CHAPTER – 5
SUMMARY AND CONCLUSION

Indian textile industry is one of the leading textile industries in the world and contributes nearly 14 per cent of the total industrial production of the country. Textile industry is one of the major growing industries for export purpose which require large number of workers. The textile industry is providing employment to numerous people in the country, but the emphasis on awareness about the environmental concern such as air, water and noise pollution during the processing from fiber to fabric is essential in the present circumstances.

Every occupation is associated with one or the other ill effects on health, and one such occupational group is the cotton textile workers. Expose to cotton dust in the textile industry has been associated with several work specific and non specific respiratory symptoms. Other morbid conditions such as musculoskeletal problems coupled with malnutrition especially anaemia were common among them. Therefore assisting them with respiratory disorders to attain and maintain optimal nutritional status is critical to enhance their physical well being and function.

Although the textile industry in India has a large population for many years health hazard of the women working in ginning and spinning factories has been overlooked. Moreover all the studies conducted so far were confined to selected area and there is no recent study which portrays clearly the health and nutritional status of ginning and spinning workers. Considering this, a study entitled Nutritional and pulmonary Health Status of Textile Women Workers of Tamil Nadu and the Impact of Micronutrient Fortified Food Supplement on Moderate Anaemic Cotton Ginners was undertaken to assess the health status of women working in textile industries.
Objectives

- To study the socio economic background and work pattern of women working in ginning and spinning units of textile industries.
- To assess their nutritional and health status.
- To formulate and evaluate micronutrient fortified soy biscuits.
- To test the efficacy of micronutrient fortified soy biscuit supplementation on haematological indices and respiratory condition of selected ginning women workers.
- To provide awareness on nutritional importance among cotton textile ginning women workers.

Phase – I

**Socio demographic characteristics of cotton textile women workers**

The investigation was carried out in the urban areas of Tirupur and Erode districts of Tamilnadu around 300 to 500 kilo meters south west of Chennai. Totally 300 nonpregnant and nonlactating women performing varied textile tasks are aged between 20 to 50 years. They were identified randomly from ginning (n=150) and spinning (n=150) industries. Socio economic characteristics and work pattern of selected women were gathered through interview method using a pretested questionnaire. The findings proved that 79 and 70 per cent of women selected from ginning and spinning industries respectively were in the age group of 20 to 40 years. Of the total, 79 Per cent were literate and completed their education from primary to diploma level. About 93 and 60 per cent of women included under ginning and spinning industries respectively were married and 57.3 and 36.6 per cent had 2 to 4 and 4 to 6 members per family respectively. The monthly income of 90.7 per cent individuals ranged between Rs.1000 and 3000 whereas 95 per cent of their family income ranged between Rs.4500 to 7500 per month. Considering the expenditure pattern, on an average 40 to 50 per cent of their income spent on food, 20 to 30 per cent on shelter, 5 to 10 per cent towards transport, personal and health care.
Of the total 150 women working in ginning industries, 53 per cent work in gin house, out of which 30 and 17 per cent worked in gutter and sorting sections respectively. Similarly, those women (n= 150) included from spinning industries about 25 per cent women worked in blowing room whereas 22 and 60 per cent worked in carding and spindle sections respectively. About 36 and 33.3 per cent worked for 12 and 16 hours per day respectively. Refering to their work experience 30.7 and 49.1 per cent had experience of 1-2 and 3-4 years respectively. Women do their activity in standing and bending posture. Thirty nine to 44.7 per cent expressed that economic compulsion, inorder to increase their family income they do participate in textile activities. The selected industries provided first aid facilities, toilet, fire alarm facilities, proper ventilation, free transport, adequate water supply and enough light, lunch room, subsidized meal in canteen etc. to their employees. About 53.3 per cent felt that the nature of work was slightly heavy and about 30.3 per cent visit hospitals once or twice a week due to various health complaints.

Phase II
Nutritional status of cotton textile women workers

Direct indicators of nutritional status such as anthropometry, dietary intake, clinical examination and biochemical assessment were carriedout for the selected 300 textile women workers. Anthropometry including height, weight and Body Mass Index; dietary intake covering food habits, food frequency and food and nutrient intake by 24 hours recall method; clinical examination through ICMR proforma and estimation of haemoglobin using cyanamet haemoglobin method were assessed. Observations showed that about 64 per cent followed non vegetarian diet including chicken and mutton weekly once, 15 and 21 per cent followed vegetarian and ova vegetarian diet respectively. Rice being the staple food was taken by the selected women and inclusion of ragi and bajra was once or twice a month. Consumption of pulses, fruits and vegetables were limited. Milk was taken by all. About 8 to 15 per
cent skip either their breakfast or lunch due to lack of time or appetite. Less than 10 per cent take coffee or tea thrice a day.

Considering the food intake, the mean cereal intake was 376 ± 5 and 396±13g by the selected ginning and spinning workers respectively. The average pulse and milk intake ranged between 32.8±5.9 to 39.1±6.6 g and 64.4±38.1 to 79±19.5g per day respectively. The mean calorie intake of the giners and spinners was 1623 ± 155 and 1697 ± 109 kilo calories respectively. The protein intake by the respective groups was 38.7 ± 14.9 and 40.2 ± 15.3 g respectively. The average fat intake was less than 20g per day. The mean iron intake was 16.6 ± 2.7 and 19.2 ± 4mg per day by the ginners and spinners respectively. Similarly, their vitamin C and folic acid intake met only less than 50 per cent of RDA.

Anthropometric indices showed that the mean height ranged between 157.1 ± 2.19 and 154.8 ± 4.83 mean weight ranged between 52.8 ± 1.41 and 53.12 ± 2.12 kg and BMI between 21.47± 0.28 and 24.6 ± 1.34. About 76 per cent of the selected women suffered from mild to severe degree of anaemia with the mean haemoglobin of10.75±0.83 to 6.1 ± 0.01g per cent. On an average, 42 per cent with moderate degree anaemia had 8.35 ± 0.72 g per cent haemoglobin.

Phase III
Health status of cotton textile workers
Cotton textile workers are susceptible to varied morbid conditions. The prevalence of nutritional deficiency symptoms, respiratory and musculoskeletal problems were assessed among the selected textile women workers. The results revealed that 43 and 18 per cent of ginners and spinners showed symptoms of protein calorie malnutrition. Similarly, 85 and 68 per cent of the respective groups had symptoms of iron deficiency anaemia. Considering the morbid conditions, about 62 per cent had general weakness, 55 per cent with
gastric problems and 35 per cent with mild hypertension. Eye and ear problems were relatively higher among women working in spinning sections.

Considering the respiratory problems mild degree conditions including headache, sneezing, cough, nasal irritation were prevalent among 20 to 49 and 21 to 51 per cent of women working in ginning and spinning industries respectively. Symptoms such as rhinitis, sleeplessness, nausea, vomiting and cough with sputum grouped under moderate degree were identified among 9 to 29 and 2 to 27 per cent of women working in ginning and spinning industries respectively. Severe degree of respiratory problems including asthma, pneumonia and tuberculosis were seen among less than 5 per cent of study population. About 31, 41 and 45 per cent working in ginning units had pain in arms, hands or legs respectively and, 33 and 41 per cent had low back pain and pain in joints respectively. Similarly, 22, 33 and 37 per cent of spinners had pain in arms, hands and legs respectively and about 26 and 34 per cent had low back pain and pain in joints respectively.

Phase – IV
Formulation and evaluation of micronutrient fortified soy biscuits

To correct micronutrient deficiency prevailing among cotton textile workers, nutrient fortified biscuits were formulated. Initially, ready to eat snack food cookies were formulated by replacing wheat flour partially with pulse flour such as untoasted defatted soy flour, toasted defatted soy flour, rajma (Phaseolus vulgaris) and moth bean (Vigna aconitifolia). Out of 18 formulations, initially 7 variations and one standard were selected for quality analysis. Subsequently, one combination with 30 per cent untoasted defatted soy flour substitution was selected based on organoleptic characteristics, physico chemical and nutrient evaluation to fortify micronutrient. Organoleptic characteristics, such as appearance, colour, texture, flavour, taste and overall acceptability were tested by 20 semitrained panel members using 5 point hedonic scale. Physico chemical characteristics such as moisture, ash, acid insoluble ash and nutrients such as energy, carbohydrate, protein, fat, iron, fiber
and folic acid were analyzed by following standard procedure. Suitable combination (70 per cent wheat flour and 30 per cent untoasted defatted soy flour) was fortified with different levels of ferrous fumarate (6.8 and 10mg) and optimal level of folic acid (175 µg) purchased from CELL RICH PRODUCTS ISO 9001, 2000 certified (Certified No.0611281j) and HACCP approved company Hyderabad. Cookies prepared with the composite flour were evaluated organoleptically. Further, based on acceptability trials the biscuit prepared with 8mg of ferrous fumarate and 175 µg folic acid was selected for intervention study. Quality characteristics of biscuits such as physicochemical, nutrient and microbial load were assessed initially and on storage (120 days).

The results showed that of the different combinations variation I with refined wheat flour and toasted defatted soy flour (70:30), variation II with refined wheat flour, untoasted defatted soy flour (70:30), variation V with refined wheat flour, untoasted defatted soy flour and rajma (70:15:15) and variation VI with refined wheat flour, untoasted defatted soy flour, moth bean (70:15:15) secured better scores for organoleptic characteristics. Moisture content of flour ranged from 2.50 and 3.70g per cent. Ash content ranged between 0.54 and 0.92g per cent against 0.50g per cent of standard (100g wheat flour). Flour had less amount of acid insoluble ash (0.012 0.04g per cent). Nutrient analysis showed that on an average the different cookies provided 55 g of carbohydrate, 8.8 to 13g protein per 100g. Of the different cookies prepared with 6, 8 and 10 mg of ferrous fumarate and 175µg folic acid, the one with 8mg recorded maximum score for appearance (4.8 ± 0.4), flavour (4.8± 0.54), texture (4.7±0.4), taste (4.9±0.3) and overall acceptability (4.9 ± 0.6). It provided 482 kilo calories, 13.5g protein, 8mg iron and 120µg folic acid per 100g biscuits. No appreciable change was observed in quality parameters except moisture which increased from 3 to 3.5 g per cent after 120 days. Similarly, bacterial and yeast count was minimum (less than 5 cfu /g) even after storage period confirming the better keeping quality of the product.
Phase V
Impact of micronutrient fortified soy biscuits supplementation among ginning women workers

Moderate anaemic women with haemoglobin level of 7.89 ± 0.19g/dl working in selected ginning units were included for intervention study. Totally 40 women were grouped under control (n=20) and experimental (n = 20) and subsequently the later group was provided with 100g of micronutrient fortified soy biscuits as midmorning and midevening snack for a period of 120 days. Changes in their haematological indices, anthropometric, clinical and respiratory conditions were assessed among the selected groups of women initially and after intervention period.

The findings showed that initially 52 to 80 per cent and 20 to 60 per cent of control and experimental group of women were with mild and moderate degree of respiratory problems respectively. However, after intervention period about 20 to 30 per cent and 10 to 20 per cent of experimental group of women under mild and moderate category of respiratory problems respectively were relived from such conditions. Similarly, 50-70 per cent of women initially showed symptoms for musculoskeletal disorders. On supplementation, 10-20 per cent of women under experimental group expressed that they were relived from such symptoms. Anthropometric measurements showed that there was an increase in body weight of experimental group of women from 48.7 to 51.5kg which reflected on their Body Mass Index.

Haematological indices revealed that the mean haemoglobin of experimental group improved to 11.04± 0.56g/dl from 9.1± 0.67. Similarly increase in serum iron from 61.9±3.24 to 65.0±2.95µg/dl was noticed and showed a significant difference at 1 per cent. Women under control group had mean transferrin, ferritin and folic acid as 188.3±11.47mg/dl, 25.16±5.1ng/ml and19.7±2.4ng/ml respectively and showed no significant change after intervention period. These levels were increased from 191± 5.3 to 201.8±
5.5mg/dl, 22.5±4.1ng/ml to 25.8 ±3.86ng/ml and 60.2 ± 1.04 to 19.4 ±
0.5ng/ml respectively in experimental group of women.

Improvement in total protein (6.62 ±0.49 to 8.11± 0.20g/dl), albumin
(3.9± 0.36 to 4.73± 0.31g/dl) and globulin (2.82± 0.24 to 3.8 ± 0.29g/dl)
showed significant difference at 1 per cent level. Similarly, an increase in
Total WBC count (7326± 19.5 to 9725 ±25.5cumm), reduction in lymphocyte
(42.16±3.6 to 35.2 ± 2.2 per cent) and eosinophil (7.4±0.8 to 4.3± 0.5 per cent)
counts were noticed in experimental group of women.

**Pulmonary Function Test**

Lung volume and capacities of air breathed in and out of lung by the
selected women (n=20) was measured by a trained technician using
multipurpose spirometer. It includes the indices such as FEV$_1$, FVC, FEV$_1$/FVC, PEFR, PEF$_{25-75}$. Pulmonary Function Test showed a considerable
change after intervention period. The initial mean value of FVC was 1.94±0.14
and it increased to 2.13±0.42. Similarly, an improvement in FEV$_1$ value from
1.65±0.31 to 1.79 ±0.42 was noticed. The mean observed value of PEFR,
PEF$_{25-75}$ were reduced slightly in selected women of ginning workers after
intervention when compared with the values recorded before intervention.

**Nutrition education**

Screening test revealed that the selected women followed poor dietary
practices and included less protective foods which was attributed to lack of
knowledge. As a preventive measure nutrition education programme was
conducted among the selected ginners (n=150) through lecture, power point
presentation and display. Further to follow and practice good dietary practices
a booklet in the local language was distributed. Improvement in their
knowledge was tested by administering a questionnaire before and after
education programme.
Observations showed that about 50-60 had no knowledge on change in life style and better food habits could improve the quality of health and life. However majority (96-99 Per cent) of them gained knowledge regarding the benefit of food, better dietary practices etc. Similarly, a considerable changes in their practice specially 90 per cent inculcate the habit of including iron rich foods and fruits and vegetables in their menu. Further, 86 per cent agreed that participation in nutrition education would improve the food habits and reduce the common nutritional deficiencies. Surprisingly, about 71 per cent accepted rather assured that they would gradually avoid consuming tobacco and betal leaves. Short term education programme though showed positive response, yet to cover a large number of populations and bring in sustainable improvement in their food habits and health status is essential to initiate continuous education among women working in textile units.

Conclusion

The findings of the study showed that higher percentage of textile women working in textile industries suffered from moderate degree of anaemia. Similarly marginal percentage of women working in ginning units was with musculoskeletal and mild to moderate degree of respiratory problems. Provisions of micronutrient food supplement showed an appreciable change in haematological and morbid conditions and improvement in pulmonary function of selected ginners. Additionally, nutrition education programme brought in retention of nutritional knowledge among textile workers.

There should be programme to reduce disease, morbidity and mortality among workers in high risk sectors. A system should be developed to do surveillance for major occupational diseases and health hazards. Efforts should be taken to collect, analyze and disseminate information on the distribution of occupational illness and health hazards to target and should evaluate the intervention and prevention efforts.
Recommendations for further research

- Studies examining the development of pulmonary impairment in cotton workers
- Longitudinal studies may be required to study the effect of respiratory problems on lung function
- Conducting periodical awareness programme to follow regular health check up and to include balanced diet.