Summary and Conclusion
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India's problems of malnutrition continue to exist despite the efforts by the Government and by the Non-Governmental organizations. Though food security at national level has been achieved the household level nutrition security is yet to be reached. There is no doubt that there is a change in the profile of malnutrition, where very severe forms of childhood malnutrition are considerably lowered but both in children and adults the mild and moderate forms are quite prevalent. Moreover, there is a shift from undernutrition to overnutrition. The prevalence of obesity is shown to be increasing gradually. While the prevalence of obesity is very high among the urban groups, in the rural areas too it is on the increase. Rural women constitute an important human resource contributing to the nation's economy through their participation in crucial roles both at home and on the farm.

Nutritional assessment is crucial for the analysis of nutrition situation of the community. The Body Mass Index is focused as a simple but objective anthropometric indicator of the nutritional status. Moreover, the cut off levels of BMI are available on a continuum from one end of spectrum of severe degree of chronic energy deficiency to normalcy and continuing from normalcy to the other end of the spectrum, the severe grade of obesity.

In this background the present investigation was planned with a primary objective to examine the nutrition situation of women belonging to extreme conditions of CED and obesity as against the normal group, while existing within a close range of socio-economic and cultural context. The investigation aims at focusing on the select physical, body compositional, metabolic, dietary, biochemical and clinical nutritional
parameters that are consistently associated with each of the chosen nutrition state i.e., CED, Obesity and Normal. The secondary objective of the study was to examine the relative value of BMI in the establishment of the different degrees of nutritional states.

The investigation was conducted in the villages of Chandragiri Mandal in Chittoor District of Andhra Pradesh state. Non-pregnant, non-lactating apparently normal women in the age group of 18-50 years were enlisted. The total six hundred women were further stratified based on standard of living and age; as Low standard of living (LSL) and Medium standard of living (MSL) and 18-30 and 30-50 years age groups. The weights and heights of all 600 women were measured and the BMI was calculated. The women were classified into different grades of nutritional status as CED, Obese and Normal based on BMI. For the present study women in the extreme grades of CED and Obesity were included and compared against a normal group. In each of the nutritional state forty women were randomly chosen, with equal representation of each age group (n=20) and each standard of living (n=20). Thus, a total of 120 women belonging to different grades of nutrition comprise the subjects of the present study.

A wide range of parameters and indices were used representing anthropometric, body compositional, metabolic, dietary, biochemical and clinical methods of assessment of nutritional status to focus on the nutrition profile of women in the three nutritional grades.
The salient findings of the study are presented below:

Prevalence of CED, Obesity among rural women:

- While 50.4 per cent of the subject's belonged to normal category 34.8 and 14.8 per cent belonged CED and Obesity respectively.

- The percent of women in the severe grade of CED (grade III, BMI < 16.0) was 11.5 percent, CED (grade II, BMI 16 - 17) was 9.6 and CED (grade I, BMI 17 - 18.5) was 13.6 percent.

- The percent of women in the severe grade of Obesity (grade II, BMI > 30) was 6.8 and obesity (grade I, BMI 25 - 30) was 8.0 percent.

When compared with those of the national surveys the prevalence of severe grade of CED and that of CED inclusive of all grades and Normal are in close accordance. The prevalence of obesity is almost double that focused through national surveys. Though the findings of the micro-level surveys cannot be generalized, these have the viability of the meticulous, continuous research monitoring and consequently the results may reveal true trends that may be masked in the macro-level surveys. The findings of the present study reveal that CED is still widely prevalent and that the problem of obesity is also increasing even among the rural women.

The profile of anthropometry of the CED, Obese and Normal women:

- The women in the CED group registered lower mean values for all anthropometric measurements with the exception of height, when compared with either obese or normal groups.

- With the exception of height all other measurements recorded by the obese were the highest.
The mean values of anthropometry of the normal were between the two extreme nutrition states.

When compared with the reference standards the mean weight of normal group was satisfactory. The percent deficit in CED was 22 and the percent excess for the obese women was 44.

Irrespective of the nutritional states the women recorded satisfactory mean height values. It was observed that women in CED group recorded highest value and those in the obese recorded lowest when compared with that of the normal group. It may be interpreted that while tall people are at risk of CED, the short statured are at risk of obesity.

The SFT values of women in the extreme states of nutrition showed least variability. The obese group chosen belongs to the severe degree of obesity (Grade II) and hence, the women might have reached the maximum scope for fat accretion. Later fat accretion may shift to other parts of the body. In the case of CED the fat layer underneath the skin reaches its minimum and probably different levels of muscle wasting may be occurring. Both, the situations might be responsible for the least variability.

The arm measures MUAC, AMC and AMA showed significant differences between different nutritional states. Further both MUAC and AMA were strongly associated with BMI.

Thus, for rapid assessment of nutritional status and to describe the level of muscle wasting both MUAC and AMA measures along with BMI may be useful. In the context of obesity, the MUAC is of some value but AMA may not be directly indicating the excess fat accretion.
The mean waist hip ratio recorded by CED, obese and normal was 0.74, 0.79 and 0.75. All the values strictly speaking are lower than the cut-off level of indicating central obesity which is >0.8. In rural areas and where women do have moderately active life styles the prevalence of central obesity appears to be low. The individual data reveal that both in the normal and in the grade II obese group 35% and 12.5% of women were have WHR values >0.8; indicating central obesity. This reveals the tendency for a selecting of these rural women to be at risk of central obesity.

Further, the distribution of each anthropometric parameter as related to BMI revealed that the ranges of values for the extreme states of nutrition were lower and the normal had a very wide range. It was also observed that the values of one state encroached into the other state. The pattern differed with each of the anthropometric parameter.

**Body composition of the subjects:**

- The CED group recorded lower body fat, lower LBM when compared with obese, which is expected because of low body weights recorded by this group.
- The percent body fat of CED, obese and normal was 18.59, 31.64 and 28.23 respectively.
- The obese recorded the highest LBM.

The body composition of the subjects was assessed using the prediction equation of Durnin and Womersley (1974) that utilized four skin fold measurements for this purpose.

The data reveal that when BMI is used as an indicator and when the prediction equations are used distinct differences in body fat as related to the nutritional state could be demonstrated. The percent body fat recorded by the CED is rather high when compared to the earlier observations of adults at lower BMIs, keeping in view the
comments made by several researchers it may be necessary to investigate the body fat at lower BMI. It is also possible that because of tall stature a majority of apparently normal individuals may be classified as having lower BMI. LBM was shown to increase with body weight. The higher LBM and the similar body fat per cent evident with obese give an impression that in a majority it may be a condition of over weight or a beginning state of obesity. The recent revision of cutoffs by WHO (2000) also reiterate this fact and this may help in interpreting the obese condition in the present context.

Food and Nutrient Intakes of the subjects:

- The mean intakes of all foods were lower for the CED when compared with the Normal and Obese. Obese recorded the highest value.

- For any food the gap between CED and Normal was greater than that existing between Normal and Obese.

- The intake of cereals was more than adequate in all the three nutritional states.

- The intake of pulses showed different levels of deficits with each group.

- The intake of protective foods; greens and other vegetables and fruits was inadequate in all groups.

- With regard to nutrient intakes it was observed that CED group was at a disadvantage and exhibited several nutrient deficiencies of varying levels.

- The mean nutrient intakes of Normal and Obese were relatively better when compared with the CED group.

- The range of values observed indicated that even in the normal and obese some of the subjects had lower intakes.

The intakes of iron and Vitamin A were not satisfactory in all three groups.
The food and nutrient intakes reflect the trends generally observed in the national nutrition survey data. It is thus evident that low food and nutrient intakes at low body weights, which is reflected in BMI is a situation of maintenance of the existing body size. The intakes may be considered to be adequate for the CED group to maintain their low body weight status. Similarly both in the normal and obese groups too the intakes may be serving the purpose of maintenance of the existing condition. While the normal and obese might escape the severe consequences of the undesirable adaptation of lower body size, the CED where the undesirable adaptation has already occurred exists in the high risk category. Further, this group may suffer the functional consequences of the vitamin and mineral deficiency states in the long run.

Energy expenditure and energy balance of the subjects:

- The physical activity pattern revealed that irrespective of their state of nutrition all women belong to moderately active group.
- The time spent for different activities revealed that both CED and Obese groups relatively spent more time for strenuous activities and also had longer sleep and rest hours.
- The EE of the CED was the lowest and that of obese was the highest when compared with the normal.
- The mean BMR recorded also revealed a similar trend as observed for total EE.

The data reveal that the energy expenditure is altered in relation to the state of nutrition. Body weight appears to be the major factor determining the TEE and the BMR.

The energy cost of activities is being revised constantly. Thus, only trends observed may have to be analyzed in the context of data utilized for calculation of total EE. From the data on physical activity it is evident that to some extent there is an
undesirable behavioural adaptation in the CED and obese groups as observed from long sleep and rest behavioural patterns.

Energy balance of the subjects:

- The energy balance of the subjects reveals that there is wide difference between EI and EE values of all three groups resulting in a mean negative energy balance in all groups.

- The mean values recorded showed that while CED and obese showed lower level of negative balance the normal groups showed very high negative values.

The energy expenditure showed very high values when compared to the energy intakes. The negative balances thus appear to be unrealistic questioning the very normal existence of the groups. Thus, it may have to be inferred that the women are not really spending what they should be for the various physical activities. While, they were able to maintain a moderate level of activity, organizing according to their own pace, their endurance capacities in physically stressful conditions, may suffer setbacks.

Biochemical status of the subjects:

- Hb status showed distinct trends as related to the nutritional state. The mean Hb levels reveal that while CED suffer from moderate degree of anaemic state; the normal and obese were in the mild anaemic states.

- Severe anaemia was prevalent in a small proportion of women in all three nutritional states.

The evidence of low dietary intakes of iron supports this biochemical state. The severe anaemic states prevalent in the normal and obese condition may be understood in the context of epidemiology of anaemia.
Triglycerides and cholesterol status:

- The mean triglyceride levels were within the range for all the groups.
- The distribution however revealed that nearly 1/3rd women in each nutritional state were in the borderline high risk group.
- A similar trend as in the case of triglycerides was observed in the mean cholesterol value of the CED, obese and normal groups.
- While a majority of the women existed in the normal range for CED and normal groups (62.5 and 72.5 per cent respectively) a higher per cent (45.6 and 10.0) of the obese were in the borderline and high risk groups respectively.

In the present group CHO intake was very high. In addition, visible fat intake was also shown to be slightly lower than the recommendation. Both visible and invisible fat intakes together might make up the existing gap. The percent body fat of these women also was higher than that focused in the literature. Thus, the borderline high risk and high risk groups may have any one or all of these as the determinants along with the levels of activity being maintained by the individuals.

Clinical signs and symptoms of nutritional deficiencies:

- While some of the women in every group suffered clinical nutritional deficiencies more number of clinical symptoms occurred with CED.
- The symptoms of B complex, vitamin C and iron deficiency were prevalent among these women.

The dietary adequacy of B complex vitamin C is to be met on a daily basis. These may be transient conditions that might get corrected in the presence of the nutrients. Iron deficiency state on the other hand indicates a very chronic state and severe form of the deficiency. While all the above deficiencies have metabolic consequences, iron deficiency may have a direct bearing on the important functional consequences such as physical activity, physical work capacity, endurance and immunity.
The nutritional profile of the CED, normal and obese clearly reveals that the CED and obese groups show a less desirable nutritional status when compared with that of the normal for a majority of parameters. The distinct differences between the groups reveal that BMI is able to clearly distinguish between the extreme as well as the normal nutritional state.

BMI showed a significant correlation with almost all the nutritional status parameters used. The regression equations for the individual groups and when all the three groups combined reveal that the number of prominent correlates and the order of correlates differed in each condition. This may be because of the fact that the profile of each state was distinctly different from the other.

From the above observations it may be inferred that BMI is a useful indicator of nutritional status, particularly in the context of rapid appraisal of nutritional status. It's utilization may further be improved through research geared towards the study of variations in body composition, energy expenditure and their relation to the BMI. Attempts are necessary particularly in the rural context to assess the energy cost of activities in different conditions and contexts, which will help in coming closer to the true energy expenditure of the subjects. Further, it becomes necessary to do exercises of distribution of BMI against the nutritional status parameters to define cut off values for classification grades of CED and for obesity. Establishment of concrete quantitative evidences pertaining to the physical, physiological, metabolic, dietary clinical, biochemical, functional and behavioural parameters will make the grading of the CED and obesity not only meaningful but also improves their utilitarian value.

The data focused through the present investigation on the nutritional status profiles of rural women may be useful for planners and programme implementers interested and involved in the community development programmes.