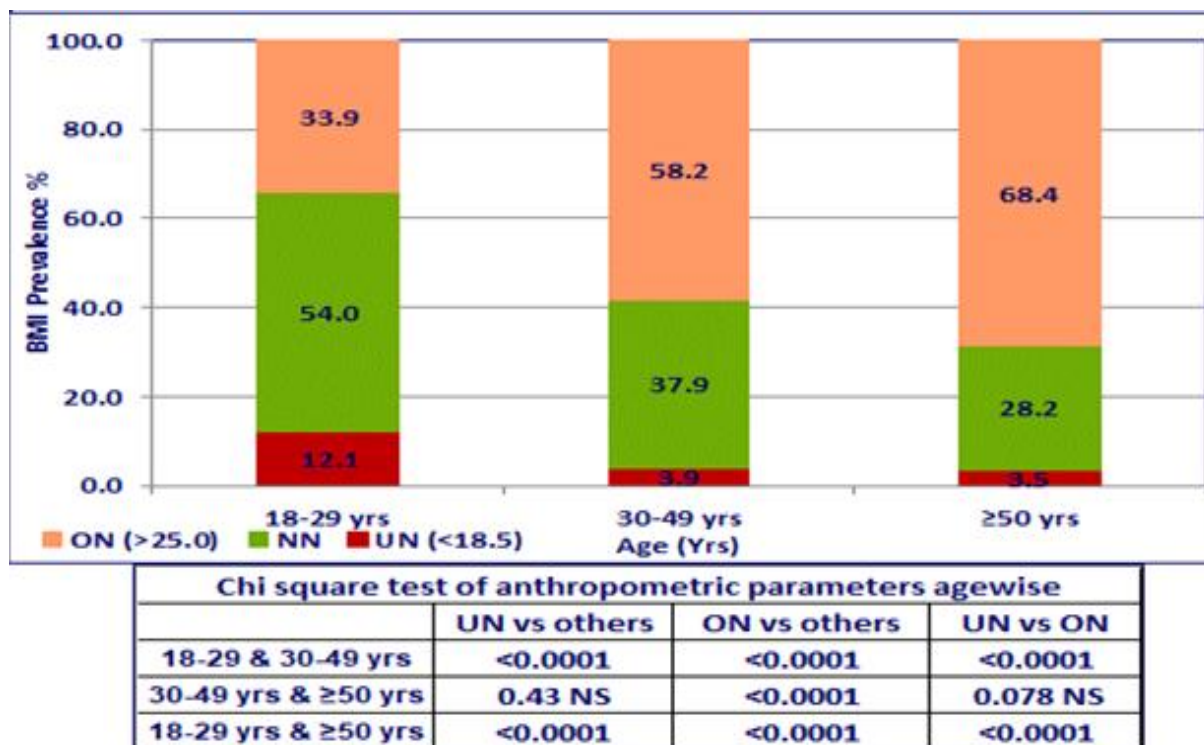


Figure 21 Nutritional Status of Women in various age groups

Figure 23 clearly shows that with increasing age the prevalence of over-nutrition was increasing and under- nutrition and normal nutrition was decreasing.

When women reach in their fifties and above, around 70% women were over nourished (Figure 21). It may be happen due because they live in one or two room on rent and they do not have a public space for doing walking and other exercises. They also love to chat on mobile with their friends and relatives after completing all the household chores. They used LPG gas and do not have any moderate activity for doing any household chores. When women reach their thirties, their children had grown up and they spend their time in leisure and when they reach in their fifties and sixties, all the household chores were taken up by their either daughter or daughter-in-law. So they spend most of their time in sitting and gossiping. They also had no awareness about the hazards of obesity on their health status. Because of these factors, the level of physical activity is very low and they had positive energy balance.

F. Prevalence of Waist and Hip Circumference in relation to age

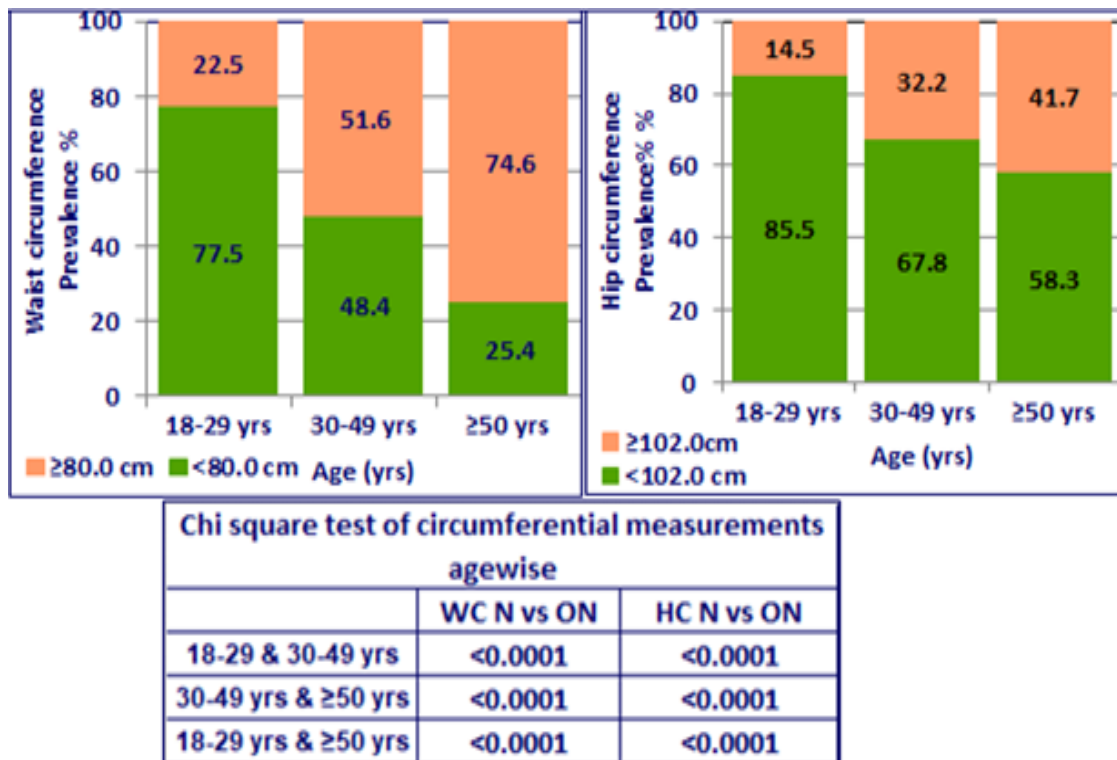


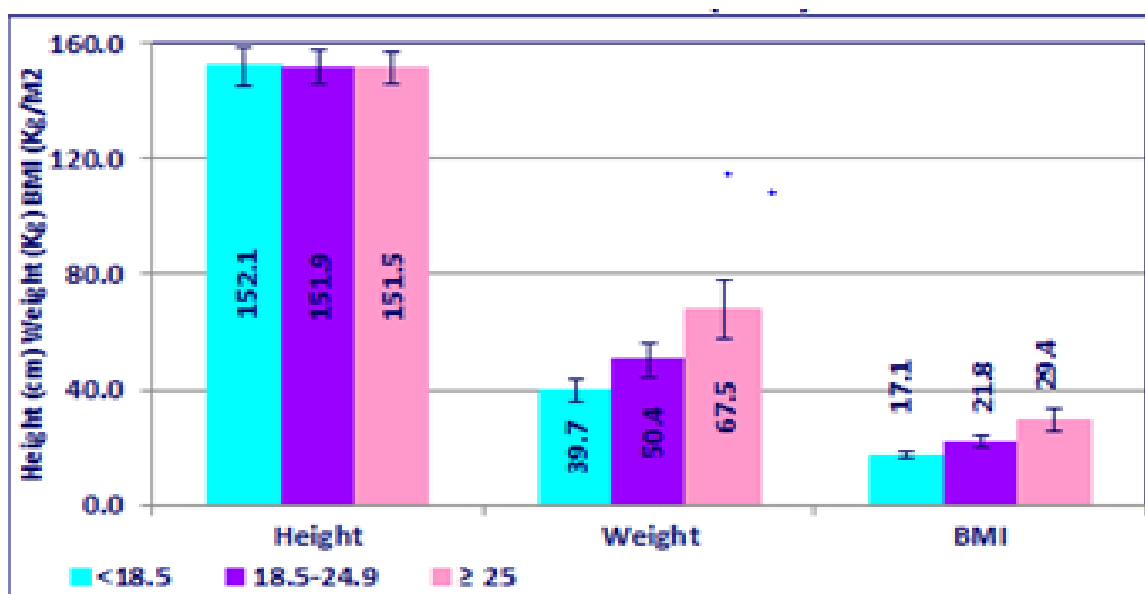
Figure 22: Prevalence of adiposity in relation to age

As shown in Figure 22 there was a progressive increase in waist circumference with age; there was also an increase in hip circumference with age but these were of a lower magnitude as compared to waist circumference. Prevalence of adiposity as assessed by high WC and HC were seen right from 18-29 years age group and increased with increasing age. In the age group of 30-49 more than 50% had abdominal adiposity. In each age group prevalence of high WC was higher as compared to high HC.

For 18-29 age groups more than 75% women had less than 80 cm waist circumference. A drastic rise was observed in 30-49 age group. Less than 50% women had <80 cm waist circumference in the age group of 30-49 and in the 50 and above it was only 25%. It depicts that three fourth of women aged 50 years and above, had high WC. So this graph shows that with increasing age, the prevalence of high WC was increasing among women.

Hip circumference was also increasing with age like waist circumference but in a lower magnitude. About 85% women had less than <102 cm in the age group of 18-29 and it was decreasing with increasing age. 41.7% of women aged 50 and above had high HC.

G. Changes in Anthropometric and Circumferential Measurements in Relation to Nutritional Status



| | <18.5 vs 18.5-24.9 | 18.5-24.9 vs ≥ 25 | <18.5 vs ≥ 25 |
|--------|--------------------|-------------------|---------------|
| Height | 0.3665 (ns) | 0.0005 | 0.0042 |
| Weight | <0.0001 | <0.0001 | <0.0001 |
| BMI | <0.0001 | <0.0001 | <0.0001 |

Figure 23: Anthropometric Measurements in relation to BMI

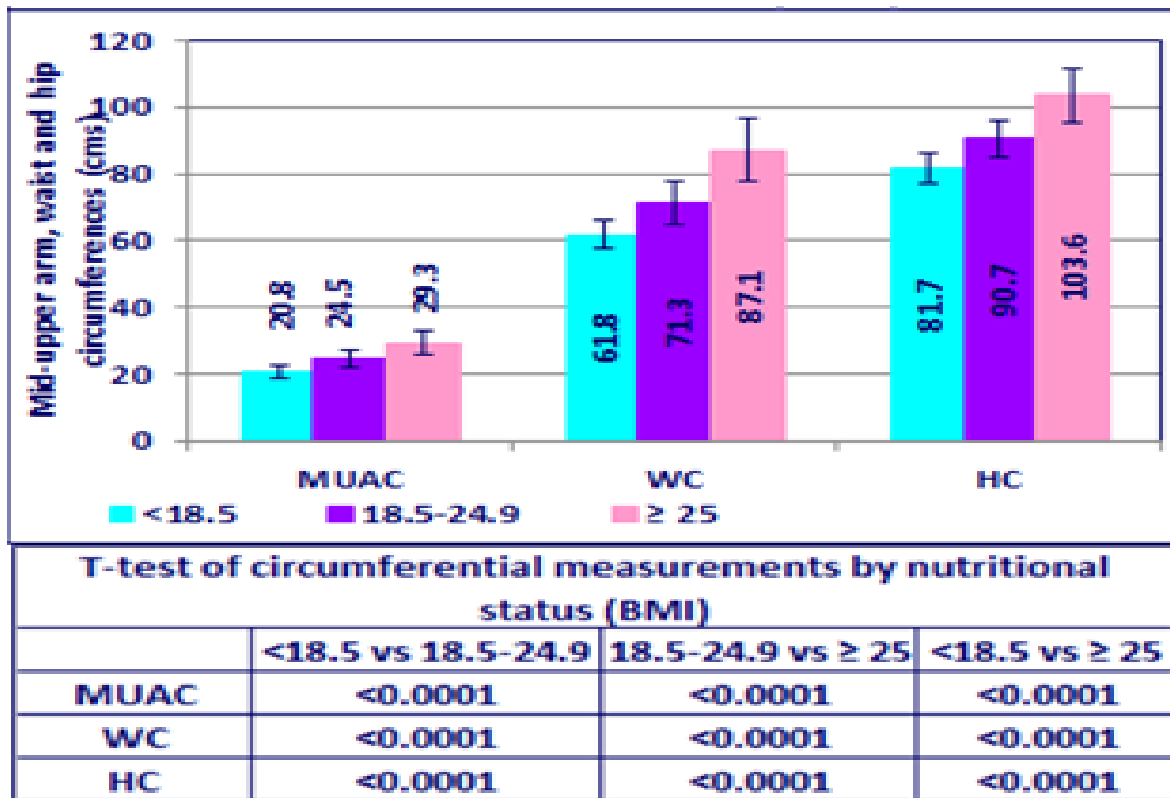


Figure 24: Circumferential Measurements in relation to BMI

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 with increasing BMI. The mean weight for under nourished, normally and over-nourished women was 39.7, 50.4 and 67.3 respectively. Mean BMI was 17.1, 21.8 and 29.4 for under, normal and over nourished women. There was a sudden steep increase observed in the mean BMI for over-nourished women. Likewise Weight and BMI, all circumferential measurements (Mid-upper arm, Waist and Hip Circumference) were increasing with increasing BMI. Mean MUAC was 20.8, 24.5 and 29.3 and WC was 61.8, 71.3 and 87.1 for under nourished, normally nourished and over nourished. All these differences were substantial and were statistically significant (Figure 23 & 24).

H. Prevalence of Adiposity in Relation to Nutritional Status (BMI)

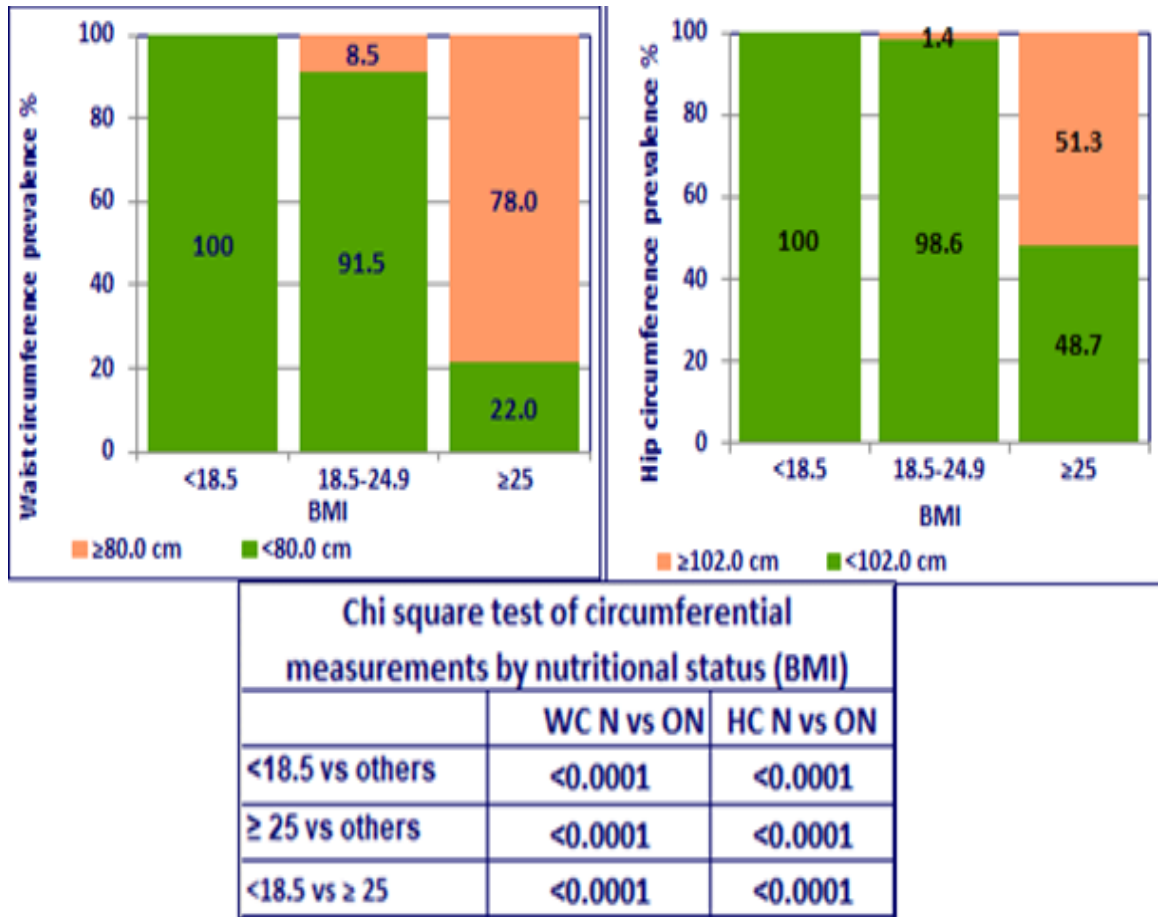


Figure 25: Prevalence of adiposity in relation to Nutritional Status (BMI)

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.

A very steep increase was observed among over-nourished women; 78% had high WC and 51.3% had high HC (Figure 25).

I. Mean MUAC, WC and HC in Relation to Age and BMI

As shown in the figure 28, the mean of MUAC, WC and HC were increasing with increasing in age and BMI. MUAC is slowly increasing with increasing in age in relation to BMI.

Any major differences were not observed in mean MUAC in all age groups in relation to BMI. Among undernourished women, in all the three age groups mean MUAC was near 20 cm and among normally nourished and over nourished it was nearly 24 and 29. For under nourished women in all age groups mean HC was nearly 80 and it was increasing as the women come under normally and over nourished. (Figure 26)

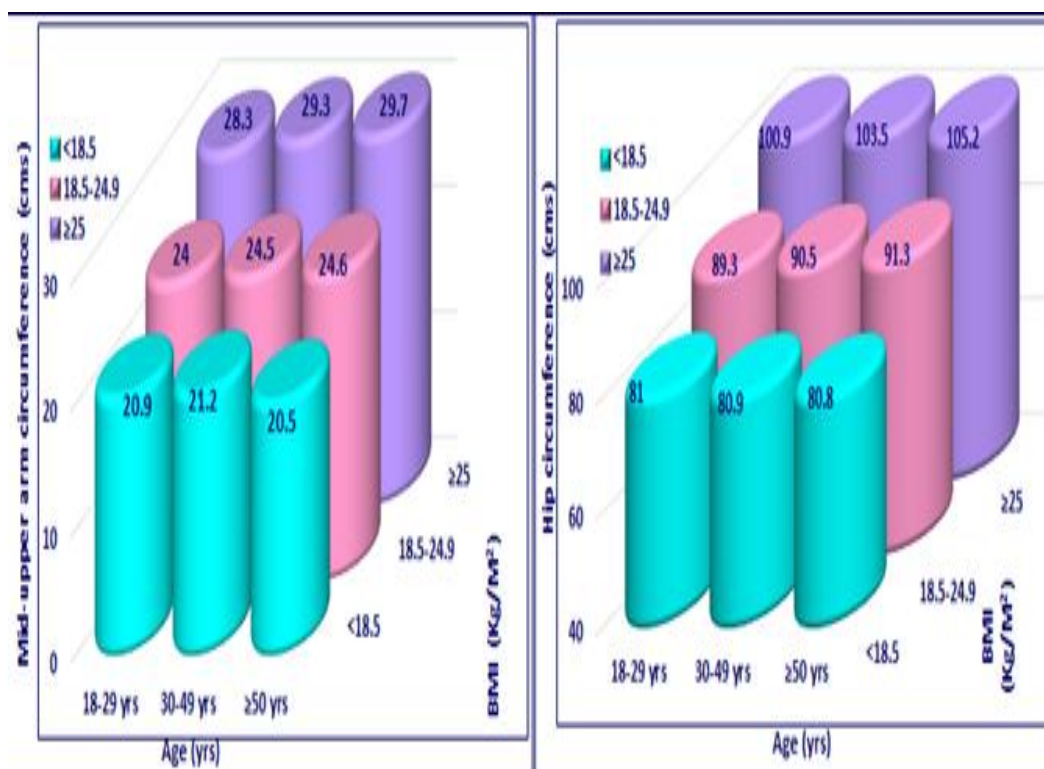


Figure 26: Mid Upper Arm and Hip Circumference in Relation to age and BMI

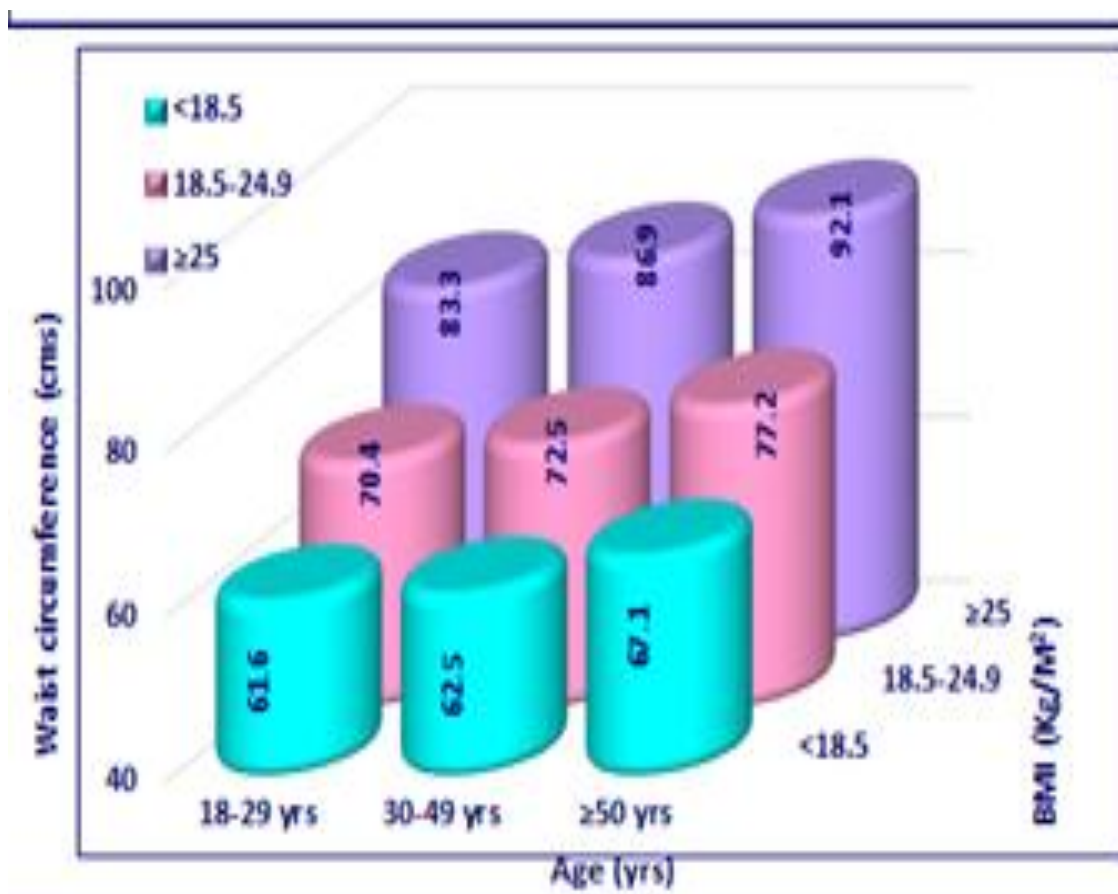
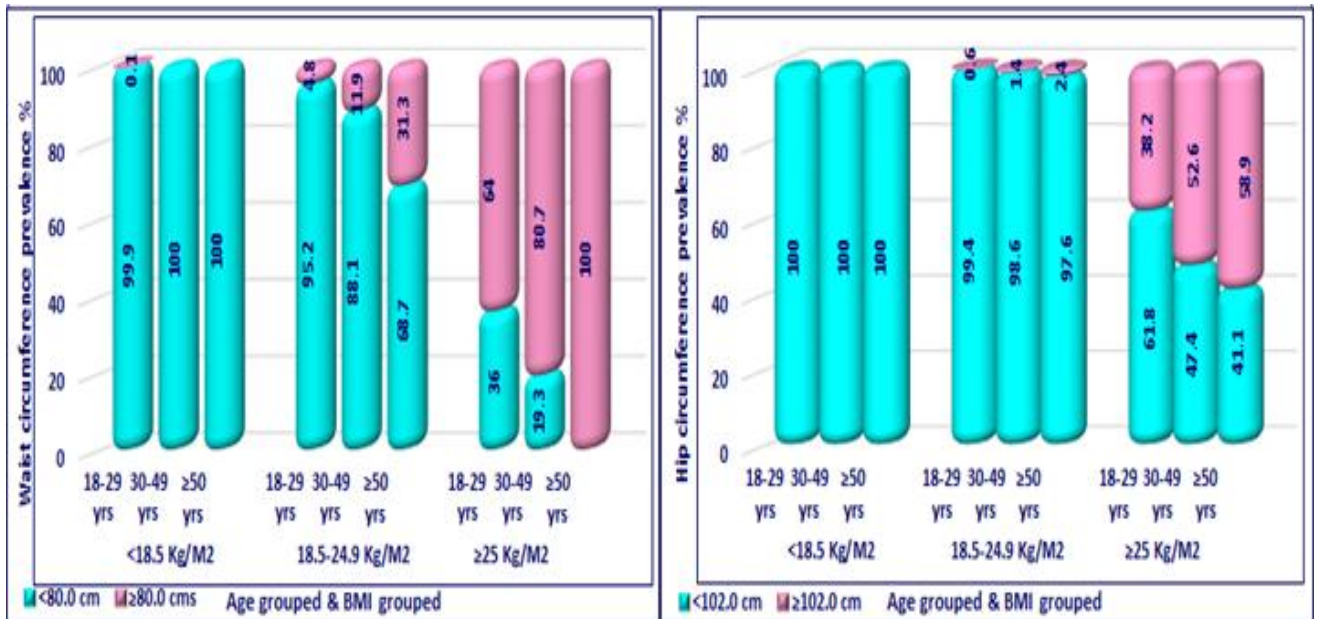


Figure 27: Waist Circumference in Relation to age and BMI

In reference to Waist Circumferences, more increase in WC was observed with increasing age in relation to BMI as compare to MUAC and Hip circumference. Among undernourished women, the mean WC for all age group was nearby 60 cm and a sudden steep has done and it reached more than 75 cm for normally nourished women; for over-nourished women it reached up to 92 cm. Now a days it seems that majority of women were having abdominal adiposity and it is a major cause for developing Non communicable disease. Like MUAC, HC was also increasing in a lower extent. (Figure 27)

Figure 28: Prevalence of adiposity in relation to age and BMI



Among under nourished women, no women in all three age group had high WC and HC. In reference to normally nourished women in the age group of 18-29 about 5 % had high WC and it was increasing with age, while Hip circumference was only 0.6% in 18-29 and 1.4%, 2.4% in 30-49 and above 50 respectively. This data suggests that the prevalence of abdominal adiposity is more as compare to truncal adiposity. It is very surprising that even normally nourished women had high Waist Circumference. Among over-nourished women, 64% in the age group of 18-29 and more than 80% in 30-49 had high WC. All 100% over-nourished women had high WC in the age group of more than 50. Prevalence of hip circumference is also increasing in all age groups among over-nourished women.(Figure 28).

Abdominal or central adiposity is the main reason for developing non communicable disease. It is shocking that even normally nourished women had abdominal adiposity. None of the under nourished women had abdominal and truncal adiposity. With increasing age and BMI, abdominal adiposity is also increasing. As compare to truncal adiposity, abdominal adiposity is increasing in a greater extent. As a result their physical activity in the household work domain was sedentary. They had relatively ready access to health care for infection. In this study assessment of nutritional status was also done by BMI. With increasing in BMI all the circumferential measurements were increasing.

J. Anthropometric and Circumferential Measurements During Different Duration of Lactation

Table V depicts the anthropometric and circumferential measurement during different period of lactation.

Anthropometric Measurements done during Different Periods of Lactation

| Duration of lactation (months) | Weight (kg) | | | WC/HC (cm) | | | MUAC (cm) | | |
|--------------------------------|-----------------|------|-------|-----------------|------|-------|-----------------|------|-------|
| | Age group (yrs) | | | Age group (yrs) | | | Age group (yrs) | | |
| | 18 - 29 | ≥ 30 | Total | 18 - 29 | ≥ 30 | Total | 18 - 29 | ≥ 30 | Total |
| 0.01 - 5.9 | 1890 | 341 | 2231 | 1413 | 248 | 1661 | 986 | 163 | 1149 |
| 6.0 - 11.9 | 2118 | 341 | 2459 | 1588 | 246 | 1834 | 1174 | 178 | 1352 |
| 12.0 - 17.9 | 1492 | 264 | 1756 | 1052 | 171 | 1223 | 747 | 125 | 872 |
| 18.0 - 23.9 | 1085 | 276 | 1361 | 745 | 191 | 936 | 585 | 147 | 732 |
| 24.0 - 29.9 | 735 | 212 | 947 | 493 | 135 | 628 | 367 | 96 | 463 |
| 30.0 - 35.9 | 379 | 166 | 545 | 262 | 115 | 377 | 206 | 99 | 305 |
| Total | 7699 | 1600 | 9299 | 5553 | 1106 | 6659 | 4065 | 808 | 4873 |

K. Impact of Lactation on Nutritional Status of Lactating Women

Changes in anthropometric indices and Circumferential Measurements in relation to duration of lactation

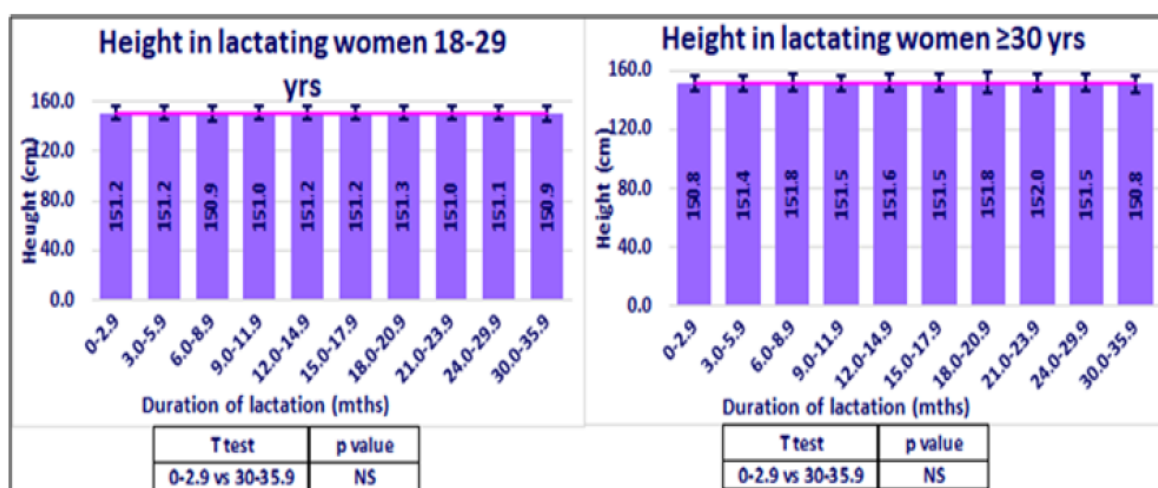


Figure 29: Height in Relation to Duration of Lactation

a. Height in relation to duration of lactation

Height was taken only at the time of enrolment. Mean height of woman in the two age groups (Group A and Group B) during different duration of lactation. There were no differences in the mean height of lactating women either in Gr A and Gr B in relation to duration of lactation, indicating that they were a homogenous group (Figure 29)

b. Weight in relation to duration of lactation

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. (Figure 30)

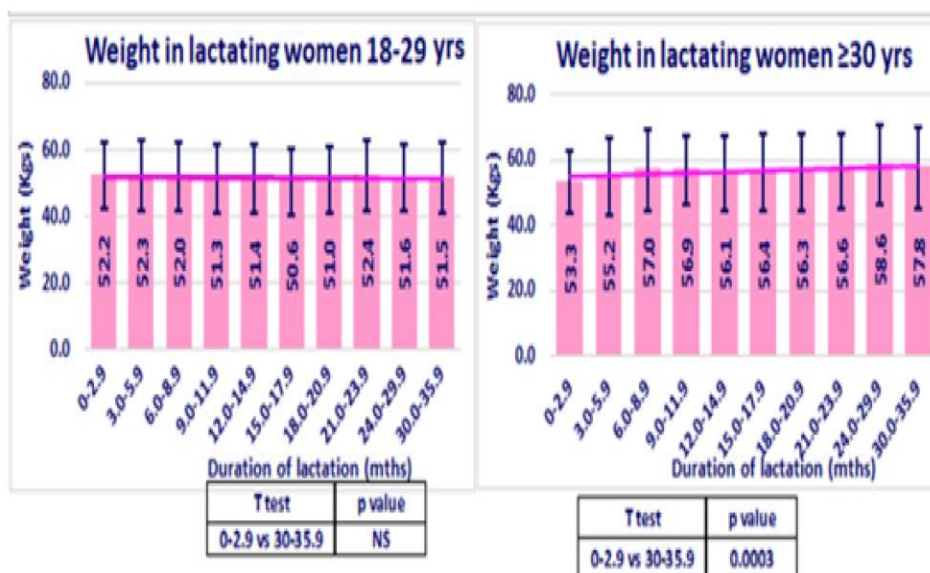


Figure 30: Weight in Relation to Duration of Lactation

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. (Figure 35).

c. BMI in relation to duration of lactation

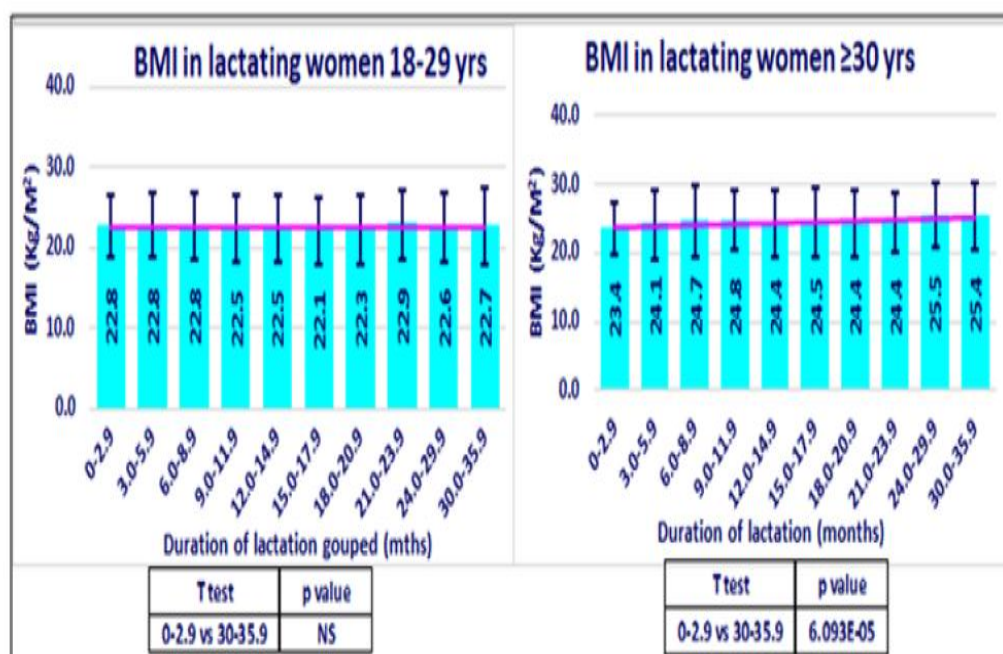


Figure 31: BMI in Relation to Duration of Lactation

Mean BMI of lactating women in Group A was lower as compared to Group B across all duration 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.(Figure 31)

d. MUAC in Relation to Duration of Lactation

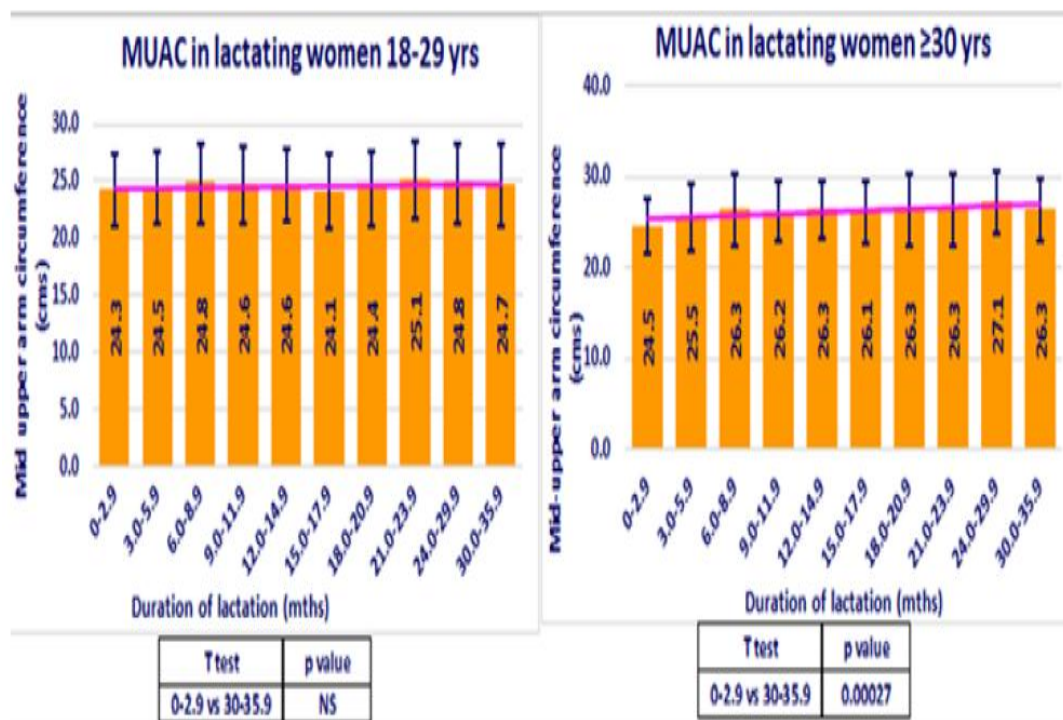
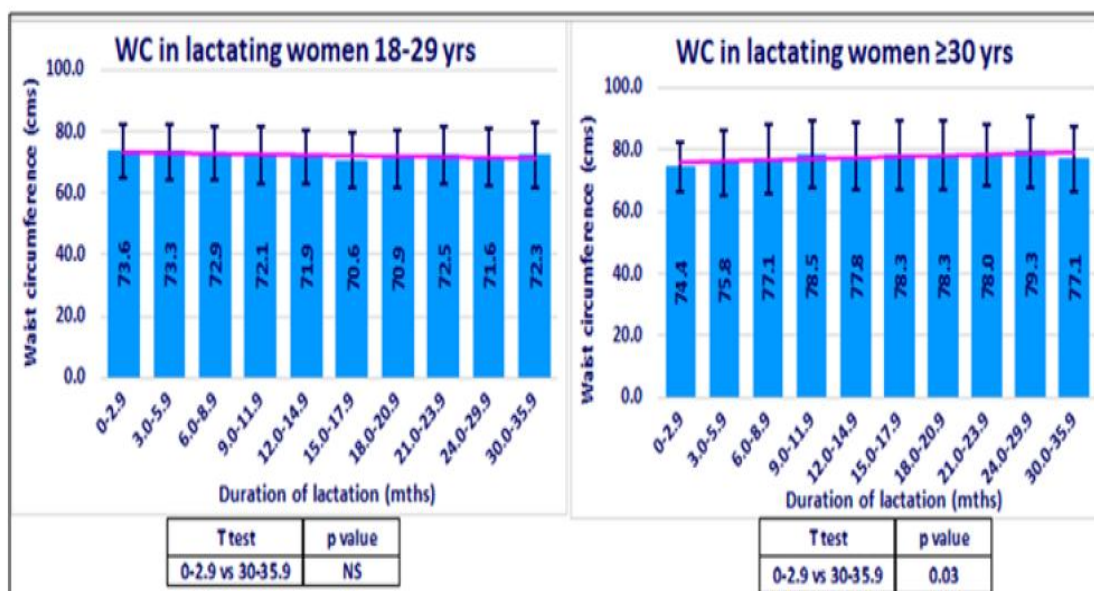


Figure 32: MUAC in Relation to Duration of Lactation

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. (Figure 32)

e. WC in relation to duration of lactation

The mean WC across all durations of lactation was higher in women in Group B as compared to Group A. In Group A the mean WC was highest in the 0-2 months. Subsequently there was a small reduction in the WC between 3 and 17 months of



lactation (Figure 37)

Figure 33: WC in Relation to Duration 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.(Figure 33)

f. HC in relation to duration of lactation

As shown in the Figure 38 the mean HC across all durations of lactation was higher in women in Group B as compared to Group A. In Group A the mean HC was highest in the 0-2 months. Subsequently there was a small reduction between 0-2 and 18-20 months of lactation.

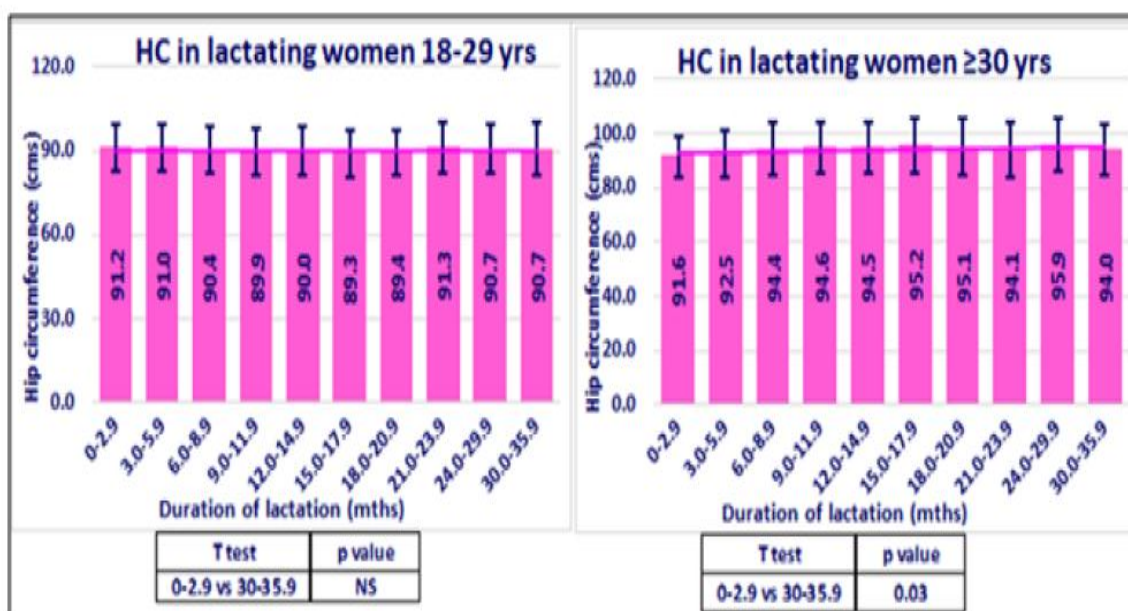


Figure 34: HC in Relation to Duration of Lactation

The reduction in the mean HC between 0-2 months and 30-35 months was 0.5 cm in Group A; this difference was not statistically significant. In Group B the lowest mean HC was seen in 0-2 months of lactation. There was a progressive increase in the mean HC till 29 months. The increase in the mean HC between 0-2 months and 30-35 months was 2.4 cm; this difference was statistically significant. (Figure 34)

g. WHR in relation to duration of lactation.

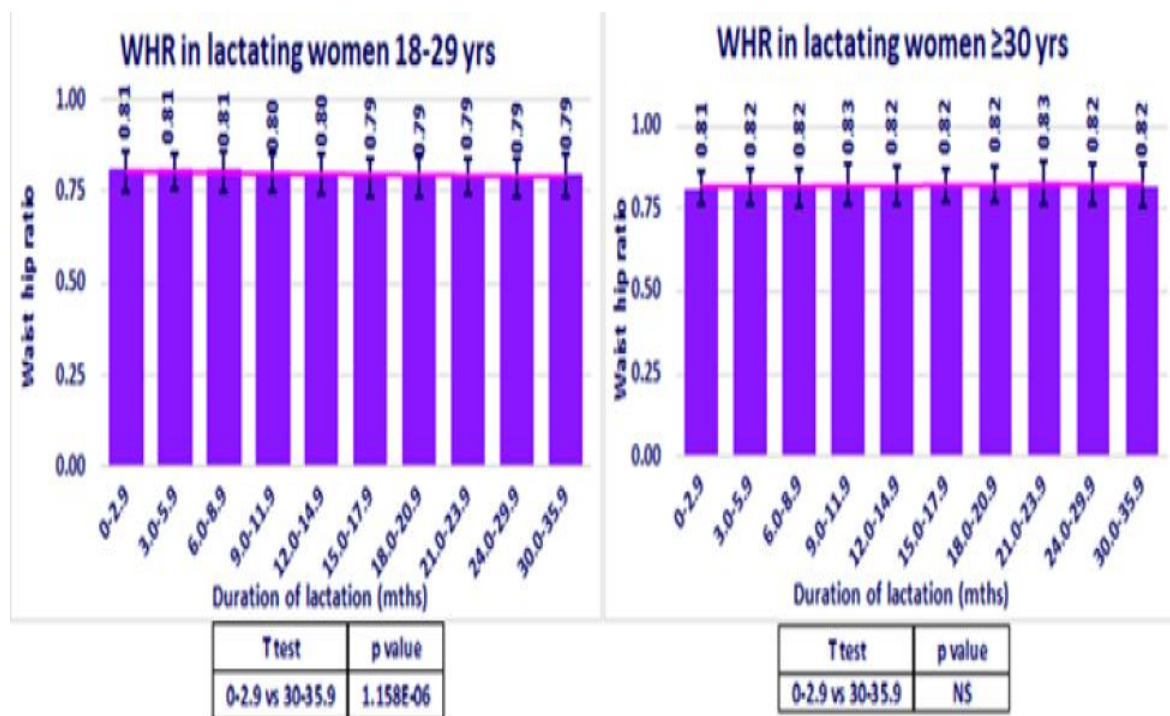


Figure 35: WHR in Relation to Duration of Lactation

As shown in the figure 35 the mean WHR was marginally higher in Group B group as compared to Group A across all durations of lactation. In Group A the mean WHR showed a small decline between 0-2 and 30-35 months which was statistically significant. In Group B mean WHR remained essentially unaltered across all different durations of lactation; the difference between 0-2.9 and 30-35.9 months was not statistically significant

L. Changes in Nutritional Status and Adiposity in relation to Duration of Lactation

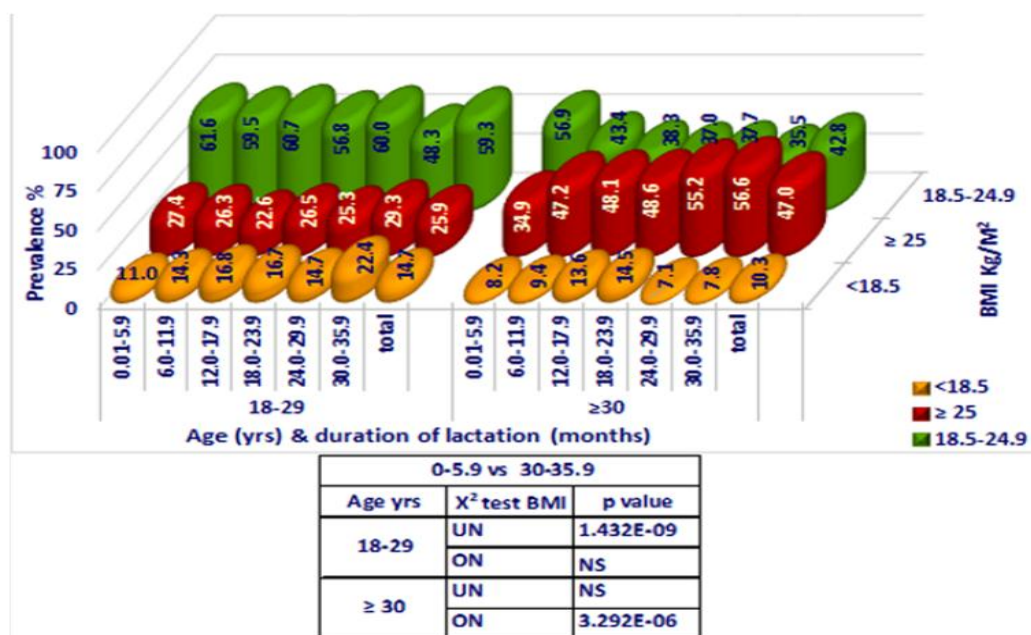


Figure 36: Changes in Nutritional Status (BMI) in Relation to duration of lactation and age

Bothin Group 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 There was sharp rise in over-nutrition rates in the 6-11 months 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 were increased by 21.7% between 0-5 months and 30-35 months and this was statistically significant. (Figure 36)

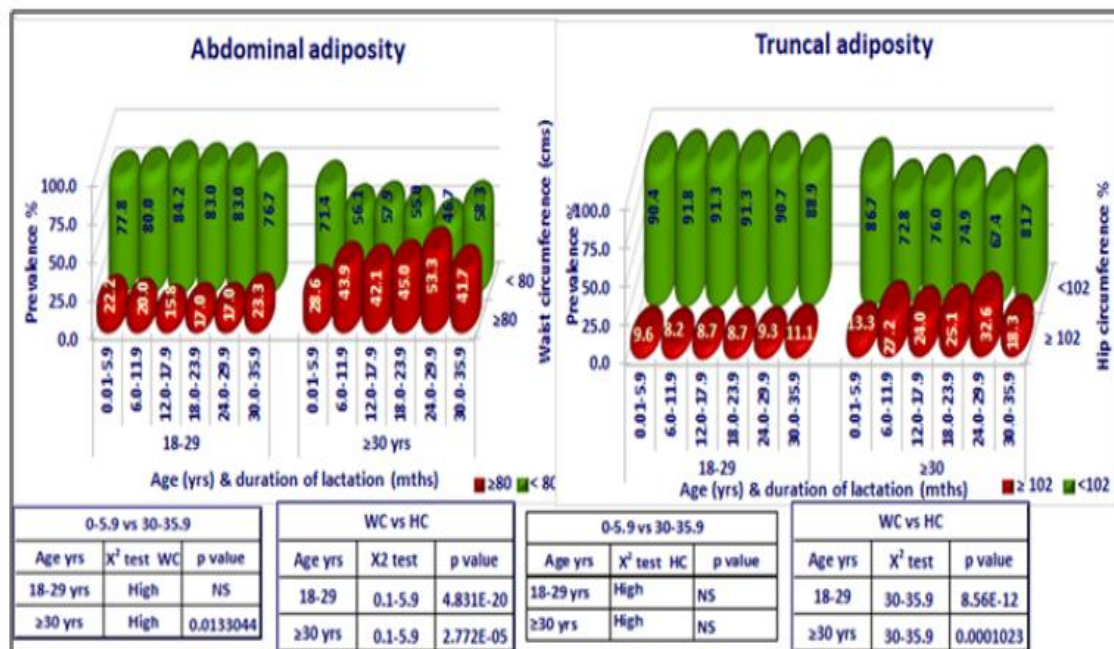
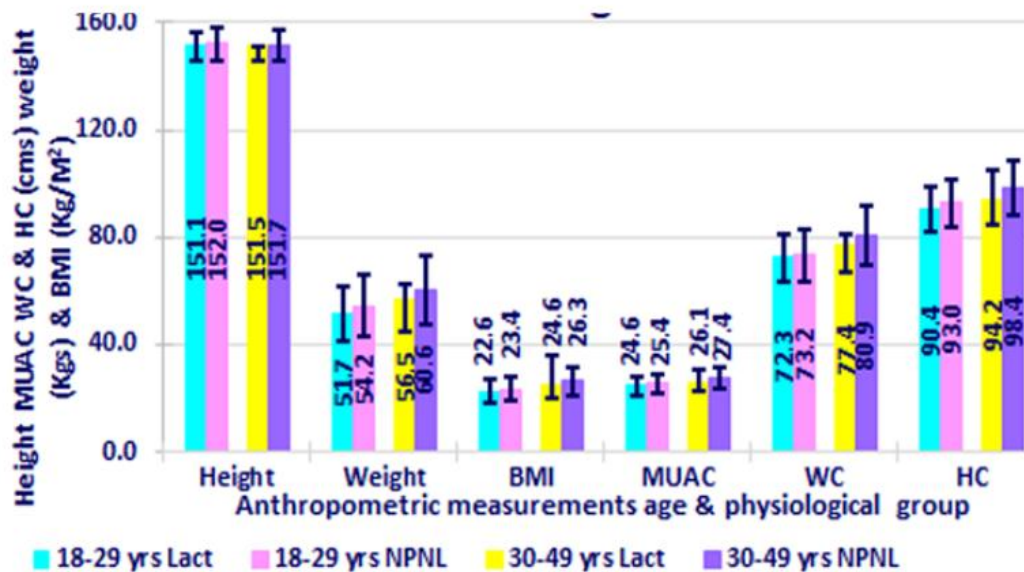


Figure 37: Adiposity in Relation to Duration of Lactation and Age

Prevalence of abdominal adiposity as assessed by high WC (≥ 80 cm) as well as truncal adiposity as assessed by high HC ($HC \ge 102$ 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. In Group A there was a progressive fall in the prevalence of high WC from 22.2% to 15.8% between 0-5 and 12-17 months; subsequently there was a rise and at 30-35 months 23.3% had high WC. There was an increase of 1.1% of high WC between 0-5 and 30-35 months of lactation. This difference was not statistically significant. Prevalence of high WC was 28.6% in the 0-5 months in Group B. There was a progressive rise in high WC with increasing duration of lactation. The increase in prevalence of high WC between 0-5 and 30-35 months of lactation in Group B was 13.1%. The substantial rise in abdominal adiposity was statistically significant. Changes in truncal adiposity (high HC) showed a similar trend but the differences between 0-5 and 30-35 months were not significant either in Group A or Group B. Abdominal adiposity rates were nearly double that of truncal adiposity rates in both Group A and B; these differences were statistically significant. (Figure 37).

M. Comparison of anthropometric and circumferential measurements between Lactating and NPNL women



| Two tailed test comparison between lactating & NPNL | | | | | |
|---|-----------|------------|--------|-----------|------------|
| Anthro | Age group | p value | Anthro | Age group | p value |
| Height | 18-29 yrs | 0.00E + 00 | MUAC | 18-29 yrs | 0.00E + 00 |
| | ≥ 30 yrs | NS | | ≥ 30 yrs | 2.22E - 16 |
| Weight | 18-29 yrs | 0.00E + 00 | WC | 18-29 yrs | 6.55E - 06 |
| | ≥ 30 yrs | 0.00E + 00 | | ≥ 30 yrs | 0.00E + 00 |
| BMI | 18-29 yrs | 0.00E + 00 | HC | 18-29 yrs | 0.00E + 00 |
| | ≥ 30 yrs | 0.00E + 00 | | ≥ 30 yrs | 0.00E + 00 |

Figure 38: Comparison of anthropometric and Circumferential Measurements between Lactating and NPNL 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.

Lactation involves additional maternal energy expenditure for breast milk production - estimated to be about 500 kcal/day and this is likely to have an impact on their nutritional status. 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 years age group from the same community. In both age groups lactating women weighed significantly less, had lower mean BMI, MUAC, HC and WC as compared to non-lactating women (Figure 31). In both age groups, lactating women had higher under-nutrition and lower over-nutrition rates as compared to NPNL women of the same age group (Figure 32). Adiposity as assessed by WC and HC was higher in NPNL group as compared to lactating women in 18-29 and ≥ 30 years age groups. Meeting the additional expenditure of milk production appears to be responsible for the lower body weight, higher under-nutrition, lower over-nutrition and lower adiposity rates in lactating women as compared to their NPNL counterparts.

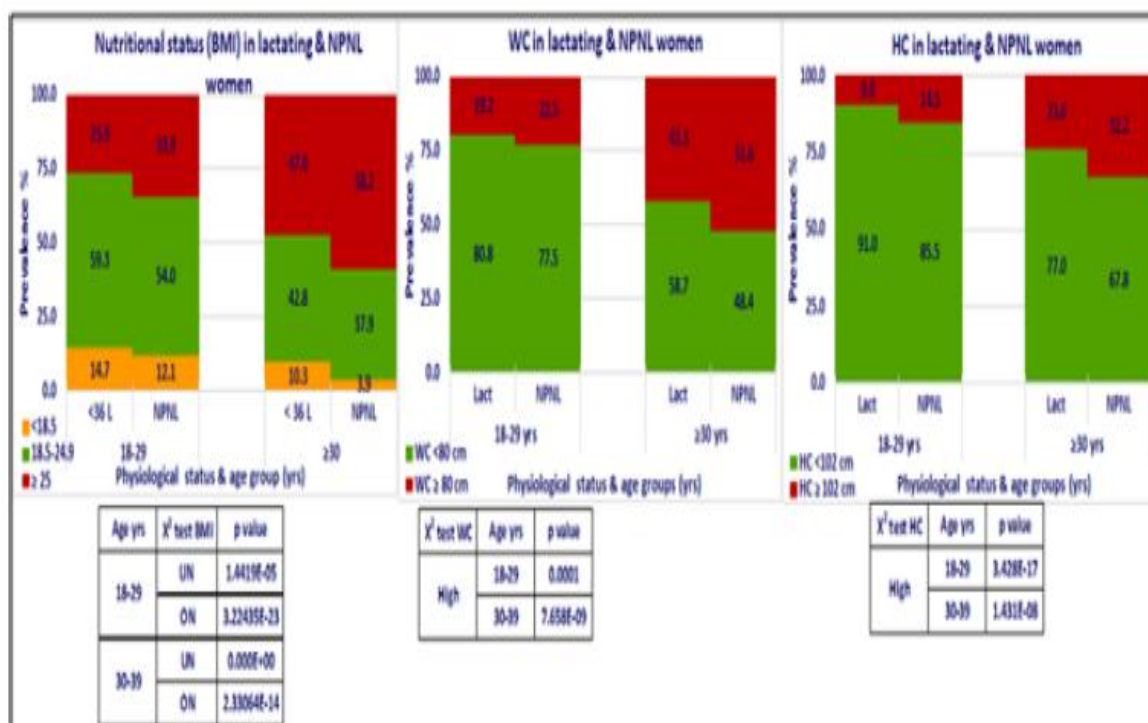


Figure 39: Comparison of Nutritional Status and Adiposity between Lactating and NPNL Women

The prevalence of abdominal adiposity ($WC \geq 80$ cm) and truncal adiposity ($HC \geq 102$ cm) both in lactating and NPNL women in the 18-29 and ≥ 30 years age groups is very high. Prevalence of abdominal adiposity is twice that of the truncal adiposity in all the four groups. Abdominal adiposity is associated with increased risk of metabolic syndrome and higher risk of cardiovascular diseases. There is an urgent need to provide health education and ensure that that these women do go to the health and wellness centres, get their blood pressure and blood glucose checked and get appropriate advice regarding physical activity and medication if needed. Early detection and effective treatment of NCD will reduce the complications and severity of these diseases in these reproductive age women.

Data from the present study indicate that in Group A there was no persistent deterioration in nutritional status or reduction in adiposity early in lactation or with increasing duration of lactation up to 36 months. This is perhaps because these women are from food secure households and physical activity household work and childcare were predominantly sedentary. The initial reduction might be due to post-delivery changes in abdominal muscle tone and reduction in abdominal fat. The rise in prevalence of over-nutrition, high WC and HC in the 30-35 months might be due to fat deposition because of lower energy expenditure in breast milk production during waning lactation

Unlike Group A, women from Group B gained weight and adiposity throughout the period of lactation. The reduction in mean weight in Group A between 0-2 and 30-35 months was 0.7 Kg but in Group B during the same periods there was a weight gain of 4.5 Kg (Figure 34). In Group B the lowest over-nutrition, high WC and HC were seen between 0-5 months. There was a progressive rise in over-nutrition, high WC and HC with increasing duration of lactation. The prevalence of over-nutrition was 34.9% in the 0-5 months of lactation and 56.6 % at 30-35 months; high WC and HC showed a similar trend. Clearly there is a positive energy balance in older lactating women leading to weight gain and adiposity during lactation. It appears that in India too there is residual weight gain in lactating women not only among the well-to-do but also among older lactating women from urban low middle income group.

There were substantial differences in nutritional status and adiposity between women in the 18-29 and ≥ 30 years age group both in lactating women and non-lactating women. This difference appears to be due to the effect of age on nutritional status of women in this community. In the study period all over-nourished women irrespective of age and duration of lactation were informed that they were over-nourished and were advised to increase physical activity. This advice was seldom followed because of the practical difficulties faced by these women. They lived in small tenements, with LPG stoves and pipedwater; household work was sedentary but time consuming. When they completed these and child care work, they felt like relaxing and watching TV. Their houses were small and cramped; in their areas there were no well-paved well-lit roads where they could walk. There is urgent need to improve access to areas where they can take up discretionary physical activity for preventing further increase in over-nutrition

Discussion

India conducted national surveys to know the health and nutritional status of population. In the early decades, under nutrition was a major problem due to poverty, lack of food and various other factors. As many technologies are mounting, people are moving from manual work to machinery work. Women are the most vulnerable segment of population especially pregnant and lactating women. Recent data of NNMB and NFHS shows that there is a slow but steady decline in under nutrition among women also and meanwhile, the prevalence of over nutrition is increasing. The prevalence of normally nourished women is almost same.

The term dual nutrition burden was coined in the 1990s to denote the phase of ongoing nutrition transition in low and middle income countries, characterized by persistent under-nutrition mainly among poorer segments of population and emerging problem of over-nutrition seen mostly among the urban affluent segments. In ninetieth century over nutrition was only prevalent in urban areas, affluent section of society, educated people but now a days it is increasing even in the rural areas, uneducated person and among people who belongs to low middle income group.

The reduction in morbidity due to communicable disease was observed in these National Surveys while morbidity and mortality rates have been increased due to non-communicable disease.

Prevalence of over-nutrition in women in Delhi which is a predominantly urban state was very high. The present study showed that the prevalence of under nutrition is low even in the 18-29 year age group and with increasing age, the prevalence of under nutrition is decreasing and over nutrition is increasing.

There are various other studies which clearly demonstrate that the prevalence of under nutrition is decreasing and prevalence of over nutrition is increasing among women as compare to men.

This state allows identifying under nourished lactating and NPNL women. They should be informed about their nutritional status and impart nutrition education for correcting the current dietary habits. Families should be counseled to increase dietary intake and lesser physical activity. For normally nourished person, person should be advised to continue their current dietary practices and physical activity. They also should be motivated for monitoring their weight periodically for keeping an eye on weight. If the weight increases, necessary actions can be taken timely. Those women who are over nourished should be advised to increase their physical activity level and also make them aware about the health hazards of obesity.

By conclusion, it emerges that the nutrition intervention like personalized nutrition education, counseling, systematic assessment of nutritional status and enhanced nutrition knowledge promote health status and prevent risk of diseases.. Obesity and abdominal adiposity is the main reason for developing non communicable diseases. These NCDs are asymptomatic in nature and symptoms arise when the complication set in. Screening of health of all women especially above 30 years and over nourished women should be done. Early detection of NCD in asymptomatic phase can be done and for avoiding further complications. Therefore, Lifestyle modification, suitable medical nutritional care, support and systematic assessment of nutritional status and early detection of under and over nutrition are the important components of public health nutrition.