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# Effect of Commercialisation on the Dietary Status of Farm Women

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## INTRODUCTION

Review of the studies conducted on the status of women in India reveal that the health and nutritional status of women continues to be unsatisfactory inspite of several developmental programes (Gopalan, 1989, 1993). However, it has to be pointed out that such interventions with relation to work or health of women has indirectly focussed on children's health or income generating schemes to alleviate poverty (Lukmanji, 1992). It is a fact that due to the inherent 'psyche', improvement in the nutritional status of women is possible only when the basic needs of the family particularly those of children are satisfied. Hence, economic necessity has promoted womens involvement in commercialised agriculture (Gordoncillo, 1991). As a result a large proportion of women are engaged in the agricultural labour (McGuire and Popkin, 1989). Thus the dual role of women as 'income earner' and 'family caretaker' has recently emerged as an important determinant of women's own nutrition (Senaur, 1988). However, it is being argued that while the women's additional labour is helpful to increase the household income, it may not always lead to an improved diet due to changes in priorities (Wandel and Ottesen, 1992). Furthermore, women's work time and heavy work load which are seen as crucial factors affecting their own health and nutrition appears to negate the 'income' effect (Rabiee and Geissler, 1992). Therefore in the present study the dietary status of women generally the female heads from the selected households representing commercialised agriculture both irrigated and non-irrigated were determined and compared with that of women from households involved in subsistence agriculture.

## METHODOLOGY

*Selection of the Villages:* The study was carried out in 17 villages out of 23 villages belonging to Bijawara mandal of Devanahalli taluk of Bangalore Rural District. The Villages were selected using a randomised sampling procedure based on the fact that these are adjacently situated and homogenous in Socio-economic and physical attributes. All the villages followed typical cropping pattern having both subsistence and commercial farming.

*Selection of the Subjects:* A general survey was conducted to locate the families involved either in subsistence farming or the commercialised farming with irrigation or without irrigation. Out of a total of 285 households, selected at random representing different farming groups - a total number of 141 women were selected which constituted 38 women from subsistence agriculture group (SG) 61 and 42 women representing commercialised farming groups with irrigation (CG-I) and without irrigation (CG-WI) respectively.

*Assessment of Dietary Status:* Dietary history of the selected women were collected using a preformed questionnaire. This consisted of recording socio-economic status, frequency of food use and 24 hour diet recall.

The food intake of all the 141 women was assessed by interviewing the women with the help of household measures relevant to Indian cuisine models to construct the individual womens 24 hour food intake. Information on the type of preparation, actual ingredients used and the quantity consumed was recorded. The reference day for the recall method on the food intake was the day immediately before the visit. Raw amounts for the cooked food items were derived by standardizing the different menu items and preparatory methods.

Energy expended in different activities was computed using the data on time use recalls of the selected women as per the FAO-WHO estimates (1985) of energy required per minute for the specified class of activities.

Antropometric measurements - the height (cm) weight (kg) arm circumference (cm), triceps skinfold (mm) waist (cm) and hip (cm) measurements using the standard procedure (Jelliffe, 1966 and Encyclopaedia, 1993) were recorded for all the 141 women.

Haemoglobin levels in the selected women were also analysed using cyanmethaemoglobin procedure (AOAC, 1980).

*Data Computation and Statistical Analysis:* The collected information was consolidated in terms of each subject and computed for the whole group using descriptive analysis. Food intake data was converted to raw amounts interms of food groups and inturn was translated into energy and nutrients by calculation using food composition tables (Gopalan, 1993). The nutrient intake of the women was compared against recommended dietary intake (RDI) for ensuring the appropriateness of intake derived based on the recommended dietary allowance (RDA) (Indian Council of Medical Research, 1987) for age, gender and activity, Resting metabolic energy (RME), nutrient adequacy and an index of nutritional quality were also derived (FAO, WHO, UNU, 724) and Windham 1983).

Energy expended was expressed both interms of the farming group and by the work status *viz.*, employed women (women engaged in agricultural labour either in their own farm and/or for wages working atleast for a period of 8 to 10 hours in a day), partially employed women (PEW) (Women who were engaged for about 4 hours a day in any of the agriculture related operations). The women who were not involved in any of the agriculture activities (Own farm or for wages) formed the control group defined here as unemployed women (UEW) for the purpose of comparison. The data was subjected to appropriate statistical analysis.

## RESULT

*General Information:* The mean age of the women was found to be 25±4 years. Majority of the women of CGI families belonged to joint families (66 per cent). Mean family size of the families was found to be 8.9 (CG-I) 7.1 (CG-WI) and 6.2 in SG respectively. The level of education obtained by women belonging to CG-I was found to be higher. Women representing CG-I were belonging to the group receiving higher family income followed by women from CG-WI and SG. Also women representing CG-I appeared to have better housing conditions, better sanitary facilities and also possessed higher material wealth when compared to women selected from CG-WI and SG.

### *Dietary Assessment*

*Food Intake:* The mean food intake of the women is presented in table 1. Cereals were the

**Table 1: Mean (±SD) dietary food intake of women from the farming groups *vis-a-vis* desirable dietary pattern**

| *Food items* | *Farming group* | | | |
|---|---|---|---|---|
| *(g/ml)* | *CG-* | *CG-WI* | *SG* | *DDP** |
| Cereals | $433^{a}$ ± 85 | $466^{a}$ ± 96 | $451^{a}$ ± 83 | 370 |
| Pulses | $11^{c}$ ± 13 | $3^{a}$ ± 6 | $7^{b}$ ± 14 | 65 |
| ** Tender field beans | $37^{a}$ | $47^{a}$ | $38^{a}$ - | |
| Green leafy vegetables | $9^{a}$ ± 13 | $11^{a}$ ± 14 | $12^{a}$ ± 16 | 100 |
| Other vegetables | $18^{b}$ ± 24 | $12^{a}$ ± 21 | $10^{a}$ ± 19 | 50 |
| Roots and tubers | $8^{a}$ ± 11 | $8^{a}$ ± 10 | $5^{a}$ ± 10 | 50 |
| Nuts and oilseeds | $12^{b}$ ± 8 | $8^{a}$ ± 10 | $7^{a}$ ± 7 | - |
| Flesh foods (Optional) | $6^{a}$ ± 22 | $5^{a}$ ± 21 | - | 30 |
| Milk | $129^{b}$ ± 62 | $72^{a}$ ± 41 | $57^{a}$ ± 56 | 150 |
| Fats and Oils | $6^{b}$ ± 4 | $3^{a}$ ± 3 | $6^{bc}$ ± 7 | 30 |
| Sugar and Jaggery | $28^{a}$ ± 11 | $26^{a}$ ± 12 | $25^{a}$ ± 15 | 30 |
| Fruits | - | - | - | 30 |
| n | 61 | 42 | 38 | |

* DDP-Desirable dietary pattern computed based on RDA of ICMR for adult women (moderate worker) with an ideal body weight (IBW) to give 2000-2200 Kcal and 50-60 g protein in per day.

** Since field beans was being consumed as pulse in the women diet it has been considered as pulse. Any two means in rows carrying different Superscripts a, b,c., differ significantly ($P<0.05$).

major item of food consumed (433g) by women of CG-I followed by milk and milk products (129g) and vegetables (35g) (Green leafy vegetables, other vegetables and roots and tubers).

Women belonging to CG-WI were found to consume more of cereals (466g) but milk consumption was fairly low (72g). Though pulse consumption was found to be only 3 g, the quantity of field bean (Dolichos lablab) which was being taken as pulse (due to seasonal availability during the period of the survey) found to be high (47 g). Consumption of green leafy vegetables, roots and tubers, flesh foods, visible fats and oils were found to be very low.

Similarly women belonging to SG also consumed higher quantity of cereals (451g) and pulses (in the form of tender field beans). But the consumption of all other foods were found to be very low. Animal foods such as meat, eggs and chicken did not find a place in the dietaries during the period of survey:

The food intake of women was similar in all the farming groups, except for a significantly higher intake of milk and milk products in CG-I.

The mean intake of all food items except cereals was found to be low when compared to the Desirable Dietary Pattern (DDP) in all the groups (Table 1). Thus the food intake was similar in all categories except for milk and milk products which showed an increasing trend with increasing income. The major staple in the diet of all the women was found to be ragi, which accounted for a significant portion of cereal consumption.

The cereal pulse ratio was found to be 9:1 (CG-I), 9.3:1 (CG-WI) and 10:1(SG) in the women's diet. This was found to be below the desirable ratio as recommended by ICMR (Gopalan, 1993), which ranges from 3:1 to 6:1. This could be attributed to the fact that due to the seasonal availability, tender field beans was substituted in place of pulses. Therefore, none of the other pulses including redgram dhal found a place in the dietaries of these women irrespective of farming group.

Consumption of visible fats and oils rarely exceeded the quantity suggested in the DDP. Fruits were virtually not consumed by any group. While consumption of animal foods (meat and eggs etc.) was low in CG-I and CG-WI, it was totally absent in the diets of women belonging to SG.

Milk was consumed mostly in the form of buttermilk and in the preparation of coffee/tea. Sugar and jaggery consumption was within the minimum range, meeting 83 to 93 per cent of the DDP in all the groups.

Thus the diets of women belonging to different farming groups showed all the features of a traditional diet of low income groups seen in India. (Gopalan, 1993). It was monotonous, mainly vegetarian in nature and consisted of very low amounts of protective foods.

*Nutrient Intake:* The mean nutrient intake of the selected women is presented in table 2 and 3. The nutrient intake of women was similar in all farming groups. While the energy intake was adequate due to a higher consumption of cereals, the lower intake of protective foods such as vegetables, fruits, meat and eggs reflected deficient intake of micronutrients except for calcium.

The results indicated that cereals were the main source of energy, protein and calcium. While 'field bean' provided a small percentage of protein, bulk of it was being contributed by

**Table 2: Mean (±SD) intake of energy and macro nutrients of the women from the farming groups**

| *Dietary constituents* | *Farming Group* | | | | | |
|---|---|---|---|---|---|---|
| | *CG-I* | | *CG-WI* | | *SG* | |
| | *Mean±SD* | *RDI* | *Mean±SD* | *RDI* | *Mean±SD* | *RDI* |
| Energy(Kcal) | 2455[a] ± 290 | 2330 ± 280 | 2445[a] ± 360 | 2320 ± 255 | 2390[a] ± 275 | 2270 ± 215 |
| Carbohydrates (g) | 490[a] ± 60 | ** | 500[a] ± 70 | - | 490[a] ± 60 | - |
| Protein (g) | 53[b] ± 8 | 48 ± 6 | 51[ab] ± 10 | 47 ± 5 | 49[a] ± 6 | 46 ± 4 |
| Total fat (g) | 32[b] ± 8 | - | 26[a] ± 9 | - | 26[a] ± 9 | - |

* RDI: Recommended dietary intake - values are mean of RDI computed using. ICMR recommendations for each women based on ideal body weight (IBW).

** No recommended dietary intake.

**Table 3: Mean (±SD) daily intake of micro nutrients of the women from the farming groups**

| *Dietary constituents* | *Farming Group* | | | | | |
|---|---|---|---|---|---|---|
| | *CG-I* | | *CG-WI* | | *SG* | |
| | *Mean±SD* | *RDI* | *Mean±SD* | *RDI* | *Mean±SD* | *RDI* |
| Calcium (mg) | 1450[a] ± 340 | 400 | 1615[b] ± 360 | 400 | 1551[ab] ± 345 | 400 |
| Iron (mg) | 18[a] ± 4 | 30 | 19[b] ± 4 | 30 | 19[ab] ± 4 | 30 |
| Retinol (mg) | 380[a] ± 355 | 600 | 450[a] ± 370 | 600 | 435[a] ± 435 | 600 |
| Thiamine(mg) | 1.6[a] ± 0.4 | 1.2 ±0.14 | 1.8[a] ± 0.4 | 1.2 ±0.13 | 1.7[a] ± 0.4 | 1.1 ± 0.1 |
| Riboflavin(mg) | 1.0[a] ± 0.2 | 1.3 ±0.15 | 1.0[a] ± 0.2 | 1.3 ±0.14 | 0.9[a] ± 0.2 | 1.3 ±0.12 |
| Niacin (mg) | 7.5[a] ± 2.3 | 15.4 ± 1.9 | 7[a] ± 2.2 | 15.3 ±0.17 | 7[a] ± 1.3 | 15 ± 1.4 |
| Ascorbic acid (mg) | 21[a] ± 14 | 40 | 20[a] ± 12 | 40 | 20[a] ± 15 | 40 |

RDI:Values are mean of RDI computed using ICMR (137) recomendations for each women based on ideal body weight.

ragi. The distribution of womens energy intake from macro nutrients also reflected the high cereals intake. Thus the pattern of mean per cent energy contributed from carbohydrate,protein and fat was 80:8:11 respectively.

Furthermore, diets though low in total fat were high in mono/poly unsaturated fatty acid due to the usage of groundnut oil. However, it is to be expected that a ratio of linoleic acid to linolenic acid may be low due to the non-consumption of green leafy vegetables. Desirable ratio is stated to be > 10. Since invisible fat content of cereals is mainly linoleic acid unless the diets are substituted with green leafy vegetables, the diets may fail to meet the desirable ratio.

Most of the micro nutrients like iron, retinol and B-complex vitamins (Table 3) were being obtained through pulses and milk. Good sources of iron and vitamin A (green leafy vegetable, animal protein, dairy products), riboflavin (dairy products) and ascorbic acid (fruits and raw vegetables) were either limited or totally absent. Though dairy products provided only a small percentage of calcium, bulk of it being contributed by 'ragi' (Eleusine Coracane). Thus calcium intake was 3.5 to 4 times higher than the RDI. With the daily diet consisting of mainly cereals, with small amounts of other foods like fruits, vegetables, milk and fleshy foods, it was clearly evident that this diet could not adequately provide sufficient intake of most of the micronutrients. Since the nutrient intake was similar irrespective of the farming group the gradient of income does not appear to have an impact on the nutrient intake. However, the data revealed that the nutrients showing the greatest variation as indicated by the standard deviation were retinol, niacin and ascorbic acid implying that a few women might have consumed foods rich in these nutrients.

The ICMR standards (1987) with cut off points of below 50, > 51-70, > 71-90 and more than 90 per cent of the recommended levels were used to compare the womens intake (Table 4)

**Table 4: Percentage adequacy of nutrients by women of the three farming groups**

| *Constituents* | *CG-I* | | | | *CG-WI* | | | | *SG* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *<50* | *>51-70* | *>71-90* | *>90* | *<50* | *>51-70* | *>71-90* | *>90* | *<50* | *>51-70* | *>71-90* | *>90* |
| Energy | * | 1(2) | 10(16) | 50(82) | - | - | 3(7) | 39(93) | - | - | 6(16) | 32(84) |
| Protein | - | - | 1(2) | 60(98) | - | - | 2(5) | 40(95) | - | - | 7(18) | 31(82) |
| Fat | - | - | 1(2) | 60(98) | - | - | 6(14) | 36(86) | - | - | 6(16) | 32(84) |
| Calcium | - | - | - | 61(100) | - | - | - | 42(100) | - | - | - | 38(100) |
| Iron | 21(34) | 26(43) | 14(23) | - | 7(17) | 24(57) | 8(19) | 3(7) | 8(21) | 23(61) | 7(18) | - |
| Retinol | 44(71) | 9(15) | 4(7) | 4(7) | 28(67) | 6(14) | 6(14) | 2(5) | 25(65) | 6(16) | 4(11) | 3(8) |
| Thiamine | - | - | 8(13) | 53(87) | - | - | 1(2) | 41(98) | - | - | 2(5) | 36(95) |
| Riboflavin | 4(7) | 12(20) | 28(46) | 17(27) | 1(2) | 8(19) | 27(65) | 6(14) | 1(3) | 12(31) | 19(50) | 6(16) |
| Niacin | 39(64) | 17(28) | 3(5) | 2(3) | 36(85) | 4(10) | 1(2) | 1(3) | 28(73) | 9(24) | 1(3) | - |
| Ascrobic acid | 55(90) | 6(10) | - | - | 41(98) | 1(2) | - | - | 35(92) | 3(8) | - | - |

* Nil

Figures in paranthesis indicate the percentage

Nutrients in which women most frequently failed to meet below 50 per cent were iron, retinol, niacin and ascorbic acid. It is also probable that data on deficiency of these vitamins are underestimated as no attempt was made to adjust for lossess that occur during storage and preparation (Ryan, 1984), while assessing the adequacy of vitamin intake. If women did not meet at least 50 per cent of ICMR levels for these nutrients and continue with low intake, they would probably be at high risk for nutrient deficiencies.

Energy, protein and calcium were the nutrients in which women were able to meet the ICMR recommended levels (1987).

The nutrient quality index (INQ) of the diets consumed by the women is represented in figure 1. Nutrients as proportions of energy were more than adequate with respect to calcium and thiamin but fell short in all other nutrients.

### *Somatic Status*

Somatic Status reflects that the body size is influenced by several factors, most important being heredity, environment and diet. At the time of the survey most of them appeared to be on the 'thinner side' of the body build. This could be attributed to the heavy work load due to their involvement in both agricultural and household activities.

Mean anthropometric measurements and indices of the women by farming group is presented in table 5. The results showed that while height and triceps skin fold (TSF) of women were similar in all the groups, the other measurements - weight, arm circumference and waist and hip were significantly lower in SG than in the other two groups. The weight of the women ranged from 43 Kg in SG to 46 Kg in CG-I with significant differences between cash crop groups (CG-I and CG-WI) and SG. Women in CG-I were found to be significantly heavier than women in SG. However, no significant differences in body weights were seen between CG-I and CG-WI.

The women (CG-WI) who were in the age group of 20-39 years on an average were 153.1 cm tall and weighed 44.1 Kg. These figures were found to be slightly higher than the reported heights and weights for rural women by National Nutrition Monitoring Bureau (1980).

The mean body mass index (BMI) ranged from 18 to 19 in SG and CG-I respectively. Though the BMI was low, the mean waist for hip ratio (WHR) was found to be > 0.71 indicating a lower segment of gluteal femoral obesity (Windham, 1983).

Similarly as observed with regard to weights, both mid upper arm circumference (MUAC), and mid upper arm muscle circumference (MUAMC) were lower in SG than in other groups. However, all the three (MUAC, MUAMC, TSF) indicators of protein and fat status were lower than the Jelliffe's standard (1966). In general, women of CG-I showed higher values for most of the anthropometric measurements.

The distribution of women on the basis of BMI and WHR classification is presented in table 6. The data revealed that 45 per cent of women of different farming families were in the normal and low weight normal range. A small proportion of women in CG-I (7%) were found to be having a BMI > 25 indicating over weight.

**Table 5: Mean (±SD) anthropometric measurements and indices of women in three farming groups**

| *Measurement/Indices* | *Farming Group* | | |
|---|---|---|---|
| | *CG-I* | *CG-WI* | *SG* |
| Height (cm) | $153.7^{a} \pm 6.0$ | $153.1^{a} \pm 5.3$ | $153.2^{a} \pm 5.7$ |
| Weight (kg) | $45.7^{b} \pm 8.0$ | $44.1^{ab} \pm 6.3$ | $42.6^{a} \pm 5.3$ |
| Body mass index | $19.3^{a} \pm 2.8$ | $18.8^{a} \pm 2.2$ | $18.1^{a} \pm 2.0$ |
| Midupper arm circumference (cm) | $22.8^{b} \pm 2.6$ | $22.4^{ab} \pm 1.9$ | $21.6^{a} \pm 2.2$ |
| Triceps Skinfold (mm) | $10.9^{a} \pm 4.7$ | $10.0^{a} \pm 3.3$ | $9.8^{a} \pm 3.2$ |
| Midupper muscle circumference (cm) | $19.4^{a} \pm 1.9$ | $19.2^{a} \pm 1.2$ | $18.6^{a} \pm 2.0$ |
| Waist (cm) | $66.0^{b} \pm 6.6$ | $65.5^{b} \pm 5.5$ | $63.5^{a} \pm 4.9$ |
| Hip (cm) | $86.8^{b} \pm 7.3$ | $85.4^{b} \pm 6.5$ | $84.0^{a} \pm 6.1$ |
| Waist/hip ratio | $0.76^{a}$ | $0.76^{a}$ | $0.75^{a}$ |
| n | 61 | 42 | 38 |

Any two means in rows carrying different superscripts a, b - differ significantly $P < 0.05$).

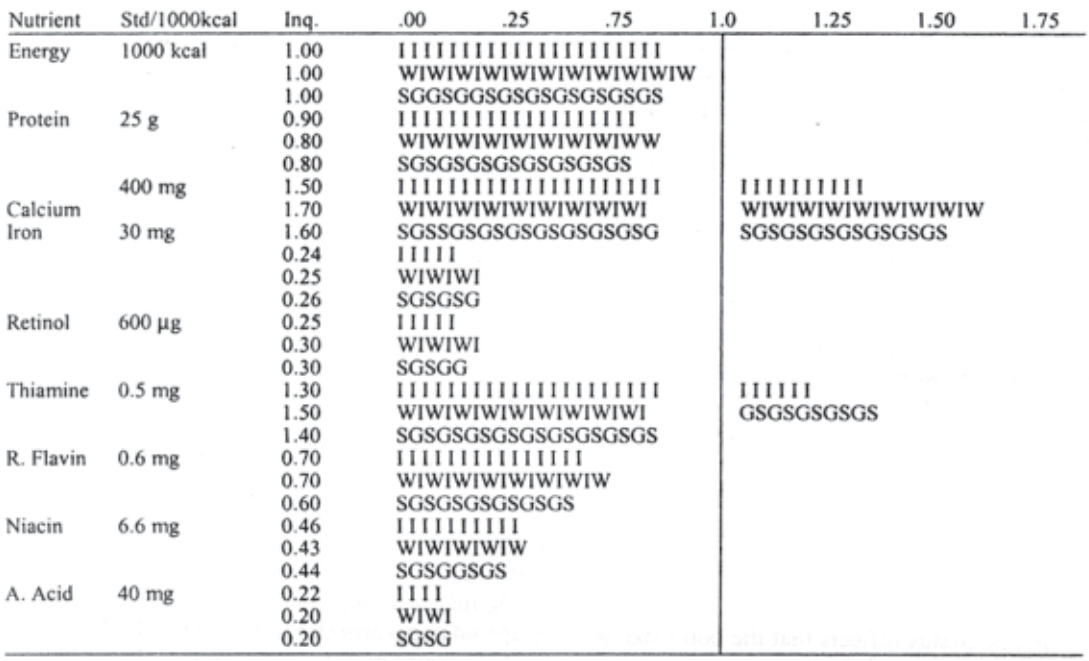


**Fig. 1. Nutrient profile of women based on standard allowances per 1,000 Kcal - INQ**

Significant proportion of women-49 per cent (CG-I), 55 per cent each in (CG-WI) and (SG) had BMI between the range of 16 to 18.5 indicating undernutrition.

However, WHR indicated a significant lower body (gluteal femoral) obesity in 68, 74 and 80 per cent of women in SG, CG-WI and CG-I respectively. As much as 27, 24 and 17 percent of women in SG, CG-WI and CG-I were also exhibiting upper (abdominal) body obesity respectively.

Percentile classification of the women by MUAC, TSF and MUAMC are presented in table 7. Comparison of these criteria with standard (Jelliffe, 1966) confirmed that varying percentage of women were exhibiting different degrees of malnutrition irrespective of the farming group. Fifty four, 64 and 76 per cent of women in CG-I, CG-WI and SG respectively, had MUAC between 60 to 80 percent of standard indicating a low protein status. Similarly, MUAMC also indicated 49. 50 and 60 per cent of the women in CG-I, CG-WI and SG respectively to be between < 60 to 80 per cent of the standard confirming a low protein status.

TSF thickness in 47 to 55 per cent of the women in the three farming groups were low indicating that lower energy reserves were present as fat. Therefore, the earlier observation which indicated lower body or gluteal femoral obesity indicated by increased WHR also should

**Table 6: Percentile classification of women by body mass index and waist/hip ratio**

| *Class* | *Farming Group* | | |
|---|---|---|---|
| | *CG-I* | *CG-WI* | *SG* |
| **BMI** | | | |
| > 16 Grade III Severe | 2(3) | 3(7) | 5(16) |
| > 16-17 Grade II moderate | 7(11) | 7(17) | 8(21) |
| > 17-18.5 Grade I mild | 21 (35) | 13(31) | 7(18) |
| > 18.5-20 Low weight normal | 14 (23) | 5(12) | 13(32) |
| > 20-25 Normal | 13(21) | 14(33) | 5 (13) |
| 25-30 obese | 4(7) | - | - |
| $\chi^2$ = 20.07 NS | | | |
| **WHR** | | | |
| < 0.70 (Normal) | 2(3) | 1(2) | 2(5) |
| <0.71-0.8 ( Gluteal femoral obesity) | 49(80) | 31(74) | 26(68) |
| >0.8-0.9 (Abdominal obesity) | 10(17) | 10 (24) | 10(27) |
| n | 61 | 42 | 38 |
| $\chi^2$ = 2.20 NS | | | |

Figures in paranthesis indicate the percentage
NS = Non Significant

be taken as an indicator of malnutrition, as abdominal obesity is being viewed as an adaptation process due to stress imposed by early and/or long term malnutrition. Since the dietary intake was similar in women, irrespective of the farming group which showed a deficient intake of the micronutrients, it is probable that increased WHR may be a cumulative effect of long term malnutrition. Though the energy and protein intake of the women in the three farming groups were found to be adequate, somatic criteria indicated a lower protein and energy status. Perhaps, this can be related to an increase in energy expenditure due to the heavy work load of these women in farming and household activities.

A comparison of the mean haemoglobin values and range in women in three farming groups showed that in most of the women the haemoglobin levels were very low, ranging from 7.02g/dl in SG, 8.47 g/dl in CG-WI and 9.06g/dl in CG-I with significant difference. This could be related to lower iron intake among the women.

Since body size measurements indicated a low energy-protein status despite an adequate intake, energy expended in daily activities by these women were computed. The estimates of energy expenditure is presented in table 8. The energy expended by thse women varied significantly between the farming groups showing a deficit of 305 Kcal/day in the CG-WI group to 265 and 165 CG-I and SG, respectively.

Energy expenditure of these women by their work status is also shown in table 8 and it clearly indicated that energy expended to be more in case of employed than in others. The energy balance in employed women (EW) showed a deficit of 765 Kcal/day.

**Table 7: Percentile classification of women by MUAC, TSF and MUAMC**

| *Measurements/ Indicees classification* | *Farming Groups* | | | *All Groups* |
|---|---|---|---|---|
| | *CG-I* | *CG-WI* | *SG* | *combined* |
| Mid upper arm circumference | | | | |
| <60 | 1(2) | - | 1(3) | 2(1) |
| >61-70 | 5(8) | 4(10) | 7(18) | 16(11) |
| >71-80 | 27(44) | 23(54) | 21(55) | 71(50) |
| >81-90 | 20(33) | 13(31) | 8(21) | 41(29) |
| >90-(Std) | 8(13) | 2(5) | 1(3) | 11(8) |
| | | $\chi^2 = 9.32$ NS | | $\chi^2 = 74.10$ S* |
| Triceps skinfold | | | | |
| <60 | 29(47) | 21(50) | 21(55) | 71(50) |
| >61-70 | 15(25) | 10(23) | 7(18) | 32(23) |
| >71-80 | 5(8) | 4(10) | 3(8) | 12(9) |
| >81-90 | 4(7) | 2(5) | 4(11) | 10(7) |
| >90-(Std) | 8(13) | 5(12) | 3(8) | 16(11) |
| | | $\chi^2 = 2.33$ NS | | $\chi^2 = 91.80$S* |
| Mid upper arm muscle circumference | | | | |
| <60 | 17(28) | 12(28) | 17(44) | 46(33) |
| >61-70 | 8(13) | 5(12) | 3(8) | 16(11) |
| >71-80 | 5(8) | 4(10) | 3(8) | 12(9) |
| >81-90 | 7(12) | 5(12) | 4(11) | 16(11) |
| >90- (Std) | 24(39) | 16(38) | 11(29) | 51(36) |
| | | $\chi^2 = 6.40$ NS | | $\chi^2 = 27.95$S* |
| n | 61 | 42 | 38 | 141 |

Figures in paranthesis indicate the percentage, * Significant at (< 0.05)

## DISCUSSION

The results of the study are indicative of the fact that maximising household income is not sufficient by itself to substantially improve the dietary status of women. The increasing income for the farming group due to cash cropping did not appear to have translated into improved nutrition for the women themselves. It has been shown that women in agricultural households have a larger amount of time devoted to work leading to a high energy output than women in nonagricultural households (Garcia, 1993). Thus, the limiting factor on the neutral effect observed on the nutrition of the women in both CG-I and CG-WI having increased income appears to be the net increase in the physical labour resulting in increased energy expenditure, consequently increasing the energy requirement. Moreover, when the resulting increase in income is marginal as in the case of CG-WI, it may not show further improvement in the household nutrition.

The demographic features, living conditions, food and nutrient intake of these women

**Table 8: Mean ± (SD) estimates of energy expenditure of women *vis-a-vis* energy intake**

| *Particulars* | *RDI* | *Energy intake (Kcal/day)* | *Energy Expended (Kcal/day)* | *Deficit/ Excess* |
|---|---|---|---|---|
| By Farm Group | | | | |
| CG-I | 2330 ± 280 | 2455 ± 190 | 2720 ± 590 | -265 |
| CG-WI | 2230 ± 255 | 2445 ± 360 | 2750 ± 530 | -305 |
| SG | 2270 ± 215 | 2390 ± 275 | 2555 ± 610 | -165 |
| By Work Status | | | | |
| EW | 2285 ± 260 | 2495 ± 270 | 3260 ± 365 | -765 |
| PEW | 2360 ± 275 | 2370 ± 260 | 2595 ± 260 | -225 |
| UE | 2330 ± 235 | 2425 ± 380 | 2050 ± 190 | ±375 |

irrespective of the farming group were similar to the reports (National Institute of Nutrition, 1985, Ramachandra, 1993 and Baltiwala, 1982) on the nutritional status of women in Karnataka, India. Women from CG-I group comparatively had better housing conditions leading to better facilities than CG-WI and SG mainly attributable to higher family income. The income gradient however did not indicate better nutrition for these women as by and large the dietary pattern and food behaviour were similar among all the women in all the farming groups.

The actual diet of the women in all the farming groups on the daily basis were simple consisting mainly of cereals with CG-I registering significantly higher intake of milk and milk products. The major staple (cereal) in the diet was ragi similar to the earlier reported studies (National Institute of Nutrition, 1991). Intake of all other foods, pulses, green leafy vegetables and other vegetables were low in all the groups. Animal foods were completely absent in the dietaries of SG. In all, the intake of all the foods except for cereals was low compared to the desirable dietary pattern (DDP) irrespective of the women farming group. It is reported that inadequate income is probably a major limiting factor in obtaining a nutritionally adequate diet (Ajula, 1981; Choudhry, 1983 and Devadas, 1986). However, in the present study increased income did not promote better food intake for these women.

The characteristic dietary pattern of women was essentially that of high carbohydrate and low fat. Nutrient intake of these women reflected the food intake and did not appear to be influenced by income. Except for energy, protein, calcium and thiamine, and all other nutrients fell short of RDI (Indian Council of Medical Research, 1987). It was observed that some of the nutrients (Iron, retinol, riboflavin, niacin and ascorbic acid) failed to meet even 50 per cent of the RDI. Moreover, most of the women (> 70 percent) irrespective of the farming group to which they belong were showing low haemoglobin levels which has reflected in a low intake of iron. Also nutrients as proportions of energy were found to fall short in all nutrients except for calcium and thiamine. Despite the fact that the energy and protein intake were adequate this did not reflect in the body size of these women. The data revealed that more than 40 per cent of the women irrespective of the farming group were in the lower normal range and on an average more than 50 per cent were undernourished (BMI 16-18.5). It is a fact that when women are employed particularly in outside labour like agriculture, the BMI levels are reported to decline (Ryan, 1984). It is also reported that normal BMI appeared to increase the capacity to carry out energy intensive work (Kennedy, 1993). Hence, work efficiency has been related to the normal BMI levels. However, considering the levels of physical activity the data indicated a deficit of more than 700 Kcal per day in employed women and a deficit of 265 to above 300 Kcal per day in the CG-I and CG-WI group respectively who were involved in greater physical labour than the SG. Hence, the results were indicative of the fact that women particularly employed in cash cropping and involved in animal husbandry were expending a greater proportion of energy leading to a negative energy balance. This appeared to have found expression in lower BMI among the women.

Considerable proportion of women was also having a low protein status and this was apparent by the greater proportion of women having low MUAC and MUAMC. Energy balance is one of the factors which must be considered in determining the risk of protein deficiency. (Harper, 1977). Even if the energy intake is adequate the energy expenditure was high as in the case of employed women in the different farming groups in the present study, protein will naturally be utilised as energy (Indian Council of Medical Research, 1987). Also, the sources of protein-pulses and milk was limited. Hence, a large proportion of women were having low protein status attributable to increased energy requirement. However, most of the women irrespective of their farming group were showing an increased waist for hip ratio (WHR) which is an indication of lower segment obesity. It is hypothesised that stress-physiological or environmental-results in increased cortisol levels which seems to favour the redistribution of fat to the abdomen (Anon, 1994). Hence, it is expected that these women could be in considerable 'stress' imposed by low energy protein status and high level activity in case of CG-I and

CG-WI, and low economic status in case of SG. Perhaps the higher WHR observed in these women may be attributed to the cumulative effect of stress induced by long term malnutrition.

Therefore, in summary the dietary status of these women could be stated to be low characterised by nutritionally inadequate diet. The risk of nutrient deficiencies appear to be greater in protein, Vitamin A, riboflavin, ascorbic acid and iron. Results are also indicative of the fact that at all levels of income women are involved in energy intensive activities (household chores and agricultural activities). Thus any positive effect that could have been seen due to increased household income on nutrition is offset by high level of women's activity. Hence, women's participation in the cash economy may negate their own nutritional status.

**KEY WORDS** Diet Survey. Food Consumption. Anthropometry. Energy Expenditure. Commercialization.

**ABSTRACT** Dietary status of farm women engaged in commercial farming with irrigation (CG-I) (n - 61) and without irrigation (CG-WI) (n=42) was determined and compared with that of women engaged in subsistence agriculture only-SG (n=38). The sample was drawn from a total of 285 households in 17 villages located in Bangalore District in the state of Karnataka, India. The data collected included food and nutrient intake of women by dietary history, frequency of food use and 24 hour diet recall, somatic measurements by anthropometry and energy expended in physical activities. The results indicated that the intake of milk and milk products, nuts, oil seeds, fats and oils was significantly higher in CGI than in CG-WI and SG. The energy intake was found to be adequate in all the groups as compared to RDI for Indians. However, they appeared to be at relatively high risk for developing micro nutrient deficiencies viz. iron, Vitamin A, riboflavin and ascorbic acid as they failed to meet even 50 percent of the RDI. Somatic status revealed that > 48 percent of the women irrespective of farming groups to be having low BMI (16-18.5), low MUAC, MUAMC and TSF. The energy expended in physical activities was found to be higher than the intake with deficits to the extent of 765 Kcal/day particularly among the employed women. Hence the low BMI could be attributed to increased energy expenditure and low MUAC and MUAMC indicative of low protein status to the fact that protein is being used as energy. The study is indicative of the fact that commercialisation of farming while leading to increased income did not appear to improve the nutrition of the women attributable to increased work output.

## REFERENCES

Anon: Tighten your belt! Five insidiously clever ways to flatten the spare tyre. *J. Amer, Dietet Assoc.*, **6(7)**: 28-31 (1994).

Ajula, P. Miglani, S.S. and Singh, A.J.: Nutritional status of rural Punjab - A study in relation to size of family and socio-economic categories. *J. Res. Punjab Agl. Univ.*, **18(4)**: 436-444 (1981).

Assoc. of official Analytical chemists (AOAC): *Official Methods of Analysis*, 13th Ed., UAS, Washington D.C., 20044 (1980).

Baltiwala, S.: Rural energy scarcity and undernutrition. A new perspective. *Econ. Poli. Weekly*, **17**: 328-334 (1982).

Chowdhury, M and Rao, K.V.: Nutritional status of preschool children and the associated factors. *Ind. J. Nutr. Dietet.*, **20**: 18-27 (1983).

Devadas, R.P.: Nutritional outcomes of massive feeding programes in Tamil Nadu. *Proc. Nutr. Soc. Ind.*, **32**:71 (1986).

National Institute of Nutrition: Diet and nutritional status of Urban population. *Nutr. New*, **6**: 2 (1985).

*Encyclopedia of Food Science:* Food Technology and Nutrition. 5 (1993).

Garcia, M.: Women's food intake and nutritional status in Pakistan and the Philippines - 'Effects of changes in income and prices'. *Proc. of the XV Intl. Cong. of Nutr., Adelaide*, 167-170 (1993).

Gopalan, C.: Women and nutrition in India, General consideration. In: *Women and nutrition in India.* C. Gopalan, and S. Kaur, (Eds.) Nutrition Foundation of India. Special Publication Series. 5: 1 (1989).

Gopalan, C.: Women and Nutrition in India, Some practical considerations. In: Problems and Policies C. Gopalan, and H. Kaur, (Eds.) Nutrition Foundation of India. Special publication series, 9: 47 (1993).

Gopalan, C. Sastry, B.V. and Balasubramanian, S.C.: *Nutritive Value of Indian Foods.* ICMR publications, NIN, Hyderabad (1993).

Gordoncillo, N.M.P.: *Maternal Time Allocation and Child Nutrition in Selected Rice Based Communities.* Food and Nutrition Planning Monograph.12 (1991).

Harper, H.A.: *Review of Physiological Chemistry*, 16th Edition, Lange Medical Pub., California (1977).

Indian Council of Medical Research: *Report of An Expert Committee on Recommended Dietary Allowances for Indians*, New Delhi (1987).

Jelliffe, D.B.: The Assessment of the Nutritional Status of the Community, WHO, Geneva (1966).

Joint FAO/WHO/UNU: Expert Consultation on Energy and Protein Requirements. WHO Technical report, 724 (1985).

Kennedy, E., and Garcia, M.: Overview. Comparative analysis of effects of development policies and programmes on womens health and nutritional status. *Proc. of the XV Intl. Cong. of Nutr. Adelaide*, 155-157 (1993).

Lukmanji, Z.: Womens workload and its impact on their health and nutritional status. *Progress Food Nutr. Sci.*, **16**: 163-179 (1992).

McGuire, J. and Popkin, B.M.: Beating the zero-sum game. Women and nutrition in the third world. Part. I. *Food Nutr. Bull.*, **11(4)**: 38-58 (1989).

National Institute of Nutrition: *National Nutrition Monitoring Bureau*, Report for the year 1979, Hyderabad (1980).

Rabiee, F. and Geissler, C.: The impact of maternal work load on child nutrition in rural Iran. *Food Nutr. Bull.*,

**14(1)**: 43-48 (1992).

Ramachandran, P.: Nutrition in pregnancy. In: *Women and Nutrition in India*, C. Gopalan, and S. Kaur, (Eds.) Nutrition foundation of India, Special publication series, 9, 362 (1993).

Ryan, C.G., Bidinger, P.D., Rao, N.P. and Pushpamma: The determinants of individuals diets and nutritional status in six villages of Southern India. *Res. Bull.*, ICRISAT, Hyderabad (1984).

Senaur, B.: The impact of the value of womens time on food and nutrition in developing countries. *Staff paper series, University of Minnesota*, 88-141 (1988).

National Institute of Nutrition: Trends in Nutrition, *Nutr. News, NNMB*, **12**: 3 (1991).

Wandel, M. and Ottesen, G.K.: Maternal work, Child feeding and nutrition in rural Tanzania. *Food Nutr. Bull.*, **14(1)**: 49-54 (1992).

Windham, C.T., Hansen, R.G. Wyse, B.W. and Sorenson, A.W.: Users of nutrient data bases for identifying nutritional relationships to public health and nutrition education in the United States. *Food Nutr. Bull.*, **5(2)**: 46-53 (1983).

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