
SUMMARY AND CONCLUSION

Women in Indian society play a vital role in the development of family and the community. The progress of a society depends a lot on women. The government and non government agencies strive to integrate women in all walks of life in an equitable manner. The Government of India introduced various policies and programmes for the development of women. In recent years increasing economic pressure, urbanization, industrialization, career interests and changing needs of the family and community have contributed to a change in the role of women from home maker to be a sustainable supporter in the economic improvement of the families.

Women are making their mark in the field of business and industry. The government and non-government agencies gave greater attention to promote self employment among women. Special training programmes were organized for women to enable them to start their own ventures. Financial institutions and nationalized banks have also set up social cells to assist women entrepreneurs (Govindappa, 2005).

Mohammed Yunus, Founder of Grameen Bank, introduced the Self Help Group Concept in the year 1975 in order to encourage women to start a small business to fulfill their needs. In the eighties, it was a serious attempt by the Government of India to promote an apex bank to take care of the financial needs of the poor, informal sector and rural areas. And then, NABARD took steps during that period and initiated a search for alternative methods to fulfill the financial needs of the rural poor and informal sector. NABARD was initiated in 1986-87, but the real effort was taken after 1991-92 from the linkage of SHGs with the banks.

It is a powerful instrument towards the empowerment of rural women. In Tamil Nadu, SHGs were supported under the Tamil Nadu Women Development Project and many Non Governmental Organizations are supporting the rural

women for their economic independence by organizing small groups consisting of 12-20 members and they are encouraged to save and mutually contribute to a common fund for the benefit of lending to its members based on the group decisions.

Functioning of Self Help Groups has been viewed only from an economic perspective. However, how these economic benefits are being translated into change in women's status, particularly their health status has not been explored. Women's participation in income generating activities is believed to increase their socio-economic status and decision making power. Participation in Self Help Group will definitely help to empower themselves, but without sound health and nutritional status one cannot achieve women empowerment.

Micronutrient deficiencies have huge impact on health of women. According to the NNMB report (2006), of the 14,039 men and 18,603 women examined, 0.4 per cent of men and 0.3 per cent women had Bitot's spots, with a relatively higher prevalence in the State of Tamil Nadu. The overall prevalence of anaemia among women was about 75 per cent, with about 31 per cent having moderate and 3 per cent severe anaemia. About 2.3 per cent women had goiter. Globally, anaemia affects 1.62 billion people, which corresponds to 24.8 per cent of the population. Consumption of green leafy vegetables, a source of micronutrients was inadequate among the community.

It is assumed that Self Help Groups will play a larger role in its contribution towards improving women's health and empowerment as well as for achieving 'Millennium Development Goals' such as eradication of extreme poverty and hunger, achieve universal education, promote gender equality and women's empowerment and improve maternal health and combat disease. Food based interventions and well designed nutrition education will definitely improve the health condition of SHG women and their families.

With this background the study entitled on the **Prevalence of Micronutrient Deficiencies among Self Help Group Women and the Impact of Interventions** was undertaken with the following objectives.

- To collect information on the general profile of selected SHG women
- To assess the health and nutritional status of the selected SHG women
- To determine the prevalence of micronutrient deficiencies among the SHG Women
- To formulate nutritious mixes using foods rich in micronutrients, conduct acceptability trials, analyse the nutrients of the developed mixes
- To supplement the developed mixes to the selected SHG women for a period of four months
- To formulate and study the effect of Nutrition education and supplementation of the selected nutritious mixes on the micronutrient status of the selected SHG women.

There are 19236 SHG groups in Coimbatore District, out of which 1044 groups are in Karamadai Block among the 17 Panchayat villages and 595 groups are in Periyanaickenpalyam block among the 9 Panchayat villages (TCDW, 2013). From each block 100 SHGs were selected at random totaling to 200 SHGs and from each group five members were selected. Thus a total number of 1000 Self Help Group Women from 200 groups formed the sample for the study. Adult women in the age group of 30-45 years involved in Self Help Group activities were selected for the study.

Two questionnaires were formulated, one was used to collect information on socio-economic and dietary background, another to assess the nutritional knowledge of the Self Help Group women.

Anthropometric measurements like height, weight, Waist circumference, Hip circumference were assessed and BMI, WHR were also calculated for all the SHG women. Clinical assessment was done with the help of the medical practitioner for all the SHG women. Biochemical tests like blood haemoglobin was done for all the selected SHG women. Based on the clinical symptoms revealed by

the 1000 SHG women, 112 were screened for serum iron and 143 were screened for serum calcium levels. With the help of 24 hour recall method the information regarding the food intake of the selected SHG women was collected for three days and this was used to calculate the mean food and nutrient intake per day.

Based on the dietary pattern, food and nutrient intake, the intake of micronutrient rich foods was found to be inadequate and the major micronutrients like Vitamin A , iron and calcium was also found to be very less. Hence in order to correct their deficiencies supplementation was planned. For the formulation of basic nutritious mixes 35g of Ragi, 22.5g of Roasted Bengal gram dhal, 10g of groundnut and 22.5g of jaggery were blended to obtain 90g of the mix. Based on the health problems of the SHG women, Araikeerai leaves powder for anaemic SHG women and drumstick leaves powder for the SHG women with low calcium levels were added to the basic mix. 10 g each of araikeerai leaves powder or drumstick leaves powder were added to 90g of basic mix in order to get nutrimix I and nutrimix II respectively.

A nine point hedonic scale score card was used for acceptability testing. The nutrient content, antinutritional factors, shelf life testing and cost of the nutri mixes were analysed. Among the women identified with micronutrient deficiencies in the age group of 30-45 years only 150 were willing to participate in the supplementation study. Among them only 120 were selected for the nutrition intervention and placed in 2 groups. The inclusion criteria are Self Help Group Women in the age group of 30 – 45 years, not taking any medications. All of them were well informed about the objective of the study and their willingness and co-operation throughout the four months supplementation study was elicited. The 120 women thus selected were divided into two groups of 60 each. Group 1 consisted of 60 anaemic SHG women (30 women in experimental group 1 +30 women in control group 1), and group 2 consisted of 60 women with low calcium levels (30 women in experimental group 2 +30 women in control group 2).

Thirty grams of the mix per day was packed in 120 gauge/30 micron clear food safe polythylene bags and 7 such small bags were put into a larger

polyethylene bag. The investigator distributed one such cover once in a week for a period of four months to the selected women. Supplements were prepared once in seven days and was distributed in person to the target groups. During the entire intervention period the investigator visited the area and assured the completion of consumption.

The effect of supplementation of nutritious mix incorporated with micronutrient rich foods among the women was evaluated by comparing the anthropometric, clinical and biochemical parameters like haemoglobin, iron and serum calcium levels of the subjects before and after supplementation.

With the aim of creating an awareness about the nutrients and their importance, balanced diet, micronutrient deficiencies and the preventive measures to control the deficiencies a nutrition education programme was planned. Nutrition Education was imparted during their Self Help Group meetings to the 120 SHG women in experimental and control group. Education on basic knowledge on nutrition and health was imparted through lectures, exhibition, demonstrations and leaflets by the investigator through group contacts for a duration of two hours per week over a period of four months. The nutritional knowledge of the subjects was evaluated through KAP scores obtained before and after nutrition education.

The salient findings of the study are summarized as follows.

Socioeconomic background of the SHG women

- Among the 1000 SHG women a majority, of 51 percent of the respondents belonged to the age group of 35- 40 years, 24 percent belonged to 30-34 years and 25 per cent belonged to 41-45 years.
- Although educational status of the women was found to be satisfactory, still five per cent of the women are uneducated. A majority of 35 per cent of the women were educated up to primary school, followed by 32 per cent with middle school education and 14 per cent with secondary school education.
- Among the selected SHG women a majority of 42 per cent were unemployed, followed by 32per cent daily wages, 15 per cent involved in agricultural activities and only 11 per cent self employed.

- In both the areas a maximum percentage (48%) of the families belonged to very low income category with less than Rs. 3300 per month, followed by 34 per cent with low income category with Rs. 3301 to 7300 and 17 per cent belonged to middle income category with Rs.7301 to 14,500 per month.
- A majority of the families 87 and 83 per cent belonged to nuclear type among the Periyanaickenpalayam and Karamadai Block respectively. Sixty nine per cent of the families in Periyanaickenpalayam Block and 81 per cent of the families in Karamadai Block, had a family size of 3-4 members.
- In Periyanaickenpalayam and Karamadai Block majority of the families, 50 and 42 per cent respectively spent within 26-50 per cent of their monthly income on food and 62 and 71 per cent of the families spent less than 10 per cent on clothing. Five to ten per cent of their income was spent towards house rent among the majority of the families in both the areas. In both the areas a majority of 59 per cent of the families spent 11- 20 per cent of their monthly income on education. Less than five per cent of their income was spent on Medicine, transport, recreation and durable goods, followed by less than 10 per cent spent on fuel and light and savings.

Dietary Pattern among the families of the selected SHG women

- Around 86 and 88 per cent of the families in the Periyanaickenpalayam and Karamadai Block were found to be non-vegetarians respectively.
- Majority of the families (59%) followed the 3 meals pattern and 60 per cent of the women planned their menu in advance.
- The selection of food based on the nutrients was found among 13 per cent in per cent in Periyanaickenpalayam Block and 10 per cent in Karamadai Block. Only a small percentage of the families possessed kitchen garden.
- Infants were given milk as the main food and idli, rice, mashed fruits and slices of soft fruits were included as the weaning foods. Eggs, milk and pulses were included in the diet of the preschool children. Fatty foods and fast foods were avoided for the teen agers and adult women. Pregnant women were given egg, garlic and greens, while papaya, pine apple and

gingelly seeds were avoided because they lead to abortion and produce heat. Lactating mothers were given garlic, dry fish and jaggery and for old people ragi and rice porridge were given as special foods.

- In most of the families (85%) head of the family was given first preference in the distribution of food, because of our tradition and custom and they are the bread winners of the families.
- In both the areas coffee and tea were the preferred beverages among the SHG women.
- A majority of 46 per cent of the families consumed ragi occasionally, and monthly consumption of wheat was found to be 39 per cent among the selected families. A majority of 72 per cent consumed red gram dhal in the form of sambar. The frequency of consumption of green and other vegetables and fruits among majority of the families was found to be weekly once or twice a week. The consumption of non –vegetarian foods monthly once was found among the selected families. In general, the intake of foods rich in micronutrients was inadequate among the selected families of the SHG women.
- Use of rice porridge, bread, rasam rice and idli for fever was suggested by nearly half of the families. Use of sugar water for diarrhoea was found to be more among both the areas. Use of banana for constipation , curd rice, tender coconut water, butter milk for chicken pox were recommended by majority of the families from both the areas.
- Non-vegetarian foods, oily foods, ice cream, buttermilk for fever, spicy and oily foods for diarrhoea, solid foods for constipation, seasonings, spicy and salty foods for chicken pox were avoided, as reported by majority of the families in both areas.
- In both periyanaickenpalayam and Karamadai Block a majority of 45 per cent of the families, spent within 31 – 40 per cent of their income on cereals and 63 per cent of the families spent 11-20 per cent on pulses. A majority of 48 per cent of the families spent only 2-3 per cent of their income on green leafy vegetables. A majority of 42 and 33 per cent of the families spent 2-3 per cent of their income on other vegetables and fruits respectively.

Expenditure on nuts and oil was found to be 11-20 per cent among 60 per cent of the families. A majority of 60 and 65 per cent of families respectively spent less than 10 per cent on fleshy foods and milk and milk products. Expenditure on sugar and jaggery and beverages occupied 2-3 per cent among majority of families. Food expenditure pattern revealed that green leafy vegetables, other vegetables, fruits and milk and milk products were purchased less by the families.

Nutritional knowledge of the selected SHG women

- The overall nutritional knowledge of the women on foods, nutrients and their importance in preventing deficiency diseases was found to be not satisfactory, hence nutrition education is important for these women to help them to select proper foods to lead a healthy living.
- Some of the selected families had food fads and taboos like papaya, raw rice, jaggery and chicken as hot foods, curds, ice cream and fruits as cold foods, potato and raw plantain as gas producing foods, tea and coffee as bile producing foods and dried fish, garlic as foods increasing milk secretion and brinjal and dried fish as foods causing skin disease.

Health problems among the selected SHG women

A majority of 41 per cent of the women reported that they had the problem of anaemia, 37 per cent of the women had dryness of skin, 36 per cent of the women had loss of appetite and 35 per cent of the women were suffering from joint pain. Among them 27 per cent of the women reported that they were easily infected, 22 per cent of the women had constipation problems and 19 per cent of the women were experiencing depression. Vision problems were common among 19 per cent of the selected women.

Details on Self Help Groups

- Details of participation in SHG activities showed that 39 per cent of the SHG women were in SHG for the past 1-2 years, followed by 24 per cent from 6 months to one year, 13 per cent from 2-3 years, 11 per cent from 0-6 months and 9 per cent were from 3-4 years.

- A majority of 66 per cent of the respondents joined SHG to avail loan and start a small business, followed by 46 per cent to develop the habit of savings, 14 per cent joined with the aim of fulfilling all their needs. The rest of 23 per cent stated the reasons such as to get economic independence, to spend their leisure time and involve in community activities.
- A majority of 53 per cent of the groups saved Rs. 10,001 to Rs. 15,000 per annum, followed by 43 per cent of groups saved Rs. 5000 to 10,000. Only 4 per cent of the groups saved more than Rs. 15,001 per annum.
- Financial support, savings habit, availing loan, self confidence, change in the personality were some of the benefits stated by the respondents after joining the SHG.

Anthropometric Measurements of the Self Help Group Women

- The mean height of the selected SHG women was found to be 160.21 cm , which was slightly lesser than the height of the Indian women suggested by ICMR (2010). The percentage deficit was only 0.5 per cent in comparison with ICMR values.
- The mean weight of the SHG women was found to be 70.2 kg which was greater than that of 56 kg suggested by ICMR (2010) and the percentage excess was found to be 25.4 per cent.
- A highest prevalence of pre- obesity based on BMI classification was found among 33 per cent of the selected women. The prevalence of obese class I, obese class II and obese class III were found to be 25,17 and 5 per cent respectively and have a total of 47 per cent of women. Nearly fifty per cent of the women under study were found to be in the obese category, which is an alarming observation. There were only 2 per cent of women in the underweight category and only 18 per cent of women were in the normal BMI class.
- A majority of 43 per cent of the SHG women had more than 0.8 WHR which is very crucial and coincides with the state of obesity among the SHG women. About 34 per cent of the women were at the moderate risk with 0.81 to 0.85 WHR and only 23 per cent of the women had a normal WHR of 0.8.

Clinical examination of the Self Help Group Women

- The clinical symptoms like joint pain, odema, bleeding gums, paleness of face and tongue, conjunctival xerosis and brittle nails were found among 60, 56,42, 44,23, 20,35 per cent of the selected women respectively. The other clinical symptoms like gastrointestinal problems like improper digestion, ulcer and worm infestation were also found among SHG women. Restlessness was found among 50 per cent of the SHG women, followed by sleep disturbances (40%), calf tenderness (40%) and mental confusion (21%).

Biochemical Parameters of the selected SHG Women

- The mean haemoglobin levels of the selected SHG women was found to be 9.87g/dl which was lower than the standard values suggested by WHO, which reveals the higher prevalence of mild anaemic status among the selected women in both the areas. As per the individual haemoglobin levels moderate anaemia was highly prevalent.
- A majority of 58 per cent of women had serum iron levels below the reference values. This observation correlates with the higher prevalence of clinical symptoms of anaemia such as paleness of tongue and face and brittle nails among the selected SHG women.
- Sixty four per cent of the SHG women had low serum calcium levels of 8.0 to 9.0 mg/dl. About 8 per cent of the women had very low serum calcium levels of 7.0 to 8.0 mg/dl.

Food and Nutrient intake of the Self Help Group Women

- The intake of cereals was found to be deficit by 6 per cent but pulse intake was excess by 4 per cent. The intake of leafy vegetables, other vegetables, roots and tubers, fruits and milk and milk products was found to be deficit by 50, 63, 60, 40 and 33 per cent respectively. Fat intake was found to be excess by 20 per cent. It is also observed that consumption of sugar and jaggery was found to be deficit by 27 per cent, a welcome observation. Majority of the women were non vegetarians but their intake was once a week or occasionally once and found to be deficit by 30 per cent. In general,

consumption of foods rich in micronutrients like green leafy vegetables, other vegetables, fruits and milk and milk products were inadequate predisposing them to micronutrient deficiencies.

- A deficit intake of calcium, beta carotene, folic acid, vitamin C and iron were found among the selected SHG women ranging from 45 to 79 per cent. The intake of thiamine and riboflavin was found to be excess by 31 and 38 per cent respectively. The intake of energy and protein content was also found to be deficit by 10 and 4 per cent respectively.

Details of supplementation of nutritious mixes

- Acceptability trials for all the nutri mixes were conducted by 25 panel members using a 9 point hedonic scale score card. Araikeerai leaves powder incorporated nutri mix I got a maximum score of 37.5 when compared to nutri mix II incorporated with drumstick leaves powder. The basic nutri mix got a score of 39.1 out of 45.
- With regard to nutrient content of mixes, nutri mix II had an energy content of 422 kcal, followed by nutri mix I with 410kcal and basic nutri mix with an energy content of 395 kcal per 100g. The carbohydrate content of the mixes were in the range of 60.2 to 63.80 g per 100g. The protein content of the basic nutri mix, nutri mix I and II ranged from 11.3 to 13.17 with a highest amount for nutri mix I with 13.7g per cent. Nutri mix II had more fat of 6.1 g compared to nutri mix I with 5.9 g per 100g. Moisture content of the formulated nutri mixes were found to be less ranging from 1.9 to 2.3 g per cent. The fibre content of the mixes was found to be high in nutri mix II with 2.3 g per 100g followed by nutri mix I with 2.0 g and basic nutri mix with 1.6 g. Proximate content of nutritious mixes was found to be in appreciable amounts to serve as a balanced supplement.
- With regard to minerals, nutri mix II was found to be high in calcium with 457mg per 100g. Phosphorus content of nutri mix II was 287 mg per 100g. Nutri mix I had a high amount of 8.5mg of iron per 100g. Supply of minerals through nutri mixes was found to be satisfactory.

- The total carotene content was found to be high in Nutri mix II with 3902mcg, followed by Nutri mix I with 3032 mcg. With regard to beta carotene also nutri mix II was found to have more amount with 3012mcg. Thiamine content of the mixes ranged from 0.19 to 0.21 mg per 100g with negligible difference between mixes. Riboflavin content ranged from 0.1 to 0.14 mg per 100g again with very little difference between mixes. Niacin content of the mixes ranged from 2.7 to 2.9 mg per 100g revealing similarity of content among the three mixes.
- With regard to antinutritional factors, nutri mix II had the highest oxalate content of 84.04mg per 100g compared to nutri mix I with 49.02 mg per 100g. In case of phytate nutri mix II had the highest phytate content of 0.41 g per 100g, followed by basic nutri mix with 0.34 g and nutri mix I with 0.23g per 100g. With regard to tannin nutri mix I had the highest tannin content of 1.75 g per 100g when compared to nutri mix II with 0.13 and basic nutri mix with 0.04 g per 100g. Alkaloid content was found to be high in nutri mix I (1.64g per 100g), compared to nutri mix II (1.22g per 100g) and basic nutri mix (0.9g per 100g). All the antinutritional factors present in the nutri mixes were found to be within the safe limits.
- Shelf life studies of the nutri mixes showed that the total bacterial count was absent, yeast and mould counts were found to be below detectable limits in all the mixes at the initial days and after 60 days of the storage. This shows that the mixes could well be stored up to 60 days at home scale level.
- The cost of araikeerai leaves powder incorporated nutri mix I was Rs. 16.6 /100gms, whereas drumstick leaves incorporated nutri mix II costed Rs. 16/100gms. The cost of basic mix was found to be Rs. 11.15 per 100g being the lowest. These formulations are found to be inexpensive and have the advantage of providing more micronutrients in addition to calories and proteins and calcium and iron.

Impact of Supplementation of Nutritious Mixes among the SHG Women

- The mean body weight of the women belonging to the experimental groups 1 and 2 showed a reduction by 1.5 and 1.6 kg respectively, whereas a

slight increase of 0.27 kg was seen in control group 1 and 2. Changes in weight of experimental group was found to be statistically significant at one per cent level, whereas in control groups it was found to be statistically not significant. Supplementation for a longer period coupled with increased physical activity might bring out reduction in weight.

- The mean BMI of the experimental group 1 and 2 was found to be 26.7 and 25.01 respectively during the initial period, whereas after the supplementation the BMI was slightly reduced to 26.06 and 24.37 respectively with a difference of only 0.64 in both the experimental groups, which was statistically significant at one per cent level. In control group 1 and 2 the initial mean BMI was found to be 24.68 and 24.65, but after the supplementation it increased slightly by 0.07 and 0.09 respectively and this was statistically not significant.
- Prevalence of clinical symptoms like dryness of skin, calf tenderness, mental confusion, restlessness, bleeding gums, general edema and white spots on nails, joint pain showed a reduction after the supplementation of nutritious mixes for four months among the selected SHG women.
- The mean haemoglobin content of both control and experimental group was found to be 10.01 to 9.67 g/dl during the initial period. After four months supplementation of Araikeerai leaves powder incorporated nutri mix I along with nutrition education improved the haemoglobin content of the experimental group I to 11.12 g/dl and the difference was statistically significant at one per cent level. In the case of control group the mean haemoglobin content was found to be 9.73g/dl after a period of four months with a difference of 0.31g/dl and it was found to be statistically not significant.
- In both the groups the mean Packed Cell Volume was found to be lower than the reference value before the supplementation period, with a value of 31.20 per cent in experimental group and 30.64 per cent in control group. But due to supplementation the experimental group had recorded significant mean difference of 4.77 per cent

- The Mean Corpuscular Volume of experimental group before supplementation was 72.57 fl and it had increased to 84.25 fl after supplementation and it was statistically significant at one per cent level. The mean value of control group was 72.22fl and it slightly increased to 73.14fl after the study period and it was statistically not significant.
- The Mean Corpuscular Haemoglobin of the selected SHG women in both the groups was found to be less than the reference levels. Supplementation of the nutri mix I increased the MCH values of the experimental group from 22.31pg to 28.46 pg with a mean difference of 6.15pg.
- Prior to supplementation, the experimental and control groups had lower MCHC than reference values. But due to supplementation a maximum increment of 4.05 gm /dl was observed in experimental group. In control group the increment was found to be very minimal (0.04gm/dl).
- In both the groups the mean serum iron levels were found to be lower than the reference value before the supplementation period, with a value of 40.93 mcg/dl in experimental group and 41.77 mcg/dl in control group. Supplementation of the experimental group 1 with nutri mix I having Araikeerai leaves powder for a period of four months showed a considerable increase to 16.94 mcg/dl in experimental group and it was statistically significant at one per cent level, whereas in control group there was a reduction in serum iron level by 0.2 mcg/dl and it was statistically not significant.
- The mean serum ferritin levels of the experimental group before supplementation was found to be 4.01 ng/dl and it had increased to 4.72ng/dl after supplementation. In control group the initial and final serum ferritin was found to be 4.00ng/dl and 3.99ng/dl respectively.
- At the beginning the TIBC level recorded by both experimental and control group was within the range of reference value. But after the supplementation, significant decrease was noticed in the experimental group with a mean difference of 31mcg/dl , whereas in control group there

was an increase in the TIBC level with the mean increase of 8.04mcg/dl. The decrease in TIBC indicates the reduction in iron deficiency due to supplementation.

- Transferrin saturation of the experimental group and control group before supplementation was found to be 10.10 and 10.33 per cent. After supplementation, the transferrin saturation of the experimental group was increased to 16.08 per cent, whereas in control group it was only 10.07 per cent.
- The serum calcium levels of the experimental group 2 with nutri mix II supplementation for a period of four months increased the mean serum calcium levels from 8.17 to 9.12 mg/dl and it was statistically significant at one per cent level. This may be due to the high calcium content of the drumstick leaves powder incorporated nutri mix II. In the case of control group the mean serum calcium levels was found to be 8.15 mg/dl initially and after four months there was a slight reduction by 0.14mg/dl of serum calcium levels, which was not statistically significant This shows the significance of incorporating drumstick leaves in the diet of the women.

Impact of Nutrition Education on KAP scores among the SHG women

- Nutrition education given to the experimental groups showed a gain in KAP scores by 10.04, 7.65 and 8.97 with reference to knowledge, attitude and practice scores respectively . In the case of the control group, the gain in knowledge and practice score was negligible (0.38 and 0.13), whereas the loss in attitude score was found to be 0.1, which may be due to the absence of nutrition education to the control group.
- Imparting nutrition education helped to gain more scores in nutrition knowledge, attitude and practice and the findings proved to be a best strategy to increase awareness and improve nutritional status of populations.

The findings of the present study revealed that the involvement of women in SHG supported to fulfill their economic needs, help them to avail loan, develop saving habit and leadership qualities etc. But their dietary habits, awareness about food and nutrients especially micronutrients and its importance and their health status was found to be not satisfactory.

To improve their nutritional status nutritious mix was developed using the low cost locally available foods and these mixes were found to be rich in proximate principles, vitamins and minerals and had anti-nutritional factors within safe limits. Acceptability scores were good and keeping quality was also good up to three months. The cost of the nutritious mix was also found to be cheap compared to commercial formulas.

Supplementation of the nutritious mixes to the selected SHG women with low serum calcium levels and anaemic women showed a significant increase in haemoglobin, serum iron, serum calcium levels and their overall health status. Nutrition education along with supplementation about the nutrition, health, deficiency diseases and its consequences showed improvement in their knowledge, attitude and practices on nutrition and health. Hence apart from regular home diet, additional intake of nutri mixes helped the SHG women to correct their micronutrient deficiencies and also to increase their knowledge about health and nutrition there by promoting a overall empowerment of the selected SHG women.

RECOMMENDATIONS

Based on the observations from the study the following strategies are recommended for future

- More educational campaigns for the SHG women should be organized at a large scale to improve the micronutrient status and their general health status.
- Long term food based calcium, vitamin A and iron supplementation studies could be carried out with continuous monitoring.
- Rural households could be encouraged with respect to kitchen gardening to achieve food security in terms of micronutrients

- Along with skill training, health education programmes could be carried out by government and non-governmental organizations for the holistic empowerment of the SHG women.
- Women development programmes focusing on physical activities, stress management and medical camps could be arranged for the rural women to make them more empowered.