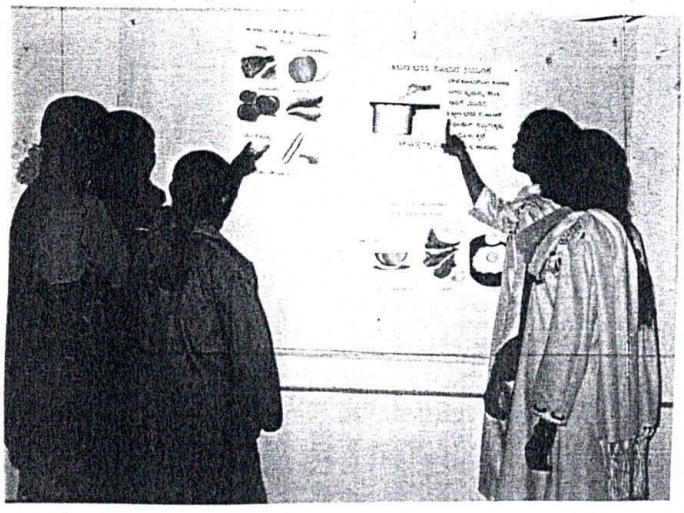
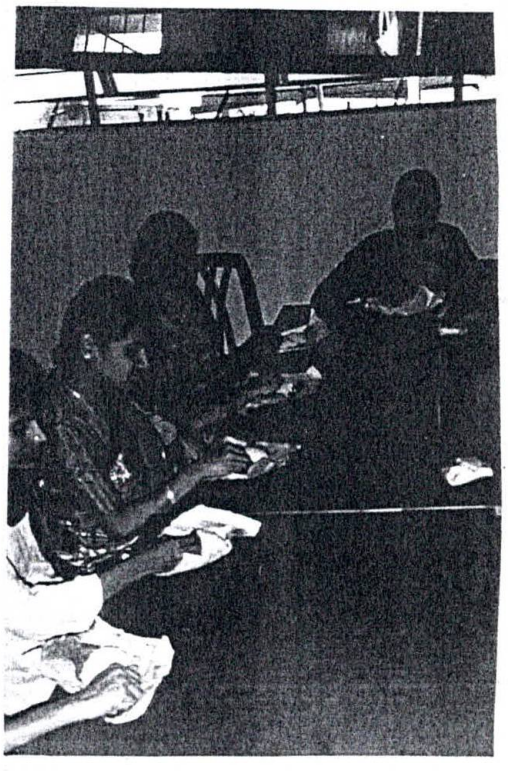
AN INFORMATION - EDUCATION – COMMUNICATION (IEC) PROJECT FOR WORKING GIRLS (18 - 23 YEARS) ON CULTURAL DIETARY PRACTICES TO INCREASE THE IRON CONTENT OF THEIR EVERY-DAY-DIETS.





TARA GOPALDAS

April 2000

Thrasher Research Fund
Salt Lake City, UT, U.S.A.

&

Tara Consultancy Services
Bangalore, India.

Title of the Project : An Information-Education-Communication (IEC) Project For Working Girls (18 - 23) Years On Cultural Dietary Practices To Increase The Iron Content Of Their Every-Day-Diets.

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AN INFORMATION - EDUCATION - COMMUNICATION (IEC) PROJECT FOR WORKING GIRLS (18 - 23 YEARS) ON CULTURAL DIETARY PRACTICES TO INCREASE THE IRON CONTENT OF THEIR EVERY-DAY-DIETS

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ACKNOWLEDGEMENTS

It gives me great pleasure in thanking the Thrasher Research Fund (Food Based Approaches), Utah, U.S.A. for giving us an adequate grant for the successful completion of this research project. I thank in particular Dr. M. Briem, Ed. D., Associate Director, Thrasher Research Fund, Ms. Julia L. Busse, Research Manager, Thrasher Research Fund and Ms. Michelle Inkley, Research Cycle Specialist, Thrasher Research Fund. All these officers of Thrasher Research Fund gave us helpful guidance and timely remittances! We are particularly appreciative of Thrasher Research Fund's gesture of agreeing to the additional quantitative interventions namely : Iddli in Unit One and Gooseberry juice in Unit Two in addition to the IEC. The Managements of these two units, that received the IEC were convinced that the interventions would be useful in bringing about the required behaviour change in their female workforce. We also greatly appreciate the additional grant of USD 6000, which made it possible for us to complete two large rounds of dietary intake surveys.

All my Colleagues, Consultants and Support Staff worked with zest and enthusiasm, especially the Coordinator of the Project Dr. Arathi Singh. So also did Usha, Nandini, Sharada, Hemal and Murthy.

We thank our contractual consultants namely, Dr. Prema Akki Dr. Raj, Mr. Santosh and Ms. Esther Mohan for their special inputs.

Ms. Iqbal Basith, Director Unit One (fermented foods) is to be thanked in particular for giving her 72 working women staff time to listen and participate in the weekly IEC lectures and for all the cooperation extended regarding the six-month-intervention. The Managers of the other three units also cooperated with us, especially Mr. Wahid of Unit Two.

It is my only desire that the Government of India and all the State Governments in my country will make it mandatory that the employers give their employees both **men and women**: blanket deworming plus either a fermented food snack; or a Vitamin C rich beverage; or medicinal iron supplementation at the WORKPLACE.

April, 2000.

Prof. Tara Gopaldas
Director, Tara Consultancy Services,
Bangalore.

EXECUTIVE SUMMARY

An Information-Education-Communication (IEC) Project for Working Girls (18-23 years) on Cultural Dietary Practices to Increase the Iron Content of Their Everyday Diets.

1. **The Rationale and Focus :** The Working Girl population (18 – 23 years) in most of India's cities and towns is the phenomenon of this millenium. Women are working as never before, mostly for economic reasons. Iron Deficiency Anemia (IDA) is highly prevalent in this segment as most come from Low Income Group families. IDA has been shown to have a clear effect on physical-work-capacity and cognition. Our recent study on female tea-pluckers has also re-confirmed its positive impact on productivity. Hence, this IEC study was designed **to increase the bio-availability of everyday-foodstuffs by simple dietary changes. The emphasis was on cereals, which are consumed in huge quantities. Fermentation of cereal-pulse batter is well accepted in South India, where the present study was conducted (1998 – 2000). Fermentation of the cereal batters, reduces the inhibitory action of phytate-iron, thus making the iron more bio-available. Similarly, attempts were made through IEC to increase the consumption of ascorbic-acid-rich gooseberry juice or lime to increase the availability of dietary iron.**

   The target population was both the **Employer** and the **Employee**. The emphasis was on doable and sustainable IEC at the **Workplace** and at **Home**.

2. **Objectives :** The overall objectives of this Efficacy trial was to determine whether simple and culturally acceptable dietary changes in the lunches at the **Workplace** and at **Home** could bring about Knowledge, Attitude and Practice or Behavioural changes that would increase the bioavailability of iron in their everyday diets.

   The specific Impact Objectives in the `Before' and `After' surveys were :

   - Changes in Knowledge, Attitude and Practice (KAP) or Behaviour.
   - Dietary and Nutrient Intake especially of bioavailable iron-rich foods.
   - Hemoglobin status.
   - Body Mass Index.

3. **Participatory Implementation :** The **Stakeholders** at the **Workplace** in this study were the **Employer**; the **Employee** and **us** (Tara Consultancy Services). The major gain in this study by adopting this approach was the **almost instantaneous Behaviour Change in the Employer. The Employer agreed to underwrite the cost of the dietary-food-interventions in Unit One and Two.** The Employees cooperated with us fully as they were getting two medical check ups; in addition they were getting workplace lunches of fermented food (*iddlis*), 3 times a week in Unit One; or gooseberry juice 3 times a week in Unit Two; and deworming + iron tablets in Unit Three.

We, the implementors and researchers of this study felt a sense of deep gratitude in particular, to the **Employer**. This very positive gesture from the **Employer** both deepened and widened the scope of the original design of this study. It also strengthened it considerably.

4. **Project Design and Methods :**

i. **Sample Selection :** Consisted of 72, 80, 70 and 80 (total of 302) Working Girls in Units One, Two, Three and Four. Each Unit consisted of a small ancillary Unit or factory making parts for electronic equipment, zippers, garments, or air-conditioners. Details of the Study Design is given at Table 1.

ii. **Methods :**

- A structured questionnaire was developed to collect data relating to the Socio-economic status and the Profile of the Working Girls;
- Dietary and Nutrient Intake (Before and After);
- Knowledge, Attitude and Practice (Before and After);
- General Health Status, Hemoglobin Status, Clinical Assessment for Nutritional Status;
- Anthropometric Status.

Standard methods were used for all parameters above.

iii. **Data Processing :** The SPSS package was used.

5. **Development of the IEC messages :** Twenty one posters were developed relating to IDA; fermented foods; dietary iron inhibitors (tea)

and enhancers (Vitamin C – rich foods); use of iron woks; consumption of GLVs; and how intestinal worms make the blood weak.

On popular request from the **Employer** and the **Working Girls** a few more posters were developed on grooming; small family norm; and on how to save money; and lectures on reproductive health were given by the medical consultant and the Project Coordinator.

6. Results :

i. Dietary and Nutrient Intake :

- Average Intake of Food Stuffs in the Post-Survey did increase significantly in the categories of cereals, pulses, leafy vegetables, other vegetables (mostly tomatoes), seasonal fruit (banana, mango, lime) and flesh foods, in Units One and Two which received the IEC plus a concrete dietary-based-intervention at the **Workplace.**
- At the Post-Survey, the mean intake of calories did go up significantly in all four units; of protein in Units One, Two and Three; of iron in Units One and Two; of calcium in Unit One; of Vitamin A in Units One and Two; and of Vitamin C in Units One and Two.

ii. Health and Nutritional Status :

General Health :

- **Chronic Illness :** Mostly related to reproductive health namely leucorrhoea, scanty or irregular periods, which improved significantly in Units One, Two and Three.
- **Intestinal Worms :** A very dramatic reduction was seen at Post-Survey.

iii. Hemoglobin Status :

- The overall mean Hb g/dl at Pre and Post Surveys went up significantly in Unit One, Two and Three. It did not in Unit Four (Negative Control). In Unit One the mean Pre Survey Hb was 11.10 g/dl Vs 12.30 g/dl at Post Survey. In Unit Two the mean Pre Survey Hb was 11.20 g/dl Vs 12.70 g/dl at Post Survey. In Unit Three the mean Pre Survey Hb was 11.50 g/dl Vs 13.00 g/dl at Post Survey. In Unit Four the mean Pre Survey Hb was 10.90 g/dl Vs 10.90 g/dl at Post Survey.

- The more severe the anemia greater was the Impact as a result of the intervention.
- The interventions (please refer to Table 1) were very effective as **all the cases** of Severe and Moderate Anemia were totally eradicated in Units One, Two and Three at the Post Survey. The percent prevalence of Normals rose to 67%, 79% and 87% respectively in Units One, Two and Three. It was the same 20% at Pre and Post Survey in Unit Four.
- In the case of fermented foods a significant benefit and increase in Hb values was seen, when the **Employee** (Married Working Girl) was in **control** of her kitchen.
- The greatest mean increase in Hb levels of 1.50 g/dl was seen in the Gooseberry Juice + IEC intervention; and the deworming plus medicinal iron supplementation. By inference, it appears to indicate that **the type of intervention at the Workplace is of greater value than IEC delivered with it; IEC in isolation; or the total lack of IEC.**
- The BMI of Working Girls in all the four Units increased significantly and was above 18.5, the accepted normal for a female adult (> 18 years). We cannot explain why this happened in Unit Four (Negative Control), except that the mean age of the Working Girls in Unit Four was 20 years versus 22 years in the other three Units.

iv. **Knowledge, Attitude and Practice :**

- Knowledge gains were impressive and went up to 87% correct responses in the Post Survey.
- Awareness among the Male members of the families of Working Girls went up in **all** four Units.
- The poster that received maximum recall was the one exhorting the girls to eat fermented foods (37%); eat GLVs (27%); and eat egg, meat and trotter soup (25%).
- The Attitude to the Concrete Interventions such as the fermented food at the Workplace was extremely positive with 75% saying they would make the *iddlis* even if the Management stopped doing so. 25% said they could not, due to time constraint, and 'no control over the kitchen'.
- The Attitude to the Gooseberry Juice intervention was very positive (100%), but the Working Girl said it was unaffordable. Unfortunately the Employer also felt likewise.

7. Conclusions/Recommendations :

i. First **orient or educate** the **Employer** rather than the **Employee** with respect to the improvement of the health and iron-status of the latter. **Expected behaviour change** in enlightened **Employers** is almost instantaneous.

ii. A concrete **intervention at the Workplace plus IEC** would be the best choice.

iii. The **Employees do appreciate the IEC and do implement the dietary injunctions** to the extent possible. However, their **time** and **economic constraints** are the **real limitations to total behaviour change or sustainability.**

iv. **Control of the kitchen** is a paramount factor in the **Employee**, where much greater consumption of fermented foods is concerned.

v. In Urban India, aluminium cooking pots/vessels have come to stay. Hence, iron woks will **not** be used.

vi. Tea **will** be drunk 2 – 6 times a day at the **Workplace**. No amount of IEC will change this. Perhaps approaching the big tea manufacturer to enrich or fortify their loose tea or cheap brands with ascorbic acid (at the very least) may partially solve the problem of widely prevalent IDA in the **Working Girls.**

vii. The **Employer** of such small industrial units is generally a small enterpreneur with small resources. This was the reason for non-continuance of the dietary-based interventions in Units One and Two. But small cooperative efforts between **Employer** and **Employee** will work. *Iddli* (fermented food) is an extremely popular food eaten by all sections of South India. A retired **Employee** can be put in charge of making this popular dish everyday and a small amount may be cut from the **Employees'** salary.

viii. Although, the **fermented food (*iddli*)** did not increase the mean Hb levels (1.20 Hb g/dl) as did the Gooseberry Juice or the Medicinal Supplementation interventions (1.50 Hb g/dl), yet, **it was the food-based-*iddli* intervention that was most appreciated.**

ix. Enhancing the Hb levels of the Working Girls makes good economic sense. Such a strategy brings about good labour relations apart from the established rewards of greater productivity, better reproductive health, better cognition and an all round better working atmosphere.

Table 1 : Details of the various interventions :

INDICATOR	UNIT 1 *(Iddili)*	UNIT 2 (Goosebery Juice)	UNIT 3 (Medical Supplements)	UNIT 4 (Negative Control)
1. Name of the Unit	Solid State Systems	A & A Zipper	Prestomac	MMS Exports
2. Type of Business engaged in	Voltage Stabilizer for T.V. Industry	Zippers for the garment Industry	Electronic components for the T.V. Industry	Exporting readymade garments
3. Sample size of Working Girls	72	80	70	80
4. IEC	Intense at once a week	Less intense at once a month	NO IEC	NO IEC
5. Intervention	Fermented, steamed dumplings (iddlis) With relish and lentil soup thrice a week at 2 p.m. when shifts changed	20 ml of Rebina (gooseberry juice) to deliver 40 mg Vit C, thrice a week	400 mg albendazole once + 60 mg elemental iron as ferrous sulphate, (twice a week)	No Intervention
6. Type of Intervention	Supervised	Supervised	Supervised	Nothing
7. Lectures to augment the IEC	A lecture on Nutrition/ Health/ Reproductive Health , twice a month	-	-	-
8. Expected benefit from intervention	Cleaving of phytic acid from the Fe, making the Fe much more bio-available	Increasing the bio-availability of Fe with a known enhancer **(15,16)**	The above regimen has been used by us with a high rate of success earlier **(4,5)**	No intervention
9. Who bore the Cost?	The Management	The Management	TCS	-
10. How much did it cost per Beneficiary for 6 months?	Rs. 156/- per worker Or Rs. 11,232/- for the entire intervention	Rs. 68/- per worker or Rs. 5,460/- for the entire intervention	Rs. 4.30/- for the Fe + Rs. 5/- for the deworming once= Rs 9.30/- per worker or Rs. 744/- for the entire intervention	Nothing.

Note : Table 1, has been reproduced from Chapter Four on Project Design and Methods.

Chapter One - INTRODUCTION AND KEY PROJECT OBJECTIVE :

INTRODUCTION :

The Project attempts to answer the Salt Lake City Declaration on Micronutrients (1995) which in essence said "Food-based systems offer sustainable solutions to malnutrition including the health problems caused by micronutrient deficiencies, thus making material improvements to the health, well-being and productivity of millions of people" **(1)**.

Thrasher Research Fund in response to a request by Tara Consultancy (TCS), Bangalore, India, was kind enough to send us the pertinent services guidelines regarding **Food-based Approaches to Preventing Micronutrient Malnutrition.** TCS submitted a proposal entitled "An Information-Education-Communication (IEC) Project for Working Girls (18 - 23 years) on Cultural Dietary Practices to Increase the Iron Content of Their Everyday Diets" TCS was indeed honoured by being awarded the above project in January, 1998.

A recent report on "A Data Base on Iron Deficiency Anemia (IDA) in India : Prevalence, Causes, Consequences and Strategies for Prevention" **(2)** has reported that the **dietary intake of iron** in the adult female (18 years plus) in the state of Karnataka (location of the present project) was as high as 37.97 mg/day versus a RDA of 30 mg/day **(3).** Our two recent studies indicated a lower dietary iron intake of 20 - 30 mg/day **(4,5)** . How then could the available literature in the state of Karnataka **(6)** and our own data indicate an extremely high prevalence (60% - 80%) of Iron Deficiency Anemia (IDA)? Our own data in the **present project** indicated a prevalence of IDA of 70% to 80%. And in our previous Tea Plantation Worker Project in Chickmagalur district of the state of Karnataka indicated that IDA prevalence among the even relatively well paid women pluckers was about 60%, 1998 (**4**). This was an enigma and a research challenge to be addressed.

WORKING GIRLS AND WOMEN - A PHENOMENON OF THE MILLENIUM IN INDIA :

Industrially burgeoning Bangalore, in Karnataka; a state in South-West India has increased its already large population of working girls several fold. Girls/young women in the age group of 18 - 23 years are preferred in the ancillary or feeder units for the export garment industry, packaging of

medicines, assembly of electronic gadgets, air coolers etc. Their educational qualification is middle to high school level. These girls belong to the non-organized sector which is far larger than the organized sector. Information-Education-Communication (IEC) is essential for both the **Employer** and the **Employee**. These girls come from Low Income Group Homes (LIG) where the total family income is less than Rs. 5,000/- (about USD 120) per month. They live in "**urbanized villages**" which are villages that were in the outskirts of Bangalore, now engulfed by the fast growing city. Yet they have no basic amenities like piped water (quantity and quality), tarred roads, electricity, garbage disposal or even a reasonably good public transport system. These young women put in long hours of work (8 a.m. to 5 p.m.) with only a half hour lunch break.

More often than not these girls leave home in a hurry with a morning cup of tea/coffee to sustain them till lunch. This is a forgotten population of extra bread-winners for the LIG family. These girls will be future mothers if not married already. It is they who are in urgent need of timely IEC on how to improve their own **iron status**. More so as traditional recipes and ingredients have been forgotten or scorned in the race to be modern.

The aim to **Reduce Iron Deficiency Anemia among pregnant women to 25% by 2000 AD** by the Government of India as a National Nutrition Goal would find a good start if it began with the working girl **(7)**.

KEY AIM OF THE PROJECT :

The Key hypothesis in this "efficacy trial" specifically, was to assess whether individuals can be convinced to alter their dietary practices relating to the bioavailability of dietary iron. If so, within a very short time period, a significant difference in hemoglobin levels **can** be achieved. The relationship between **dietary practices to enhance the bioavailability in the typical food stuffs consumed by the study population - is the essential focus of this proposal.**

Chapter Two : OVERALL AND SPECIFIC OBJECTIVES :

Overall Objective :

The Overall objectives of this Efficacy trial on Information-Education-Communication for both **Employer** and **Employee**, was to determine whether simple and culturally acceptable dietary changes at the **Workplace** and at **Home** (for the **Employees**) could bring about knowledge, attitudinal and practice or behavioural changes that would increase the bioavailability of iron in their every-day-diets.

Plan of Action Objectives :

- To first orient the **Employers** of the 4 Study Units as to the objectives of the present study and to obtain their full cooperation in the implementation of the same.
- To then orient the **Employees** of the 4 Study Units as to the objectives of the present study and to seek their full cooperation in the implementation of the same.
- To develop the IEC content and a mutually agreed upon Plan of Implementation for this IEC study.
- To develop 'packages' for the IEC interventions, namely, simple **workplace lunches** that would reinforce the audio-visual IEC content.
- To document the acceptability, cost-effectiveness and sustainability of the said strategies.

Socioeconomic and Impact Objectives :

I. Socioeconomic Objectives :

- To document the Socioeconomic profile of the **Working Girl** (18 – 23 years) employed in the small ancillary units of peri-urban Bangalore.

II. Dietary and Nutrient Intake :

- To assess the increases, if any, in the dietary and nutrient intake of the **Working Girls**, Before and After the specific Interventions.
- To examine, in particular, the consumption of bioavailable-iron-rich foods Before and After the specific Intervention

III. Knowledge, Attitude and Practice :

- Knowledge, Attitude and Practice (Behaviour) regarding the `packages' of **IEC + Workplace** lunches, Before and After the specific Interventions.

IV. General Health, Hemoglobin Status and Nutritional Status :

- To determine whether some chronic illness and common illnesses improved as a result of the interventions.
- To determine in particular, if intestinal helminthic infections decreased as a result of the interventions.
- To assess, in particular, the `Before' and `After' Hb status of the **Working Girls** as a result of the specific interventions.
- To assess the clinical and nutritional status, particularly with respect to IDA `Before' and `After', as a result of the specific interventions.
- To assess the BMI of the **Working Girls**, `Before' and `After', as a result of the specific Interventions

Chapter Three: PROJECT DESIGN AND METHODS :

PROJECT DESIGN :

Rationale : As stated earlier, the major aim of this IEC study was to attempt to increase the bio-availability of iron in every-day diets of the **Working Girls**. Maximum weightage was given to increasing the consumption of fermented cereal foods. It is well established that the inhibitory effect of phytate iron is reduced in such fermented foods, making the dietary iron more available (**8-14**). This effort was greatly augmented by the **Employer** (also our target for IEC), agreeing to supply the *iddli* to the **Employee** population at the **Workplace** (Unit One).

The IEC study also attempted to change dietary behaviour through promoting the greater use of iron enhancers such as Vitamin C (**15-16**). In this instance also the **Employer** (Unit Two) readily agreed to supply Gooseberry Juice to the **Employee** population at the **Workplace.**

Our research and project design was consequently strengthened by the **Employers** realising very early (at the time of signing agreement letters in October/November, 98), that the `good health' of the **Working Girls** would translate into better productivity. The Project Design included a Positive Control group, where deworming and medicinal iron supplementation were given (Unit Three). Our own work in two earlier studies among schoolers in Gujarat; (**5**) and Plantation Workers in Karnataka (**4**), had shown consistent and positive results of deworming plus medicinal iron supplementation, significantly improving Hb levels, in spite of nutritionally poor diets and high prevalence of soil-transmitted helminthic infections (**5**).

The Project Design also included a Negative Control group, which did not receive any IEC or dietary based/any other intervention (Unit Four).

Please refer to Table 1for details of the various interventions.

METHODS :

1. Sample selection :

Selecting the Study Ancillary Units : This activity took up much more time than we estimated. Project staff visited atleast ten large factories and several small – sector – Ancillary or Feeder Units, employing working girls in peri-urban Bangalore before we could finally select four units that

exclusively employed about 70 to 80 working girls/women each and who were comparable in some major characteristics such as socio – economic level, place of residence, salaries paid, working hours, social benefits and so on. We finally selected and entered into written agreements with Four Units as under:

- Solid State Systems Pvt. Ltd., made voltage stabilizers for the TV industry and employed 72 women workers predominantly in the age group of 18 – 23 years. This was our Unit No. One.
- A and A Zipper Pvt. Ltd. made zippers for the garment industry and employed 80 girls. This was our Unit No. Two.
- Prestomac Pvt. Ltd., which made electronic components for the TV industry and employed 70 girls. This was Unit No. Three.
- MMS Export Pvt. Ltd., which made ready-made-garments for export. It employed 80 girls. This was our Unit No. Four.

Our total sample in the four units was **302**. We obtained full cooperation from the Owners/Managers of each of our Study Units. The Aims, Objectives and Scope of work/collaboration were fully explained to the Owners/Managers. Signed Agreements were entered into. Meetings were held with the workers, all of whom agreed to the medical examination and the Hb estimations. Signed Agreements for the various tests were obtained from the Management. The Owners/Managers of the Small Ancillary Units knew each and every worker well. They wanted their workforce to be in a better state of health for work efficiency and humanitarian reasons. They were appreciative of the fact that TCS was trying to improve the health of their women workforce.

We on our part found it much more convenient to give our **different** intervention treatments to comparable but different units. TCS staff and our Consultant in Graphics visited a number of homes of the Working Girls – best to worst – to get a pre – Baseline feel of living conditions.

2. Visiting Homes and Making Inventories of Food Shopping, Cooking and Eating Habits :

The Project Coordinator and the Research Associates visited 30 representative homes out of the total sample of 302 women workers (about 10%). This is the summarized information collected regarding food shopping, cooking and eating habits. In addition several other areas of relevance to health and nutritional status such as Water, Sanitation, Type of Dwelling and Space Constraints were observed.

Food Shopping Habits : All the homes visited were 'Ration Card Holders' which entitled them to buy rice, sugar and kerosene at subsidized rates through the Public Distribution Shops (PDS). What was interesting to note was that the majority of the households only availed of the kerosene ration for cooking their food. The reason stated was that the Ration Shops were far away. Further, there was not much difference in the price of rice or wheat in the open market. Depending on the size of the family about 60 Kgs of rice, 10 Kgs of wheat and 10 Kgs of ragi (*Eleusine coracana*) were purchased every month. Meager quantities of sugar, oil, pulses (all very expensive) were purchased. Very spicy food was eaten – hence large quantities of red chillies, tamarind and other condiments were bought. Generally one Kg of meat and a few eggs were bought once a week; half a Kg of seasonal vegetables especially tomatoes every day; as well as 250 to 500 ml of milk every day. **Iodized salt** was bought by almost all. It was gratifying to note that greens were consumed in lentil curry at least twice a week. Beetroot and tomatoes were favorites as they were tasty. Also being red in colour were perceived to heighten the red colour of their blood! Fruit consumption was limited to bananas, jackfruit and seasonal mangoes. Guavas (rich in ascorbic acid) were believed to give sore throat! Lime was bought for lime rice (once a week) and by some of the working girls for lime juice (in summer).

Cooking and Eating Habits :

- Life styles have changed dramatically. All male and female family members from the age of 16 + years were earning for **economic reasons** and to enjoy a better level of food and clothing. Hence, where the worker was unmarried, the mother or some other relative did the cooking and **controlled** the kitchen.
- Several family members (5 to 10 members) lived in tiny 2 – room row houses. Five to Ten houses shared a common toilet. Although, family members rose very early to fetch water and do the various daily chores, we found that time management by the working girl regarding eating breakfast or even carrying a full packed lunch was extremely constrained.
- All homes had **moved away** from brass, copper or iron vessels. All homes had aluminium pressure cookers. Cooking was done in aluminium vessels. We hardly saw an iron wok or vessel any more. Food was served on stainless steel plates (status symbol).
- Cooking was done on kerosene pump stoves. Most homes possessed small electrical grinders. Hardly any had a refrigerator. **All food** was consumed on that very day.

- The packed lunch of choice and convenience was rice and lentil curry (3 to 4 times a week); fermented and steamed dumplings (*iddli*) once a week; and lime rice or curd rice two times a week. No beverage was carried to work as tea was served several times at the **workplace**.
- Although fermented and steamed dumplings or fermented and fried pancakes were great favourites, the person doing the cooking found it labourious to soak the rice and lentil, grind, steam or fry the fermented batter more than once a week. Fermented food lunches were the Monday treat. They were eaten with spicy coconut chutney and/or lentil curry. Special food including meat was prepared on Sundays. Entertaining of guests was done on this day. Hardly anyone, especially the working girl, spent money on eating out.
- Perhaps this is why they longed for ice-cream, pastries, chocolates and snack food (made by the roadside vendors). All their earnings were handed over to the head of the household. A small amount was given back as pocket money for personal needs and necessities. Even a new set of clothes was bought by the head of the household once a year for Diwali (festival of lights). All walked a few kilometers to work and back. The head of the household was expected to take care of all the needs of his family including food, shelter, clothing and saving-up for the girl's marriage expenses.
- We did not see the dire poverty or raw hunger of rural or slum India in this population group. Generally 3 to 5 adult members pulled in a collective income of Rs. 3000/- – Rs. 5000/- per month (middle class incomes). If the girls did not eat breakfast before they left for work or regularly it was due to poor time management of household chores and getting ready for work.

Water/Space/Sanitation :

Hardly any of the houses had piped water, their own private toilet or clean surroundings. Water had to be fetched in bucketfuls (at a nominal cost) from a common tap or borewell and stored at home. In the kitchen, very few had water filters. If they did, the candle was rarely replaced. The most pronounced negatives were the extreme congestion of living space (17), no privacy and **no separate kitchen**. The street lanes were dirty and slushy with cattle, stray dogs and hens making the living environment even worse. Almost **all** family members complained of worm infections, chronic diarrhoea (amoebiasis) and repeatedly asked for prescriptions for treatment. Water for bathing was boiled outside with firewood with cowdung cakes. A few who had a patch of green **did** grow greens, chillies, coriander and vegetables for home consumption.

3. Development of the IEC content and Pretesting it :

Since our graphics artist visited almost all the homes with the coordinator, he got a feel of what he was expected to develop. A list of 21 messages was developed by the Project Director/Coordinator (please refer to Chapter Five for details). Each message was made into a large colourful poster with simple captions in the local language. Each of these were tested over a one month period, one a day per poster, at **another** Ancillary Unit that was similar to the Four Units where our IEC study was to be conducted. All the messages were understood and appreciated. The working girls in particular were concerned about their looks and grooming (not necessarily health). They showed a lot of interest in the posters on how to rid oneself and family members of intestinal infections. Almost all the working girls at this Unit where we did the pre-testing and at our 4 Study Units had more than a primary school education in the local language – Kanada.

4. Developing and Standardizing Methods of Data Collection :

November, 1999 was devoted to developing a comprehensive Baseline Questionnaire. The Research Associates administered the questions in the local language - Kanada. The questionnaire comprised four sections. Section A covered Socio-economic data. Section B covered Medical Assessment which included Medical History; Nutritional and Clinical Assessment. Section C covered KAP (Knowledge, Awareness and Practice). Section D covered information on the family's monthly to daily purchases of non-perishables to perishable food items. It also covered information on usual or special daily dietary patterns, packed lunches, consumption of fermented foods and ascorbic acid-rich-foods. The questionnaire was pre-tested for ease of comprehension, in a similar but different small factory employing working girls. Slight modifications as required, were made and this tool was finalized. All three Research Associates were jointly trained by the Director and the Coordinator in the use of the questionnaire.

5. Standardization and Use of other Methods :

- The four quantitative measures were : hemoglobin value (g/dl); Height (upto 0.1 cm); Weight (upto 0.5 Kg); and Dietary and Nutrient Intake.
- Well known and standard methods were used for all measures or indicators. **(18).**

- `A Plus Diagnostic' was our contractor for the Hemoglobin estimation. This was done by the Standard Direct Cynmethamaglobin method. (**19, 20**). A digital colorimeter was carried to the factory sites. The Hemoglobin estimations were done within a week of the conduct of the Dietary and Nutrient Intake estimations on the subset of 180 girls. The WHO cut offs used were : severe anemia (< 7 g/dl), moderate anemia (7 - 9.9 g/dl), mild anemia (10 -11.9 g/dl); and normal 12 or above 12 g/dl (**19**).
- The team coordinated well. The concerned Research Associate administered Section A, C and D. Dr. Arathi Singh, the Coordinator took full responsibility for Section B (Medical etc). After this, the subject's Height and Weight was taken by the Research Associates. The subject then proceeded with her questionnaire to the Lab Technician (Ms. Esther Mohan) who did the Hemoglobin estimations and filled in the value in the questionnaire. The subject (all had primary schooling or more) was shown her Hemoglobin value on the digital colorimeter. This method elicited good participation from the subjects which was done at Pre and Post Survey. This was a powerful IEC instrument in itself. The entire interview took 30 - 40 minutes per subject. The Managements were very cooperative and sent working girl by working girl.

Details of procedures used :

- Body Weight : The subject was weighed with normal clothing to the nearest 0.5 Kg using a Krup's weighing scale. The Scale was adjusted to zero each time the subject was weighed.
- Body Height : Height was measured to the nearest 0.1 cm with the help of a non-stretchable measuring tape affixed on a smooth surface wall.
- Body Mass Index (BMI) : Waterlow's classification was employed for nutritional categorization of the subjects based on their BMI. A cut-off point of equal to or above 18.5 indicated normal nutritional status. A BMI of less than 18.5 was taken as indicative of under-nourished status. BMI was calculated using the formula, Weight (Kg) / Height^2 (m) (**21**).

Clinical examination :

All Subjects were examined for eye signs of Vitamin A deficiency using the "Field Guide to the detection and control of Xerophthalmia" (**22**). The ocular signs of Vitamin A deficiency were classified as follows :

XN	Night Blindness
XIA	Conjunctival Xerosis
XIB	Bitot's spot
X2	Corneal Xerosis

Presence of Anemia : An anemia recognition card (cards were obtained from the Voluntary Health Association of India) was used to determine the prevalence of anemia, especially of pale conjunctiva.

Iodine Deficiency Disorder (IDD) : The subjects were clinically examined for the presence of clinical/sub clinical manifestation of iodine deficiency.

Hemoglobin estimation : The direct cyanmethomoglobin procedure as described by Oser (1976) was used for hemoglobin estimations (**19, 20**).

6. Dietary and Nutrient Intake Survey :

This was done by the 24 hour recall method. Atleast 2 home visits were made for each subject. The raw food commodities were weighed on the first visit. The cooked food and that consumed by the working girl (inclusive of her packed lunch) was assessed the next day. The 180 randomly selected families were very helpful and cooperative. However, the organization and conduct of this measure, proved to be the most exhausting activity in this Project. The Nutritive Value of raw foods was calculated using the Indian Council of Medical Research (ICMR, 1989) (**23**) data. The Recommended Daily Allowance of Nutrients was calculated following ICMR, 1992 (**3**).

The concerned Research Associate held a few informal Participatory Research Assessments at the Workplace in Unit One, to get to know whether more of the fermented food *iddlis* was being made and consumed at home. If not what were the real constraints? The Supervisors (also an employee) gave useful feed-back in Units One and Two.

7. Data Processing and Analysis :

Data Entry and Validation : The data were entered using Foxbase and data files were created. The data were checked and validated for internal consistency.

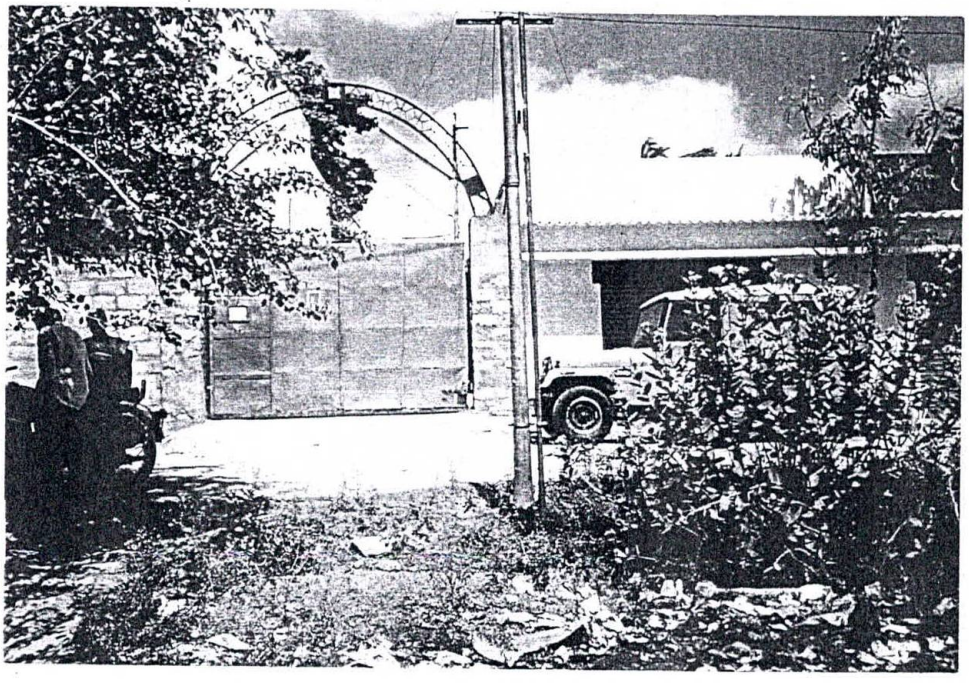
Tabulation and Statistical Analysis : SPSS was used for tabulation and statistical analysis. SPSS commands were written to apply statistical tests namely t-test, and Chi square test. Finally, when the complete data set was ready, Tables were produced and Statistical Analyses carried out. All tests were considered significant at $p < 0.05$.

Table 1 : Details of the various interventions :

INDICATOR	UNIT 1 *(Iddili)*	UNIT 2 (Goosebery Juice)	UNIT 3 (Medical Supplements)	UNIT 4 (Negative Control)
1. Name of the Unit	Solid State Systems	A & A Zipper	Prestomac	MMS Exports
2. Type of Business engaged in	Voltage Stabilizer for T.V. Industry	Zippers for the garment Industry	Electronic components for the T.V. Industry	Exporting readymade garments
3. Sample size of Working Girls	72	80	70	80
4. IEC	Intense at once a week	Less intense at once a month	NO IEC	NO IEC
5. Intervention	Fermented, steamed dumplings (iddlis) With relish and lentil soup thrice a week at 2 p.m. when shifts changed	20 ml of Rebina (gooseberry juice) to deliver 40 mg Vit C, thrice a week	400 mg albendazole once + 60 mg elemental iron as ferrous sulphate, (twice a week)	No Intervention
6. Type of Intervention	Supervised	Supervised	Supervised	Nothing
7. Lectures to augment the IEC	A lecture on Nutrition/ Health/ Reproductive Health , twice a month	-	-	-
8. Expected benefit from intervention	Cleaving of phytic acid from the Fe, making the Fe much more bio-available	Increasing the bio-availability of Fe with a known enhancer **(15,16)**	The above regimen has been used by us with a high rate of success earlier **(4,5)**	No intervention
9. Who bore the Cost?	The Management	The Management	TCS	-
10. How much did it cost per Beneficiary for 6 months?	Rs. 156/- per worker Or Rs. 11,232/- for the entire intervention	Rs. 68/- per worker or Rs. 5,460/- for the entire intervention	Rs. 4.30/- for the Fe + Rs. 5/- for the deworming once= Rs 9.30/- per worker or Rs. 744/- for the entire intervention	Nothing.

Note : Table 1, has been reproduced from Chapter Four on Project Design and Methods.

SSS factory



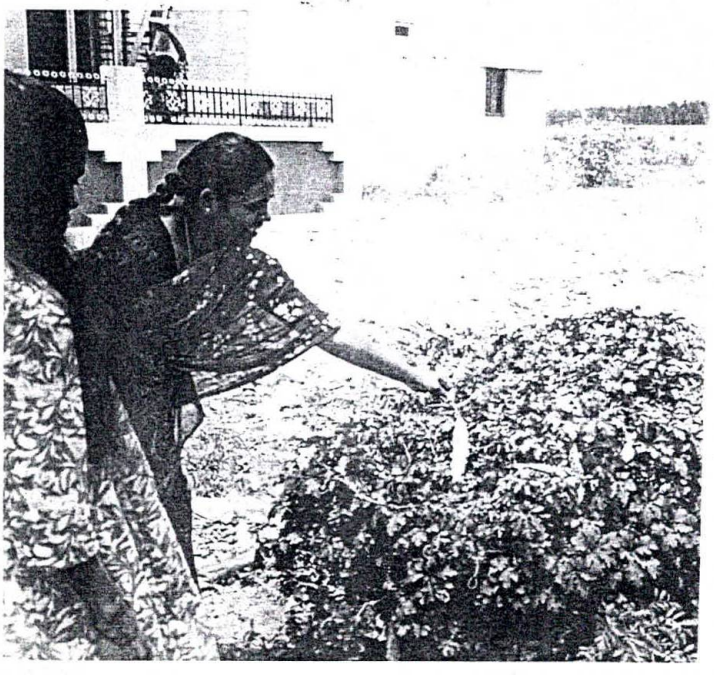
A & A Zipper entrance

Dry measure of food cooked per day for a family of 3 adults and one child. Total family income Rs. 1,800/-.

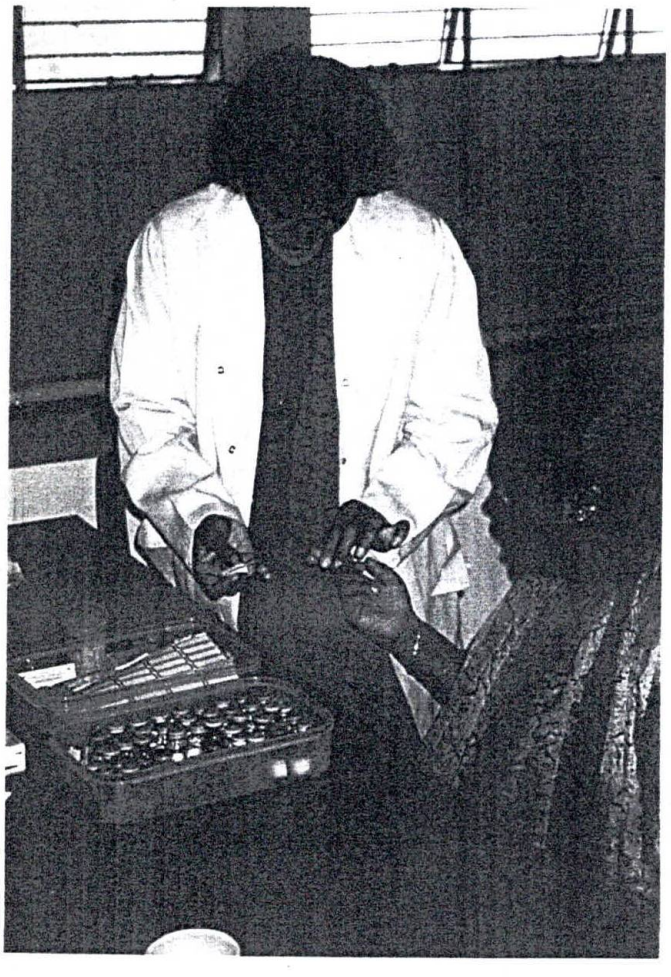
The cooked ration of food for the day

Water stored in the kitchen in a cement tank

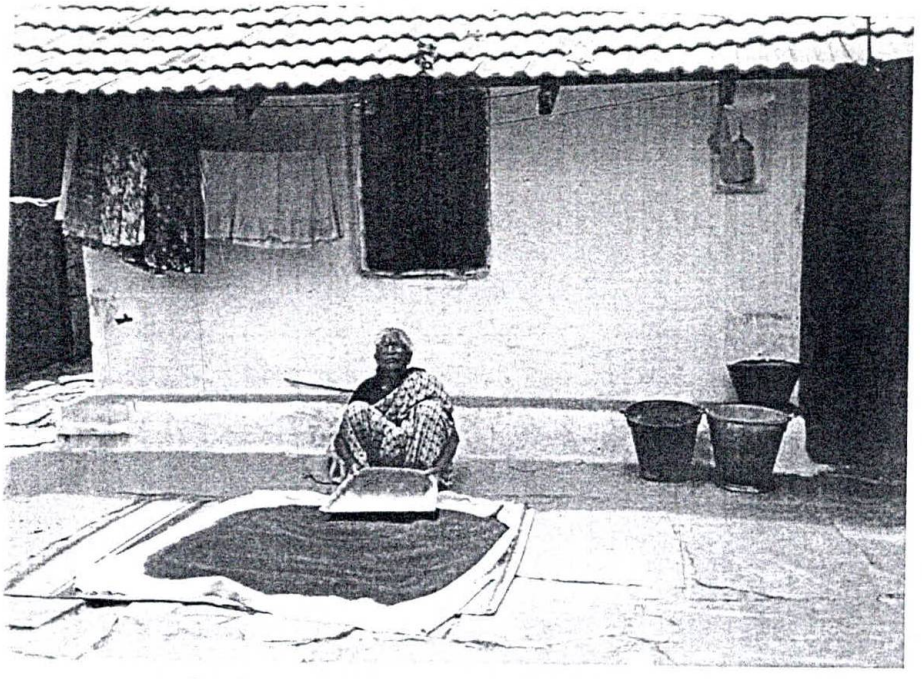
Cowdung cakes drying on the wall is used as fuel to boil water for bath



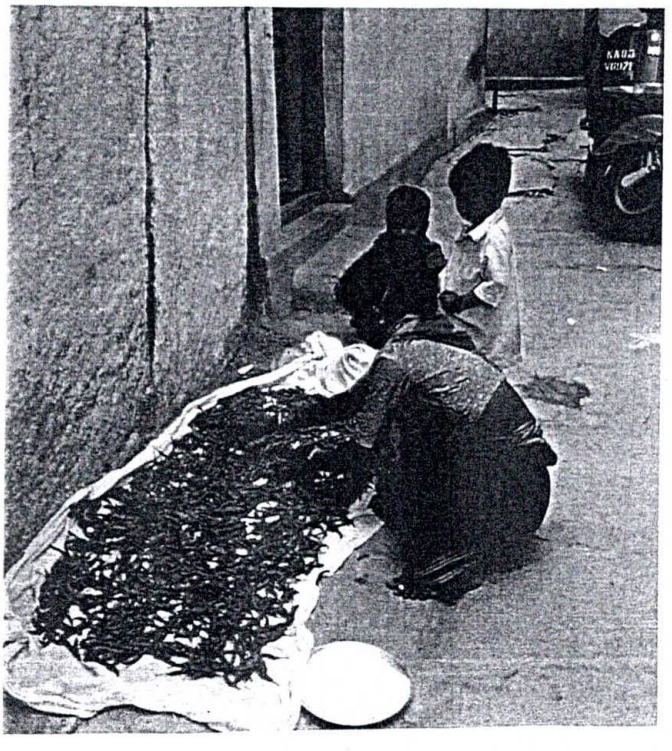
Some grow their own vegetables at home Gourds & pumpkins & chillies



Pre Survey Height and Weight record, Hemoglobin estimation and Medical examination.



Ragi – a staple diet being dried before sent to the mill to be ground into floor



Condiments dried and powdered at home

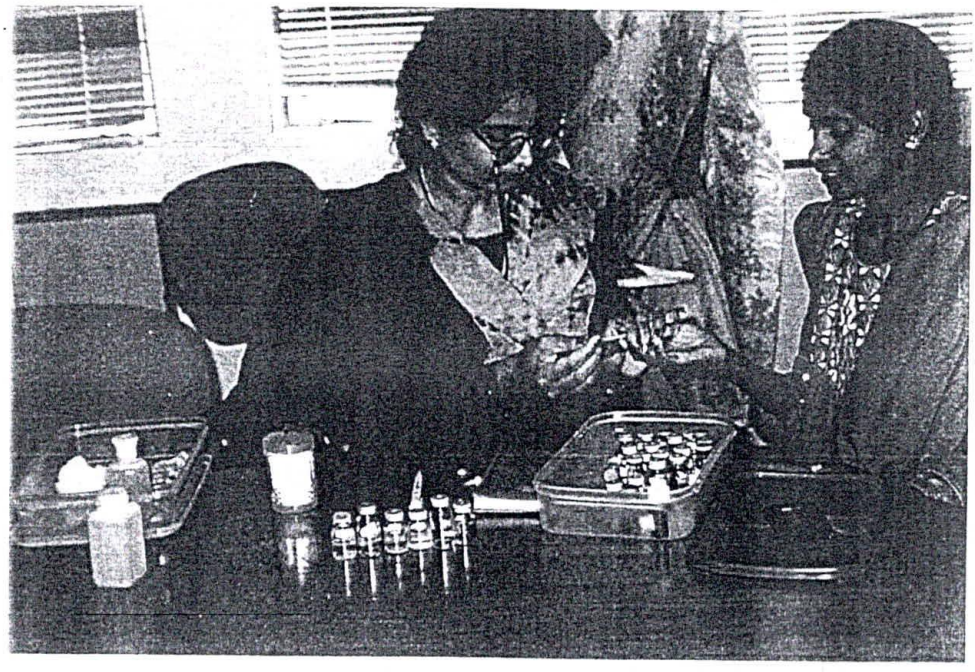
Prestomac worker – Iron wok replaced by Aluminium

MMS exports – lunch time

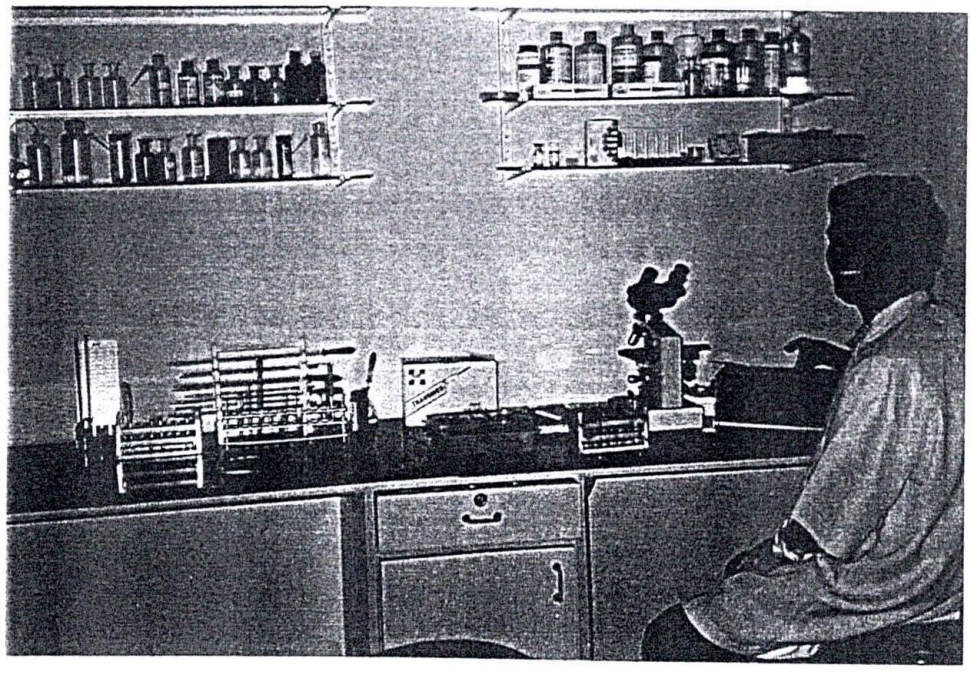
Worker - SSS – eating lunch at home. Ragiball, Rice & greens curry

Heating her meal while at home from work.

Water collected at the local pump. Bypanahalli.



Post Survey Haemoglobin estimation



Post Survey - Hb Estimations in
a clean and modern laboratory

Chapter Four - PARTICIPATARY IMPLEMENTATION :

INTRODUCTION :

We have devoted a chapter to Participatory Implementation as we feel that apart from cost-effectiveness and the four `A's of Availability, Accessibility, Adequacy and Affordability probably - Participatory Implementation stands on top of the pyramid (**4, 5**). We have therefore, described in some detail as to how the **Employer** or Management, the **Employee** or the Working Girl and TCS participated in this research project, in each of the three units where specific IEC and supportive interventions were conducted.

UNIT ONE (The Intense Level of IEC + *Iddli* or Fermented Food) :

What did the Employer do? :

On being convinced by TCS that the health and productivity of the **Employees** would improve, the **Employer** :

- Made available a spacious hall with table and chairs for TCS to conduct its various tasks.
- Delegated a middle-level staff (Ms. Yamuna) to be our primary contact.
- Gave the Working Girls time to listen to the IEC sessions.
- More than anything financially supported the girls being given 2 *iddlis*, with coconut relish and lentil soup per worker three times a week at Rs. 156 (USD 3.60) per worker for the entire intervention for the 72 Working Girls. Or Rs. 11,232/- (USD 261) for the entire intervention; or Rs. 2/- (4-5 US cents) per worker per serving. The same serving would have cost double in and around Unit One.
- The two Directors demonstrated their total support to our Action-Research endevour by financing the project; and by attending some of the IEC sessions.
- They made unannounced visits on the "*Iddli*" distribution days.

What did the Employees do? :

- The **Employees** readily gave their consent to the Hb and medical examination. They felt they were definitely the gainers, as private doctors and medical tests were unaffordable.

- Hardly any of them absented themselves on the `Employer-Financed' *Iddli* days! The 12 to 15 odd men workers were included for the free *iddlis*, as they felt excluded and marginalised. The *iddlis* were served at 2.00 p.m. when the shift went off, and the other came in. The timing was greatly appreciated as the Working Girls on the first shift clocked in at 6.00 a.m. Consequently, many missed their meager morning snack. This was also one of the reasons why the girls could not bring an *iddli* lunch. A quick packed lunch was rice, cooked with a small packet of bought curd. However, our IEC on steeping rice overnight and mixing it with curd (please see later) was considered infradig.
- As stated earlier the IEC sessions by Dr. Prema Akki and Dr. Arathi Singh were greatly appreciated. The poster of the week was later put up on the General Notice Board so that the **Employer** and **the Men Employees** could also benefit.
- The Women Employees readily opened up their `tiffin-dabbas' (lunch boxes) on request by Usha Chettur, the Research Associate. These were random checks at about 12 (72/6=12) girls on any working day. After a month or so of the intervention, we did notice that the young marrieds who had control over their kitchens or those who were severely or moderately anemic did increase their home level *iddli* consumption.

What did TCS do? :

- Took full responsibility of co-ordination between **Employer**, **Employee**, developing the IEC content, delivering the lectures, and hiring a contractor to deliver the *iddlis* for the **Employer.**
- TCS met Ms. Iqbal Basith the **Employer.** Explained the aims and key objectives of the project and obtained the signed concurrence to continued collaboration and participation.
- TCS developed 21 key IEC messages for the posters and for the lectures (Please see the separate booklet on IEC messages attached).
- TCS developed a cyclic menu of what we felt would be simple and doable iron-bioavailable lunches. The girls did not agree that all our suggestions were simple or doable!
- Took full responsibility for all aspects of Research.
- In fact, in most action-research projects the outcomes depend heavily on the planning, organizational and managerial skills of the researchers. Even when an intervention is very simple, the institution or target population does not appear to have the confidence to continue.

UNIT TWO (The Less Intense Level of IEC + Gooseberry Juice intervention) :

What did the Employer do? :

- In spite of Unit Two not being so financially stable as Unit One, the **Employer** Mr.Wahid, summed it up by saying "It is good for the health of my girls. I will collaborate and cooperate".
- Made available the canteen for the various tasks and activities of TCS.
- Delegated Ms. David to be our prime contact.
- Gave the Working Girls time to listen to the monthly IEC sessions.
- More than anything, financially supported the girls being given Gooseberry juice, (Please refer Table One, Chapter Four for details). This intervention cost Mr. Wahid Rs. 5,460/- (USD 127) or Rs. 68/- (USD 1.60) per girl for the whole intervention of six months; or a mere 33 paise (less than one US cent) per serving to deliver 40 mg of Vitamin C.

What did the Employees do? :

- The **Employees** readily gave their consent to the Hb and medical examination. They felt they were definitely the gainers, as private doctors and medical tests were unaffordable.
- Hardly anyone missed out on the refreshing drink 3 times a week for 30 weeks (about seven month till the Post-Survey) was conducted.
- However, they did not stop drinking tea 2 - 4 times a day.
- Practically all the Working Girls attended the monthly IEC sessions. We noted in both the units - Unit One (*Iddli*) as well as Unit Two (Gooseberry Juice), that whatever intervention was done had to be done during the working hours. The Working Girls got very restive and anxious if requested to stay back.

What did TCS do? :

- TCS appealed to Smithkline Beecham (SB), Bangalore, to kindly deliver 100 bottles of '**Rebina**' (Gooseberry concentrate) free. SB delivered 20 bottles free to TCS. TCS in turn handed over these bottles and made arrangements for the monthly requirements for this intervention.
- Apart from this all that we have stated for Unit One, applied here also.

UNIT THREE (Deworming + Medicinal Iron Supplementation) :

What did the Employer do? :

- At Unit Three, it is we (TCS), who underwrote the cost of the intervention. However, Mr. Suhas Tiwari was extremely cooperative. He permitted the Employees free interaction with TCS. He gave them time off for the Baseline and Endline surveys
- However, he was unwilling to continue with the intervention. His argument was that the girls were paid enough to spend about Rs. 20/year on keeping themselves worm + IDA free. Further it was statutory that all Employers had to pay for the Employees' State Insurance (ESI) of their **Employees**.

What did the Employees do? :

- As reported in the case of Units One and Two, all the Employees appreciated being given the deworming tablet (400 mg albendazole) more than the bi-weekly iron tablets (60 mg elemental iron in the form ferrous/sulphate). Dr. Arathi Singh herself undertook the responsibility of dosing the subjects. Since, no IEC was given, neither the **Employer** nor the **Employee** had to do much.
- Many of the **Employees**, after the intervention bought the expensive deworming tablet at Rs. 5/- single dose tablet for both themselves and their family members. Strangely enough they did not purchase the iron tablets although we explained that one bottle of 1000 tablets, at Rs. 33/- per bottle, would last 10 Working Girls for a whole year. We suggested to Mr. Tiwari that he could stock both the deworming and iron tablets in his factory. He was not amenable to this suggestion. He said "you doctors are here now, what shall I do later on?"

What did TCS do? :

- The same as has been reported previously. Since we knew from where to get the deworming and medicinal iron supplementation at wholesale rates – we passed on this information to the **Employer** and **Employees.**
- We were able to obtain low-cost iron tablets at Rs. 33/- for 1000 tablets or just a few paise per tablet per dosing.

UNIT FOUR (Negative Control) :

What did the Employer do? :

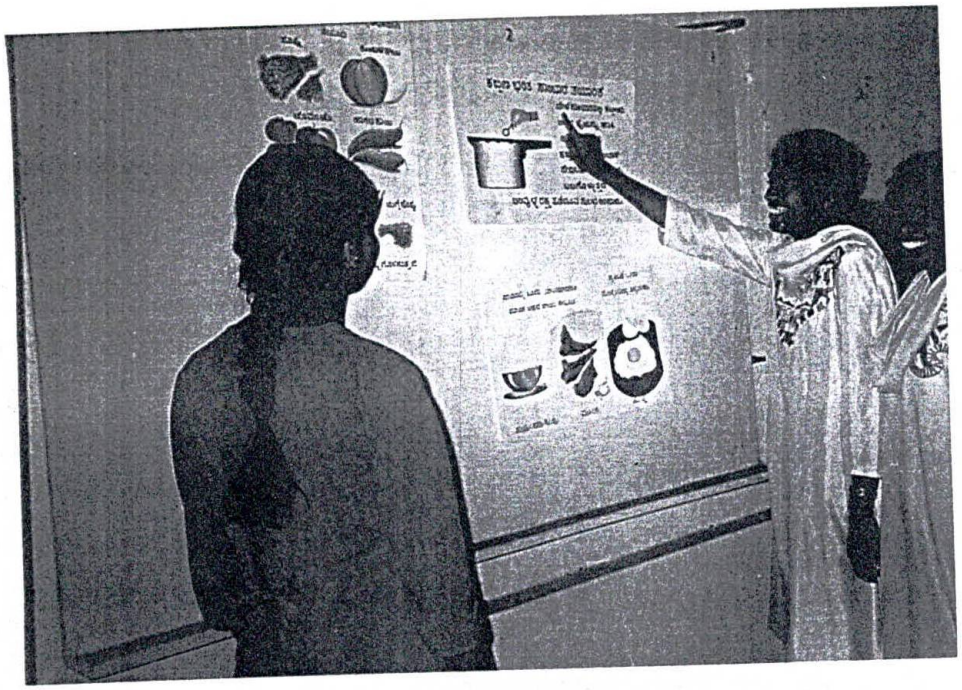
He was good enough to agree to giving each girl half hour to an hour off for the Baseline and Endline data collection.

What did the Employees do? :

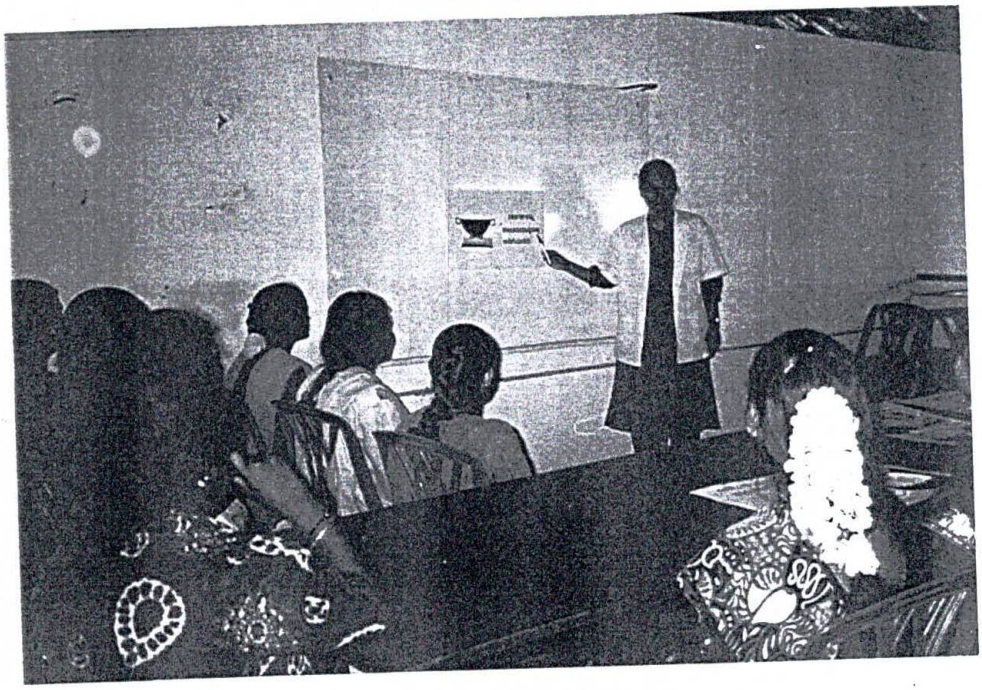
They cooperated as they were getting two medical examinations free.

What did TCS do? :

Same as reported for Units One, Two and Three.



IEC : girls find the poster "Your Key to Good health" most intriguing.



IEC; lecturing the girls on the importance of using iron vessels for cooking.

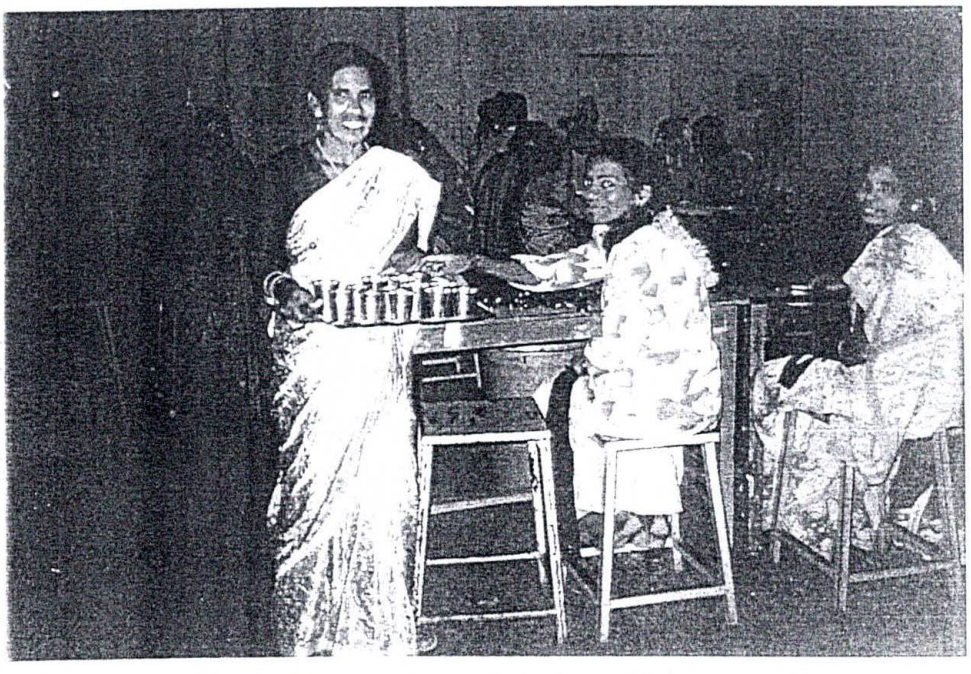
IEC : recording by 24 hour recall method fermented or other iron rich food eaten the previous day.

Unit One: intervention with fermented food - iddlis

Unit Two: intervention with Gooseberry juice

Unit Three : dosing with iron tablets - the positive control

Our Negative Control. The Working Girls at lunch time. Their Hb levels were more or less stagnant



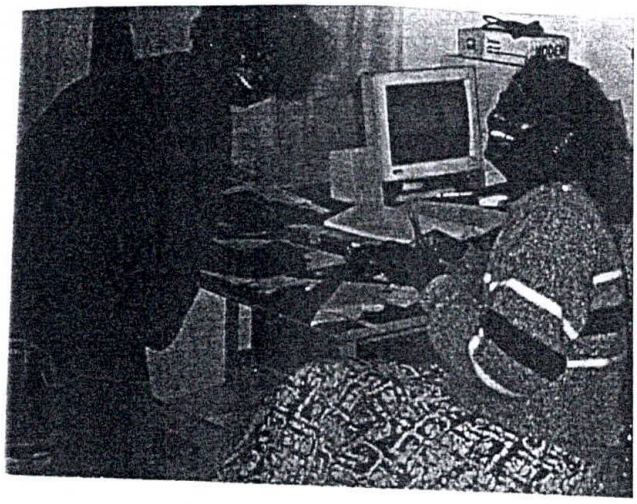
The Gooseberry Intervention : The most refreshing juice! Also The most successful in enhancing Hb levels

The Management was most
Cooperative throughout the
intervention

Happy faces at work at the end-
of the intervention, at Unit Three
- Medicinal Supplements

Checking names w
Working Girls onc

Cleaning, checking and entering data



Checking and recording work place lunches

Chapter Five - DEVELOPMENT OF THE IEC MESSAGES :

I. RATIONALE :

- A scrutiny of the most recent Nutrition Profile of Karnataka (**6**) indicated that as much as 450 to 600g of cereals were consumed per day by women (> 18 years) V/s an RDA of 440 g. The most commonly eaten cereals were rice and to a lesser extent ragi (*Elusine Coracana*). Hence, a specific and key hypothesis was that a reduction in the phytate level in cereals by well known and well accepted household level fermentation methods will make much more of the **non-available cereal-iron; available**. In summary, our Information-Education-Communication (IEC) Strategy strongly promoted the consumption of *iddlis, dosais, appam* (all made from fermented rice - lentil batter) at Home and at the **Workplace (12, 13, 14)**.
- Our IEC strategy also promoted the much greater use of Lime Juice rich in Vitamin C, an Iron Enhancer in the popular Lime Rice or in the commonly drunk lentil soup. Gooseberry juice and lime juice as beverages at the **Workplace** rather than tea.
- The use of iron woks or traditional sauce pans and griddles were promoted (**24-28**). Our innovation was an IEC poster on dropping in an iron key into the lentil soup as it cooked and fishing it out before serving.
- Use of jaggery, seasonal fruits (bananas, citrus, papaya, guavas, orange) and vegetables such as tomatoes, GLVs, beetroot were promoted (**29-32**).
- However, in order to develop the IEC, on visiting some 10% of randomly selected though representative homes of the Working Girls of Units One, Two, Three and Four, pointed to the need of adding on messages. These were as under :
    - Eat as much of trotter soup, meat, chicken and eggs on Sundays. (Non vegetarian foods are cooked only on Sundays.)
    - Wear slippers when you use the out-side toilet (Intestinal worm infections were rampant in the slums) (**33, 34, 35**).
    - Don't buy food from the street Vendor. Drink only boiled water (messages relating to very poor environmental hygiene) (**36**).
    - The Working Girls wanted to know about grooming; small family norm (how?); and how to save money? So the lectures on these were interwoven.

The Management requested that some general lectures be given on Reproductive Morbidity and Mortality; Prevention of Unwanted Pregnancy; Safe Motherhood; Child Survival; and Sexually Transmitted Diseases.

II. THE MESSAGES :

1. Relating to Prevalence of IDA :

- You have iron in your blood. If there is little iron in your blood you will feel weak and tired. This malaise is called Anemia. 8 out of 10 of you are anemic. 2 out of 10 of you are healthy.

2. Relating to Fermented Foods and Dietary Injunctions :

- Your health is in your hands. If you are healthy there will be no need to go to the hospital. EAT FERMENTED FOODS.
- Drink tea not more than twice a day. Use jaggary instead of sugar. Jaggary is full of iron. It will strengthen your blood.
- Eat more fruit, lime juice.
- Eat groundnut and jaggary toffees instead of cakes and ice creams.
- Every morning instead of just tea eat a breakfast of one egg and two slices of bread or two chappties and one glass of milk.
- Eat meat once a week. Eat an egg a day.
- Eat plenty of greens and vegetables. This will strengthen your blood.

3. Relating to the use of iron enhancement :

- Use lime to sour your soups or sambars.

4. Relating to the use of iron cooking vessels :

- Put your iron key into the lentil soup being cooked. The iron from the key will enter the soup. From the soup into your blood and hence you will be strong.
- Cook your vegetables in an iron wok.

5. Relating to worms, vendors, innoculations :

- Wear your rubber slippers when you go to the toilet or if you have to walk through slush and mud.
- Eat home cooked food. Do not buy and eat food sold on the roadside. Drink boiled water.

- To prevent worm infection in you and your family, do the following : Sun dry the seeds of papaya fruit. Give each person 6 – 8 seeds to chew and swallow. It will rid you of worms.
- Ask for your typhoid vaccination at the hospital.

6. Relating to good grooming :

- De-louse your heads every week. Brush your teeth twice daily. Oil and braid your hair everyday. Apply turmeric to your face as it serves as an antiseptic and keeps away pimples.

7. Relating to IDA, small family norm :

- It is important to have strong blood even when you are married.
- Marry after you are 21. Two children are enough.
- If your blood is full of iron before you marry, your children will be strong.

8. Relating to monthly saving practice :

- Save at least Rs. 50/- per month at the Post Office Savings Account.

9. Relating to our final injunction :

- If you have followed our advice, then 6 months later when we check your blood again you will find your blood has become stronger and contains more iron.

(Please refer to the separate booklet on IEC posters).

III. DELIVERY OF THE IEC AT THE WORKPLACE (UNITS ONE AND TWO) :

Each poster was put up for a whole week on a big Notice Board at the entrance of Unit One. The points made in the poster were reinforced by the expert in the bi-monthly lectures. The concerned Research Associate stayed on to answer questions and clear the doubts.

The poster of the week caught the eye of all - the **Employer** and the **Employees** (male and female).

The same poster was then shifted to Unit Two, for the next week. Lectures were given in the same way, but only once a month, as is the case in most government – run – IEC programmes.

The lecturers, namely Dr. Prema Akki and Dr. Arathi Singh again and again stressed the facts that :

- All the messages could very well be implemented by all the Working Girls.
- Prevention was better than cure.

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- Prevention was better than cure.

Chapter Six – RESULTS :

SECTION A : SOCIO ECONOMIC PROFILE OF THE WORKING GIRLS :

As stated in Chapter One namely, Introduction and Key Project Objectives, the Working Girl/Woman is the phenomenon of this millenium in India, especially so in her mega cities. Bangalore is the capital of Karnataka in South West India. This project was conducted in the outskirts of this enormously expanding city.

This section is organised into five sub sections as under :

1. Socio economic profile of the Working Girls or Employees.
2. Household Data of the Working Girls.
3. Contribution of the Working Girls to Household's Monthly Income.
4. Kitchen Gadgets and Vessels owned by the Working Girls family.
5. Other Valuable Assets owned by the Working Girl's family.

1. **Socio economic profile of the Working Girls** : As can be seen from Table 1, the average age of these girls/young women in our study range from 20 years to 23 years. In each of our four study units, most of the Working Girls or Employees had a primary level to even junior college level of education in the local language of Kanada. Hence, overall they were in a very good position to comprehend the IEC and the lectures given by the two women doctors.

   Approximately half were married – usually at 18 to 20 years of age, except for Unit Four (Negative Control) where all were unmarried at a mean age of 20.

   Overall the majority had lived in the 'Urban Villages' all their lives.

   Almost all had a job experience in their respective units of three years or more.

2. **Household Data of the Working Girls** : Table 2 indicates that approximately half came from nuclear families; while the rest came from joint families.

Generally, three adult members earned in a household. The composition of the households indicated that adult earning members predominated (>75%). This again differs from the present rural pattern of households having young children (**37**). The rural and urban poor are entitled to ration cards under the Public Distribution System. Units One and Four had a large number of ration card holders (> 75%); while in Units Two and Three only about 40% held ration cards. In any case, the ration cards were only used for the purchase of kerosene. The market rates for coarse rice, poor quality wheat, sugar and edible oil were only slightly higher.

3. **Contribution of the Working Girls to Household's Monthly Income :** The average monthly pooled earnings of a family ranged from about Rs. 3,000/- to Rs. 6,500/- with a mean of about Rs.3,700/-. The average monthly contribution of the Working Girl had a range from 20% to 40% of the pooled income. The overall average was about 30%. In our Participatory Research Assessment, these girls were told by the male head of the household, that they had to earn for their marriage expenses and dowry. Since most of the unmarried Working Girls had already crossed 18 years of age, they willingly handed over their monthly income except for a niggerdly amount handed back to them for their personal expenses and pocket money (**Table 3**).

4. **Kitchen Gadgets and Vessels owned by the Working Girls family :** From Table 4, it can be seen that hardly any family except for 15% in Unit 4, owned a refrigerator. The reason given was that all the cooked food was consumed on that day itself. Vegetables, milk, meat/chicken were bought and consumed on that very day.

Aluminium Pressure Cookers which were cheap, fuel efficient and easy to clean were used in almost all the households of all the four units (overall > 80%). A brass water filter, big brass vessels and every-day-cookware (aluminium) and a set of stainless steel vessels are usually given to the girl as part of her trousseu. Hence, these were owned by most of the households in all the four units (> 75%). The big brass vessels were pawned and came in handy when the family required money. Cooking gas was a rare luxury. Except for Unit Four, in the other three units, only about 13% had cooking gas. Most used fuel wood or kerosene.

A small mixie grinder was found in about 50% of the households in Units One and Two; while its ownership was much higher in Units Three and Four. A mixie or grinder is an essential requirement for making the *iddlis* (fermented food). Raw rice and black gram (*phaseolus mungo roxb*) 2 : 1 ,which is soaked in water overnight, is finely ground and then the dumplings are steamed in a pressure cooker. However, practically every street had large commercial electrically operated grinders which charged a very nominal amount for grinding. Hence, whether a family had a mixie or not was not a great constraint to making iddlis if they so desired to make them.

5. **Other Valuable Assets owned by the Working Girl's family :** As we had pointed out earlier these households had their own aspirations and 'wish list'. A bicycle was owned by about 50% of the households and was usually the sole property of the man of the house. Two wheelers which were much more expensive were owned by only 14% of the households. Radio, a good source of information from the outside world was owned by only 35%. Overall by way of contrast, the audio-visual television was owned by 78%. The TV we found was an extremely potent influencer. A branded iodized salt (Captain Cook), frequently advertised on TV was used in almost all the households. Other items considered of value such as tape-recorder were owned overall by 45%; table fans by 72%; and a steel cupboard by 63% (**Table 5**).

SECTION - A

Table 1 :Socio-economic Profile of the Working Girls :

Characteristics or Indicator	UNIT 1 (Iddili or the fermented food)	UNIT 2 (Goosebery Juice)	UNIT 3 (Medicinal Supple)	UNIT 4 (Negative Control)
Population Size N	72	80	70	80
Average Age	23	21	22	20
Education in % Illiterate Upto Primary Primary and/or College	 11(8) 15(11) 74(53)	 8(6) 30(24) 62(50)	 17(12) 23(16) 60(42)	 0(0) 0(0) 100(80)
Marital Status in % Married Unmarried	 54(39) 46(33)	 48(38) 52(42)	 64(45) 36(25)	 0(0) 100(80)
Urban or rural background in % Urban Rural	 100(72) 0(0)	 100(80) 0(0)	 83(58) 17(12)	 66(53) 34(27)
Years of experience in % <1 year 1-3 years >3 years	 0(0) 56(40) 44(32)	 0(0) 89(71) 11(9)	 0(0) 91(64) 9(6)	 0(0) 88(70) 12(10)

Note : n is in brackets.

Table 2 : Household data of the Working Girls :

Characteristics or Indicator	UNIT 1 (Iddili or the fermented food)	UNIT 2 (Goosebery Juice)	UNIT 3 (Medicinal Supple)	UNIT 4 (Negative Control)
Population Size N	72	80	70	80
Families in % Nuclear Joint	 53(38) 47(34)	 50(40) 50(40)	 36(25) 64(45)	 51(41) 49(39)
Average number of earning Members	2.7	3.0	2.9	2.9
Percentage of : Adult (>18 years) Children (<18 years)	 73.5(53) 26.5(19)	 76.7(61) 23.3(19)	 77.6(54) 22.4(16)	 84.8(68) 15.2(12)
Urban or rural background in % Urban Rural	 100(72) 0(0)	 100(80) 0(0)	 83(58) 17(12)	 66(53) 17(14)
Ration Card holders in % Yes No	 74(53) 26(19)	 49(39) 51(41)	 41(29) 59(41)	 83(66) 17(14)

Note : n is in brackets.

Table 3 : Contribution of the Working Girls to the Household's Monthly Income :

Characteristics or Indicator	UNIT 1 (Iddili or the fermented food)	UNIT 2 (Goosebery Juice)	UNIT 3 (Medicinal Supple)	UNIT 4 (Negative Control)
Population Size N	72	80	70	80
Average monthly household Salary in INR	3739	3275	3061	4920
Average monthly salary of Working Girl in INR	850	577	951	1048
Average contribution of monthly household income in %	27	20	44	23

Table 4 : Kitchen Gadgets and Vessels owned by the Working Girl's family :

Items	UNIT 1 (Iddili or the fermented food)	UNIT 2 (Goosebery Juice)	UNIT 3 (Medicinal Supple)	UNIT 4 (Negative Control)
Population Size N	72	80	70	80
Refrigerator in % Yes No	 1(1) 99(71)	 1(1) 99(79)	 3(2) 97(68)	 15(12) 85(68)
Pressure Cooker in % Yes No	 90(65) 10(7)	 68(54) 32(26)	 74(52) 26(18)	 81(65) 19(15)
Water filter in % Yes No	 28(20) 72(52)	 18(14) 82(66)	 21(15) 79(55)	 40(32) 60(48)
Big Brass Vessels in % Yes No	 83(60) 17(12)	 74(59) 26(21)	 81(57) 19(13)	 68(54) 32(26)
Cooking Gas in % Yes No	 19(14) 81(58)	 14(11) 86(69)	 7(5) 93(65)	 34(27) 66(53)
Mixie in % Yes No	 53(38) 47(34)	 46(37) 54(43)	 77(54) 23(16)	 73(58) 27(22)
Others in % Yes No	 1(1) 99(71)	 0(0) 100(80)	 0(0) 100(80)	 5(4) 95(76)

Note : n is in brackets.

Table 5 : Other Valuable Assets owned by the Working Girl's family :

Items	Unit 1 (iddli or the fermented food)	Unit 2 (Gooseberry Juice)	Unit 3 (Medicinal Supple)	Unit 4 (Negative Control)
Population Size N	72	80	70	80
Bicycle in % Yes No	53(38) 47(34)	39(31) 61(49)	43(30) 57(40)	59(47) 41(33)
Two wheeler in % Yes No	26(19) 74(53)	3(2) 97(78)	9(6) 91(64)	18(14) 82(66)
Radio in % Yes No	43(31) 57(41)	35(25) 65(55)	20(14) 80(56)	40(32) 60(48)
Television in % Yes No	71(51) 29(21)	78(65) 22(15)	90(63) 10(7)	73(58) 27(22)
Tape Recorder in % Yes No	26(19) 74(53)	44(32) 56(48)	46(32) 54(38)	63(50) 37(30)
Table Fan in % Yes No	67(48) 33(24)	66(53) 34(27)	76(53) 24(17)	80(64) 20(16)
Steel cupboard in % Yes No	39(28) 61(44)	70(56) 30(24)	73(51) 27(19)	68(54) 32(26)

Note : n is in brackets.

SECTION B :DIETARY AND NUTRIENT INTAKE (BEFORE AND AFTER) :

1. Average Daily Intake of Food Stuffs by the Working Girls (Before and After :

i. **Cereals and Millets** : Rice followed by ragi (*Elusine Coracana*) were the cereals consumed in great quantities. Wheat, as wheat flour was consumed in far less quantities. The Nutrition Profile of Karnataka (**6**), indicates that adolescent (16 years plus) and young women were consuming on an average 605 g Vs an RDA of 440 g for cereals. The bulk of the common man's and woman's diet in this southern state came from cereals. The mean Pre-Survey intake among the 180 girl subjects in our study was 519 g. As indicated earlier our subject households did not buy their rice from the Public Distribution System or ration shops. Generally rice ranging from Rs. 15/- to Rs. 20/- per Kg (or USD 50 cents) was bought. Ragi (*Elusine Coracana*) was about half this price. In the four Units this rose to a mean intake of 635 g at Post-Survey or a mean increase of 101 Kcal/subject. The mean calorie increase in Unit One, Two, Three and Four were 163 Kcal; 192 Kcal; 32 Kcal and 17 Kcal respectively. In Unit One (fermented food), the calorie increase was mostly contributed by the *iddlis*. In Unit Two, the Working Girls in our PRAs said they felt so hungry that they bought some roasted groundnuts from the roadside hawker.

ii. **Pulses or Lentils** : The mean intake of pulses among our subjects at the Pre-Survey was 28 g Vs a RDA of 45 g. The Nutrition profile for Karnataka indicated a higher mean intake of 39 g for similar age group. Pulses are very expensive and at current prices are about Rs. 40/- (USD 1 per Kg). Generally to make *iddli* (fermented food) two measures of raw rice to one measure of split black gram (*Phaseolus mungo roxb*) is used in middle to upper middle class homes. However, we noted that only half to one – fifth the amount of black gram was used due to its high cost. The lentil soup which was an everyday item also contained minimal quantities of red gram (*Cajanus cajan*). To compensate huge quantities of red chilli powder and quite large quantities of tamarind pulp (to sour the soup) were used. Significant increase in pulse consumption at the Post-Survey was noted (only in Unit One).

iii. **Leafy vegetables** : The Pre-Survey revealed an extremely poor consumption of green and leafy vegetables (GLVs). The mean intake

was 12 g Vs the RDA of 100 g. The Nutrition Profile of Karnataka confirms this (value of 16 g). Greens are called "*sappu*" and are bought in small quantities (250 g/day for the whole family) as a filler for the lentil soup. It is also believed to relieve constipation. In the Post-Survey, the intake of GLVs went up significantly in Units One and Two where the IEC was given. The mean intake of GLVs at Post-Survey rose to 19 g Vs 11 g at Pre-Survey in Unit One.

In our PRAs, it emerged that GLVs are not a favourite, as a lot of time is spent in rinsing the greens in water and chopping it up fine. Usually, the GLVs also have tiny worms/insects or *poochis* (local term) or sometimes come with a fine dusting of insecticides or DDT powder. Hence, GLVs are never given to young children. The seasonal GLVs were drumstick leaves, knol-knol, agathi, corriander and cabbage.

iv. **Other Vegetables** : Tomatoes were the favourites. In India tomatoes are considered a vegetable and not a fruit. They had to be used in the daily cooking, no matter what the price. Depending on the size of the household, usually 3 to 4 adults and 3 children (6 – 8 members), 100g to 250 g were bought everyday. It was also used to give body and taste to the lentil soup. Depending on the season and available finances, other vegetables bought were beetroot, cauliflower, carrots, yellow pumpkin, onions, ridge gourd, ash gourd, brinjal, cluster beans, field beans, ladies fingers etc.

The mean intake was about 22 g at the Pre-Survey Vs 25 g at Post-Survey Vs a RDA of 40g per day.

The IEC appears to have been successful in propelling families in Unit One and Two to consume **more of the above vegetables.**

v. **Roots/Tubers** : Potatoes head the list of tubers. However, a separate vegetable dish is not eaten everyday except in the homes of the better off. The mean intake was 33 g at the Pre-Survey Vs 34 g at Post Survey Vs the RDA of 50 g. No significant increase was observed in any of the four Units at Post-Survey.

vi. **Oils/Fats** : Extremely low intake of oils/fats was seen. This is in confirmity with the observations of the Nutrition Profile of Karnataka (**6**). The mean intake at Pre-Survey was a mere 6 g Vs 7 g at Post-Survey Vs the RDA of 25 g.

Oil is again a very expensive item for the common man at Rs. 55/- to Rs. 70/- per litre (about USD 1.25 to 1.75). It was saved for seasoning the condiments used in the lentil soup or the occasional vegetable dish. Most of the oil/fat (hydrogenated) was used up on Sunday when a special non-vegetarian fare was served.

vii. **Milk** : Milk intake was extremely low with a mean intake of 30ml per day. This however, is one and a half times what is reported in the Nutrition Profile for women (>18 years) in the rural, slum or low-income-group areas, Karnataka (**6**). The intake of milk did not show any significant increase. It was 30 ml at the Pre-Survey Vs 31 ml at Post-Survey Vs the RDA of 150 ml.

Tea was the beverage of choice where a dash of milk was used to whiten it. Milk in the form of curd (used for the weekly curd-rice) was a great favourite. Whatever was available was given as milky tea or coffee to the young ones or schoolers.

Milk packets are readily available at Rs. 12/- per litre (about 35 US cents) – yet not affordable in the homes with pooled incomes of Rs. 3,000/- to Rs. 5,000/- p.m.). It is indeed a sad testimony that India which is the biggest milk producer in the world today, cannot reach out to this `not so poor' population segment. This is one **everyday commodity that can be fortified with all the fat soluble vitamins.**

Our PRAs brought out the argument from the side of the Working Girls as under :

- Tea is available to us at the Workplace.
- Milk is only for children.
- Milk is good but too costly.
- Milk is the food of the rich and our Gods.

viii. **Sugar/Jaggery** : Although jaggery (for Hb enhancement), instead of sugar, formed an important lesson of our IEC, hardly anyone switched from sugar to jaggery.

The mean intake of sugar was 24 g at the Pre-Survey Vs 26 g at Post-Survey Vs the RDA 20 g. The intake levels remained more or less static.

ix. **Fruit** : This category of food stuffs is again economically beyond the means of the households of the Working Girls. The mean intake of fruit at Pre-Survey was 22 g Vs 27 g at Post-Survey Vs the RDA of 100 g.

Apparently the IEC did have a positive impact as there was a significant rise from 27 g to 38 g of fruit in Unit One and from 20 g to 28 g in Unit Two.

In Unit Two (Gooseberry Juice intervention) the increase in fruit/fruit juice was almost entirely due to the Employer giving the Employee, gooseberry juice 3 times a week. The consumption of lime as lime-rice, lime-pickle and very occassionally lime juice did go up somewhat.

x. **Flesh Foods** : Generally, one or even two Kg of meat at Rs. 100/- a Kg was purchased for the Sunday lunch. Theorotically, this would have nearly met the RDA of 30 g for a 6 member household. Unfortunately, the intra-household distribution was such, that the male members and male guests got the lion's share. The Working Girl hardly got her fair share. In short, any food stuff that was of high biological value was expensive. Whatever was bought, bar milk, was consumed mostly by the male members of the household.

The mean intake of flesh food and eggs was 20 g at Pre-Survey Vs 16 g at Post-Survey Vs the RDA of 30 g. It is indeed ironic and sad that these households were prepared to spend on an average Rs. 500/- a month for the Sunday – lunch – meat, but could not be persuaded to spend it on more milk, more fruit or more fats/oil.

2. Average Daily Nutrient Intake by the Working Girls (Before and After :

i) **Calories** : The mean calorie intake at the Baseline Survey was 2620 Kcal Vs the RDA of 2225 Kcal for a Moderate Woman Worker. Or nearly 400 Kcal more/day for a woman worker in this category. Since, hardly anyone of our Working Girls were obese, it would appear that they leaned in their work load (home load, running home some 4-5 Kms to work and back and; the work load at the workplace), in between the 'Moderate' and 'Heavy Worker' category, namely 2925 Kcal RDA for women (**3**). The mean and significant calorie increase from Pre to Post Survey in Unit One was 163 Kcal,

contributed mostly from the *iddli* lunch at the **Workplace**. In Unit Two the increase was 192 Kcal.

In sum, the IEC plus the food based intervention in Units One and Two do appear to have influenced food-energy intake to some extent.

ii) **Protein** : The mean protein intake at Baseline was about 70 g Vs the RDA of 50 g. The Protein sources were predominantly cereals and pulses of biological value. There were significant increases in protein intake at Post and Endline Survey of 6 g in Unit One; 7 g in Unit Two and 5 g in Unit Three.

iii) **Iron** : This study was primarily focused on an IEC strategy based on removal of dietary inhibitors of iron in Unit One and; the addition of a dietary iron enhancer in Unit Two. The mean dietary iron availability at Baseline was 27 mg Vs the RDA of 30 mg. However, very little of it appears to have been available. (In Units Three and Four there were small but non-significant increases of 1 g of dietary iron at Post-Survey).

There does appear to have been some impact of our IEC messages on greater consumption of vegetables, fruits and meat. However, by inference in Unit One, the much greater and/or frequent consumption of *iddlis* at the **workplace** and **at home**, does appear to have been the main reason for the significant increase in the mean Hb values of the Working Girls in Unit One. In Unit Two (Gooseberry Juice intervention), the major reason for enhancement of Hb values in this group at Post-Survey appears to have been due to the regular but intermittent consumption of the gooseberry juice again at **workplace**. Vitamin C-rich gooseberry is known to be a powerful enhancer of Hb values (**15, 16**). The Indian gooseberry is possibly one of the richest sources of Vitamin C (63 mg/100g edible portion) in India.

iv) **Calcium** : The mean intake of calcium was 534 mg at the Baseline Vs the RDA of 400 mg. In Unit One, there was significant increase in dietary intake of calcium from 511 mg at Baseline to 539 mg at Endline Survey. This did not happen in the other three units. Calcium in known to be an inhibitor of iron bioavailability (**37**).

v) **Vitamin A** : India is known to be one of the most Vitamin A deficient countries in the world (**38**). Our dietary and nutrient intake data for this `not–so-economically-poor' group also shows this to be

true. The mean intake of Vitamin A or its precurssor β-carotene, was only 267 mcg Vs the RDA of 600 mcg.

It is heartening to note that the intake of Vitamin A did go up significantly in Units One and Two, namely the Units where the **Employer** and the **Employees** received IEC and a specific dietary-based-intervention to enhance the Hb status of the Working Girls. The increase came mostly from a higher consumption of tomatoes, a rich source of β-carotene (590 mcg per 100 g). Our latest edition of the Nutritive Value of Indian Foods, 1993 (**39**), also lists ripe tomato as a good source of folic acid (30 mcg per 100 g edible portion by the HPLC method); and of Vitamin C (27 mg/100 g edible portion).

vi) **Vitamin C** : The mean intake of Vitamin C was 29 mg at Pre-Survey Vs the RDA of 40 mg.

It went up significantly in Unit One from 24 mg at Pre-Survey to 31 mg at Post-Survey. This reflects a Practice or Behaviour change, perhaps due to a combination of the intense level of IEC plus the actual food-based intervention.

The greatest and significant enhancement of Vitamin C was seen in Unit Two, which was contributed almost totally by the gooseberry juice at the workplace.

CONCLUSIONS :

Dietary Intake :

- The Dietary Intake Survey supported the claims that the 'appetite had improved' (Please refer Section C & D). It was also supported by significantly higher intake of food stuffs, especially so in Units One and Two.

Nutrient Intake :

- The IEC plus the fermented food (*iddlis*) aided in enhancing Hb levels of the Working Girls.
- The Gooseberry Juice intervention was the most successful in enhancing the Hb levels of the Working Girls.
- Enlightened Managements should offer such simple and cost-effective lunches at the **workplace.**

Table 1 : Average Daily Intake of Food Stuffs by the Working Girls :

FOOD STUFFS	RDA (g)	UNIT 1 (*Iddli*)		UNIT 2 (Goosebery Juice)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
		N = 45		N = 45		N = 45		N = 45	
		Before	After	Before	After	Before	After	Before	After
Cereals	440	491±39	670±21 **	483±41	667±19 *	513±9	593±3 *	589±30	609±21 NS
Pulses	45	28±8	35±4 **	21±2	21±9	29±9	30±2	34±8	34±7 *
Leafy Vegs.	100	11±9	19±4 **	16±3	20±8 *	10±4	8±3	10±2	10±1 NS
Other Vegs.	40	21±3	29±9 **	19±3	22±4 *	22±2	24±1	24±2	25±5 NS
Roots/Tubers	50	31±1	33±3 NS	29±9	30±2 NS	31±2	30±3	40±2	42±1 NS
Oils/Fats	25	6±1	6±2 NS	5±1	7±2 *	6±1	7±4 NS	7±3	8±4 NS
Milk	150	33±4	35±1 NS	30±4	31±3 *	27±3 NS	27±1	30±3	31±1 NS
Sugar/ Jaggery	20	21±4	20±3 NS	25±3	30±1 *	20±3 NS	21±4	30±9	31±8 NS
Fruit	100	27±9	38±4 *	20±1	28±5 *	19±3 NS	20±1	22±3 NS	23± 5 NS
Flesh Foods/ Eggs	30	15±1	19±3 **	10±1	11±3 NS	12±2	13±3 NS	19±2	19±3 NS

Note : $p < 0.1$ = *
$p < 0.01$ = **
$p < 0.001$ = ***
NS = Not significant

Table 2 : Average Daily Nutrient Intake by the Working Girls :

NUTRI-ENTS PER DAY	RDA (g)	UNIT 1 (Iddili)		UNIT 2 (Goosebery Juice)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
		N = 45		N = 45		N = 45		N = 45	
		Before	After	Before	After	Before	After	Before	After
Calories (Kcal)	2225 (for the moderate worker category)	2546± 258	2709± 201 *	2507± 211	2699± 204 *	2609± 198	2641± 179 *	2618± 213	2635± 249 *
Protein (g)	50	65±4	72±9 *	68±3	74±8 *	70±2	75±5 *	74±4	73±8 NS
Iron (mg)	30	29±2	32±3 *	29±1	31±2 *	25±3	26±2 NS	24±4	25±6 NS
Calcium (mg)	400	511±35	539±41 *	502±25	501±34 NS	521±31	513± 33 NS	605±39 NS	611± 44 NS
Vitamin A (mcg)	600	239±31	300±52 *	241±11	295±19 *	205±3	219± 11 NS	381±8	373± 24 NS
Vitamin C (mg)	40	24±4	31±3 *	29±9	49±4 **	28±4	29±3 NS	34±5	35±7 NS

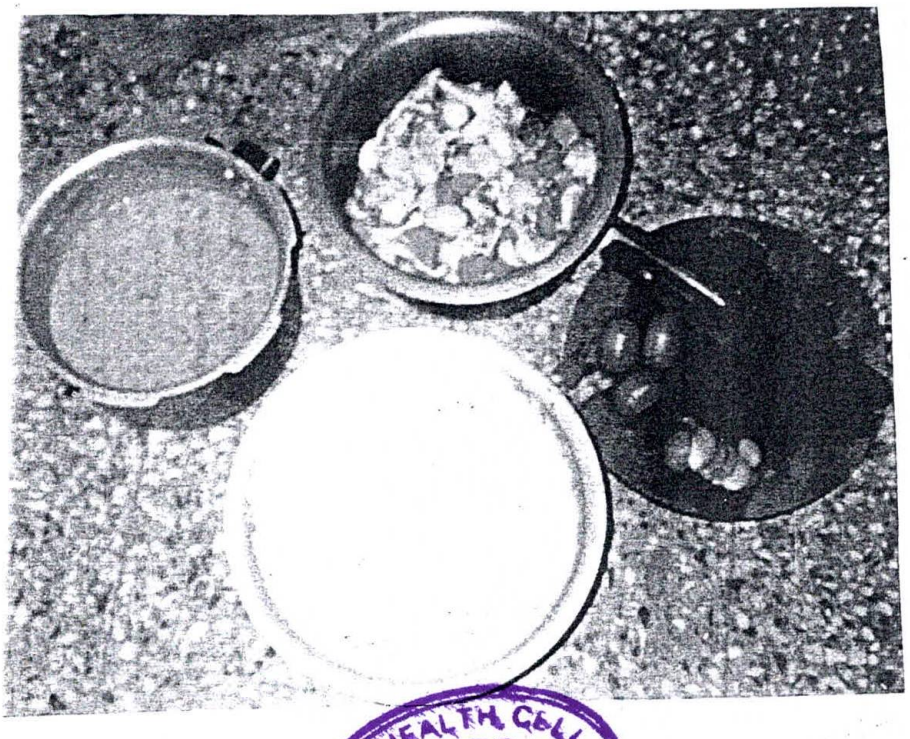
Note : $p < 0.1$ = *
$p < 0.01$ = **
$p < 0.001$ = ***
NS = Not significant

Post Dietary Intake Survey
That's what most of us eat
most days!

We love tomatoes! Have to
have some in our lentil soup
everyday

Rice and lentil curry -the usual
workplace lunch

Dietary record of food cooked per day for a family of 6 adults and 4 children. Total family income is Rs. 6,000/-.



SECTION C : KNOWLEDGE, ATTITUDE, PRACTICE (BEFORE AND AFTER) :

To recapitulate the IEC interventions were as follows :

- In Unit One, it was a poster session with a simple lecture by either of the lady doctors once a week, on how one's `blood could be made strong' through simple dietary changes. This intense level of IEC was buttressed by the **Employer** giving the **Employee** the fermented food *iddlis* 3 times a week at the **workplace**.
- In Unit Two, the same poster sessions were repeated once a month. The IEC was buttressed by the **Employer** giving the **Employee** gooseberry juice three times a week at the **workplace**.
- In Unit Three, our Positive Control, deworming + medicinal iron supplementation was given. No IEC was given.
- In Unit Four, our Negative Control, no intervention was done.

The `Before' and `After' KAP evaluation was done in all the four units. Spontaneous as well as aided recall techniques were used. This section is organized into three sub sections as under :

1. Knowledge responses Before and After.
2. Attitude responses Before and After.
3. Practice responses Before and After.

1. Knowledge responses Before and After :

From **Table 1**, it can be noted from the `Before' situation that, the **spontaneous recall responses** and the general knowledge of anemia or IDA was extremely poor ranging from 9% in Unit Three to 23% in Unit Four. Highly significant increases of correct responses of > 87% were noted in Units One, Two and Three in the `After' situation. This was seen even in Unit Four (Negative Control) a jump from 23% to 35%. The major reasons quoted for anemia were : Weak blood and deficiency in the diet. Although 21 messages – not all dietary – were beamed at our target working girls, the one that made the greatest impression **were food – related**. Even in the specific intervention groups of fermented food (Unit One) and the Gooseberry Juice intervention (Unit Two), all four groups were firmly convinced that **meat (trotter soup)** was a good dietary way to make one's blood strong! Aided recall of "Eat fermented foods" and "fruits and vegetables" also were high on the list. Although `drinking more milk' was **not** any in of our IEC messages, the spontaneous responses in the **`After'**

situation was significantly higher V/s. the `**Before'**. Milk is considered the food of the Gods and the affluent. Perhaps this could be a reason for this unexpected response.

From our section on Impact, it will be noticed that Knowledge does not necessarily translate into Practice or Behaviour Change. The Hb levels of the girls in Unit Four (Negative Control) did **not** show a change, although their Knowledge levels did. **Fermented foods did** obtain high `**After'** scores we expected. As a result of much higher consumption of the **fermented food (*iddlis*) at the workplace and a somewhat higher consumption of the same at home, the mean Hb levels of the Working Girls did go up significantly.**

The all-important-male-heads also benefited by being more aware of the causes and consequences of anemia (**Table 2**).

At the end of the 6 months intervention each Working Girl was given the booklet containing all the visuals and copy of the 21 messages. She was given 5 minutes to go through the booklet. She was told she should pick the poster or lesson that **impressed her the most**. In an **aided-recall situation,** we see that **fermented foods** topped the list (**Table 3**).

In both Units One and Two, we noted that the poster asking the girls to eat more fermented foods (*iddlis, dosais*) or cooked rice steeped in water overnight with their favorite lime pickle and tomato chutney was the most popular scoring 38% in Unit One; and 36% in Unit Two. In Unit One, the other toppers were `Eat eggs, meat, and trotter soup' (30%) and `Eat a lot of GLVs and Vegetables (27%).

In Unit Two the posters that had made a deep impression were `Put the Iron Key into the lentil soup as it cooks' (13%); `Save some money every month' (17%); `Eat eggs, meat and trotter soup' (15%).

2. Attitude responses Before and After :

Attitude in Unit One was assessed at Post – Intervention.

It can be seen from **Table 4**, that the attitude to the *iddli* (fermented food) was extremely positive. All the Working Girls were highly appreciative of the Employer being so magnanimous as to serve them their `favorite packed lunch' of *iddlis* three times a week. This had not happened before. Generally the packed lunch for Mondays were `*iddlis*'. Many claimed that

they did increase the number of times and quantity of *iddlis* brought from home or eaten at home. This also coincided with what we observed in a few homes on our home visits. About three-quarters claimed that they would continue to eat *iddlis* 4 times a week even if the intervention stopped. The remaining fourth frankly stated that they did not have time to make *iddlis* 4 times a week, should the intervention stop. All requested the Employer to please continue with the intervention. The various reasons stated for continuing with making the *iddlis* even if the Employer discontinued with it were : improved health; strong blood; better appetite; and irregular periods (some confided to us that their white discharge or leucorrhoea) had stopped. The *iddli* intervention was considered above all as a food intervention. However, we were disappointed to note that when we did a random check of some homes in end October, that most had discontinued with their good intentions and had gone back to the `Monday – *iddli*' pattern. However, the Working Girls claimed that they ate 4 - 6 *iddlis* at their Monday packed lunch. **The Employer did not continue the intervention.**

Our Impact Evaluation confirmed that the mean Hb of this group had gone up by 1.20 Hb g/dl.

In Unit Two the Gooseberry Juice intervention was greatly appreciated (**Table 5**). Our Impact Evaluation revealed that it was as good as the medicinal supplementation in enhancing the Hb levels of the Working Girls.

In contrast to Unit One, the Working Girls stated quite candidly that they **could not afford** to buy a bottle of Gooseberry juice (brand name Rebina), marketed by SB for Rs. 68/- per bottle, even though it would last them for two months. They requested the Management to continue with the intervention.

The positive reasons stated were : extremely refreshing; made their blood strong; improved their appetite; and that their periods had become regular and prevalence/incidence of leucorrhoea had decreased.

3. Practice responses Before and After :

Table 6 shows that apart from extremely good Knowledge gains and Attitudinal changes, the most favoured practice was to seek the help of a doctor; and/or take the medicinal iron supplementation!

SECTION - C : KNOWLEDGE – ATTITUDE – PRACTICE (KAP)

Table 1 : Knowledge Regarding Anemia in the Working Girls before and after the Interventions :

INDICATOR	UNIT 1 IEC+ (Iddili)		UNIT 2 IEC+ (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
	N = 72		N = 80		N = 70		N = 80	
	Before	After	Before	After	Before	After	Before	After
Knowledge :								
% having heard of anemia	10 (7)	*** 99 (71)	14 (11)	*** 94(75)	9 (6)	*** 87(61)	23 (18)	*** 35 (28)
% stating correctly :								
weak blood	15 (11)	*** 57 (41)	21 (17)	*** 64 (51)	11 (8)	*** 66 (46)	11 (9)	*** 30 (24)
Deficiency in diet	1 (11)	*** 65 (47)	18 (14)	*** 71 (57)	19 (13)	*** 66 (46)	12 (1)	*** 26 (21)
Can't say	83 (60)	*** 6 (4)	61 (49)	*** 18 (14)	70 (49)	*** 5 (7)	89 (71)	*** 53 (92)
% stating which food makes blood strong								
Fruits	15 (11)	*** 22 (16)	11 (9)	*** 66 (53)	14 (10)	*** 19 (13)	11 (9)	*** 36 (29)
Vegetables	32 (23)	*** 54 (39)	26 (21)	*** 58 (46)	37 (26)	*** 53 (37)	16 (13)	*** 39 (31)
Meat	17 (12)	*** 75 (54)	28 (22)	*** 65 (52)	47 (33)	*** 86 (60)	13 (10)	*** 39 (31)
Milk	10 (7)	*** 47 (34)	13 (10)	*** 33 (26)	11 (8)	*** 14 (10)	18 (14)	*** 43 (34)
Others	8 (6)	*** 15 (11)	8 (6)	NS 10 (8)	NIL	NIL	13 (10)	*** 38 (30)

Notes : 1. Sample size is given in brackets.

2. The 'Students' t-test was applied for each statement Before and After.

$P < 0.05$ *

$P < 0.01$ **

$P < 0.001$ ***

Sometimes % responses add up to more than 100% for each statement Before and After.

Table 2 : Awareness about Iron Deficiency Anemia Among the Male Members in the Households of the Working Girls :

INDICATOR	UNIT 1 IEC+ (Iddili)		UNIT 2 IEC+ (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
	N = 72		N = 80		N = 70		N = 80	
	Before	After	Before	After	Before	After	Before	After
% stating		***		***		***		***
YES	17 (12)	33 (24)	9 (7)	23 (18)	9 (6)	14 (10)	29 (23)	34 (27)
NO	83 (60)	67 (48)	91 (73)	78 (62)	91 (64)	86 (60)	71 (57)	66 (53)

Notes : The Chi-Square Test was applied.

< 0.05 *
< 0.01 **
< 0.001 ***

Table 3 : Which IEC poster Impressed you the most? Aided recall answers by the Working Girls who received the *Iddli* or the Gooseberry Juice Intervention :

Caption of Poster	*Iddlis* (Unit One) N=72	Gooseberry Juice (Unit 2) N=80
1. Eat Foods rich in Fermented Foods	38%	36%
4 Eat full breakfast	2%	
5. Deworm yourself with papaya seeds		4%
8. If you follow our advice your blood will be stronger with more iron.	4%	
9. Put the Iron Key into lentil soup being Cooked		13%
12. Save some money every month	2%	17%
13. Use lime in your lentil soup	4%	4%
14. Don't eat food sold by Hawkers	2%	
15. Eat egg, meat and trotter soup	30%	15%
21. Eat a lot of GLVs and Vegetables	27%	
TOTAL	109%	115%

Notes : 1. Eat foods rich in Iron (fermented; lime; gooseberry) 2. Better Grooming. 3. Drink less tea. 4. Eat a full breakfast. 5. Deworm yourself with papaya seeds. 6. Eat jaggery groundnut toffee. 7. Should have strong blood even if you are married. 8. If you follow our advice your blood will be stronger with more Iron. 9. Put the Iron Key into lentil soup being cooked. 10. Wear slippers when you go to the toilet or walk is slush and mud. 11. Cook vegetables in an iron work. 12. Save some money every month. 13. Use lime in your lentil soup. 14. Don't eat food sold by hawkers. 15. Eat egg, meat and trotter soup. 16. Eat Gooseberries, Guavas, Papaya, Bananas, Mangoes and Apples. 17. Eight out of 10 of you are anemic. 18. Take Typhoid vaccination. 19. Strong blood results in strong baby. 20. Marry aftet 21, have only 2 kids. 21. Eat a lot of GLVs and Vegetables.

ATTITUDE

Table 4 : Attitude at Post – Survey to the *Iddli* Intervention and reasons for the same among the Working Girls :

INDICATOR	(N)	(%)
1. Total number receiving *iddlis* thrice a week at the work place	(72)	100%
2. Number stating that they will continue making the *iddlis* at home even if the intervention stops	(53)	74%
3. Number stating that they will **not** be able to do so.	(19)	26%
4. Number requesting the Management to continue the intervention	(72)	100%
5. Major Positive Reasons for continuation :		
i. Greatly influenced by the IEC programme	(72)	100%
ii. Will improve my health.	(72)	100%
iii. Will make my blood strong	(72)	100%
iv. My appetite has improved	(36)	50%
v. My periods have become more regular	(36)	50%
6. Major Negative Reasons for not being able to Continue :		
i. No time to make *iddlis* 4 times a week	(19)	26%

ATTITUDE

Table 5 : Attitude at Post – Survey to the Gooseberry Juice Intervention and reasons for the same among the Working Girls :

INDICATOR	(N)	(%)
1. Total number receiving the Gooseberry juice thrice a week at the work place	(80)	100%
2. Number stating that they **cannot afford it.**	(80)	100%
3. Number requesting the Management to continue the intervention	(80)	100%
4. Major Positive Reasons for continuation :		
i. Very refreshing	(80)	100%
ii. Good for blood and health.	(80)	100%
iii. Improves appetite	(80)	100%
iv. My periods have become more regular	(32)	40%

PRACTICE

Table 6 : Practice regarding Control of Anemia in the Working Girls Before and After the Interventions :

INDICATOR	UNIT 1 IEC+ (Iddili)		UNIT 2 IEC+ (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
	N = 72		N = 80		N = 70		N = 80	
	Before	After	Before	After	Before	After	Before	After
% saying								
Go to Doctor	79 (57)	96 (69) *	59 (47)	94 (75) **	50 (35)	81 (57) ***	68 (54)	98 (78) **
Do nothing	22 (16)	4 (3) **	43 (34)	5 (4) ***	50 (35)	29 (20) ***	38 (30)	3 (2) ***
Take iron tablets as prescribed	44 (32)	74 (53) ***	36 (29)	63 (50) ***	36 (25)	57 (40) ***	43 (34)	68 (54) ***

Notes : 1. Sample size is given in brackets.
2. The Student T-Test was applied for each statement Before and After.

$P < 0.05$ *
$P < 0.01$ **
$P < 0.001$ ***

SECTION D : IMPACT (BEFORE AND AFTER) :

This section is organized into four sub sections as under :

1. General Health Status.
2. Hemoglobin Status.
3. Clinical Assessment for Nutritional Status.
4. Anthropometric Status.

1. General Health Status : (Table 1)

Chronic conditions or illness : Gastritis and/or severe acidity was very often mentioned. Perhaps due to the extremely spicy and chilli hot food consumed. The other illness quite often mentioned by the Working Girls were leucorrhea and low backache. The few who worked in the soldering section were particularly anemic. They also complained about acute acidity due to the acid fumes they were exposed to. Such health problems showed significant improvement on counselling by Dr. Arathi Singh (**Table 1**).

General illness : The general illnesses were intestinal helminthic infections, which showed significant improvement in Units One, Two and Three. A special poster and lecture dwelt on this subject in Units One and Two. In Unit Three, where deworming and medicinal supplementation were given, there was a highly significant reduction from 74% '**Before**' to 3% in the '**After**' situation. Since, worms were a very socially unacceptable condition in adults, many acted on our advice and purchased deworming tablets in Units One and Two. Upper Respiratory Tract infections were also mentioned. A significant reduction in this condition from 12% to 1% was noted in Unit Two. Perhaps due to the effect of ascorbic acid in the Gooseberry Juice served three times a week. As also higher intake of lime and tomatoes (precursor of Beta Carotene). Other conditions mentioned were constipation. Perhaps due to many having to share a single toilet, lack of time and short water supply. Many admitted that GLVs were consumed in the lentil soup to aid digestion and prevent constipation. The toilets at the Workplace were a luxury compared to what was available at home (**Table 1**).

2. Hemoglobin Status (Tables 2, 3, 4 and 5) :

I) The Hb status was significantly improved in Unit One, Two and Three. In Unit Four (Negative Control) the values remained more or less the same : (Table 2)

- In Unit One or the IEC + fermented food intervention, there was a significant mean increase of 1.20 Hb g/dl, from 11.10 Hb g/dl to 12.30 Hb g/dl. The greatest benefit as viewed by the Working Girl was that it was basically a food with 'properties of making weak blood strong'.
- In Unit Two, IEC + Gooseberry Juice intervention, there was a significant mean increase of 1.50 Hb g/dl from 11.20 Hb g/dl to 12.7 Hb g/dl. The Working Girls viewed this intervention as a 'most refreshing drink' that also had the ability to make their blood strong.
- In Unit Three, deworming + medicinal iron supplementation, there was a significant mean increase of 1.50 Hb g/dl, from 10.42 Hb g/dl to 12.43 Hb g/dl. This intervention was most successful in eradicating worms and for 'making the blood strong'. No IEC was given. However, when it came to **practice** – it was the doctor and the medicinal iron supplementation that scored.
- In Unit Four, Negative Control, there was no increase in Hb. It may be recalled that there were significant knowledge gains regarding the causes and consequences of IDA in spite of no intervention being given. The questions asked in the Pre or Baseline Survey had made the Working Girls in Unit Four curious enough to seek information on IDA.

This begs the question, should it be a concrete intervention alone **(40)**? Or should it be IEC + a concrete intervention? **(4, 5 and 40)** ? Or Should it be IEC alone **(41)**? As one can see there are studies to support or disclaim each of the above questions.

II) Percentage Prevalence of the Different Grades of Anemia in the Working Girls Before and After the Interventions : (Table 3)

Percentage prevalence of severe anemia (< 7 Hb g/dl) was totally eliminated in all the four groups. This was noted even in Unit 4 (Negative Control). On some probing in Unit 4, at the Endline Survey, it emerged that the girls had sought medical intervention and had been prescribed '*Matrae*' or tablets by the lady doctor. Moderate anemia (7 to 9.9 Hb g/dl) had also been virtually eliminated in Units One, Two and Three. Whereas, it had increased from 23% to 30% (significant at $p < 0.05$) in Unit Four. Mild Anemia (10 to 11.9 Hb g/dl) had also

significantly reduced in Units One, Two and Three. The same was the case in the Normals category (Hb ≥ 12 g/dl).

At Baseline, the overall prevalence figure for Normals in Units One, Two and Three was 35%; at Endline it rose to an impressive 76%. The largest group of Normals were found in Unit Three (87%). In the case of Unit Four (Negative Control) a stagnant figure of 20% was noted.

III) Interrelationship Between the Intense Level of IEC + the Supervised Iddli Intervention and the Severity of Anemia in the Working Girls Before and After the Interventions : (Table 4)

- An analysis of the mean number of *iddlis* eaten at home and at the **Workplace** was undertaken and is exhibited in Table 4. It was interesting to note that the mean total number of *iddlis* eaten over six months did not vary very much from the severely anemic (< 7 Hb g/dl) to the normal (≥ 12 Hb g/dl). The range was 224 to 283. However, what was very interesting was the effect of the above intervention on the severely anemic (< 7 Hb g/dl) where the increase was 5.0 g/dl; in the moderately anemic (7 to 9.9 Hb g/dl), it was 2.4 Hb g/dl; and in case of mildly anemic (10 to 11.9 Hb g/dl) it was 1.3 Hb g/dl; and in those who had normal Hb values (≥ 12 Hb g/dl) a decrease of 0.60 Hb g/dl was noted. Overall the increase in the Hb of the Working Girl Group was 1.20 Hb g/dl (11.10 to 12.30 Hb g/dl).
- Further analysis of the above intervention on the unmarried Working Girls who generally did not have access to their kitchen and the married Working Girls who did, strengthened our hypothesis that '**control of the kitchen**' was an important factor if the IEC component was to be followed at home. The mean increase in the Hb level in the 33 **unmarried Working Girls** was 0.9 Hb g/dl Vs 1.60 Hb g/dl in the **married Working Girls** (n=39). The difference in the Hb values of the unmarrieds Vs the marrieds was found to be highly significant. Since, the psycho – social and cultural values are unlikely to change in the near future, the above important finding also strengthens the fact that the **Employers** need to be persuaded to provide such iron-rich lunch packages at the **Workplace** to their Working Girls.

IV) Interrelationship Between the Less Intense Level of IEC + the Supervised Gooseberry Juice Intervention and the Severity of Anemia in the Working Girls Before and After the Interventions : (Table 5)

- An analysis was conducted as described, for the *iddli* intervention. Each Working Girl in Unit Two received 3120 ml of Gooseberry Juice, at 40 ml per girl, three times a week for 26 weeks (6 months). There was also some increase in the consumption of lime pickle, occassionally of lime juice, and lime rice. Lime was usually not used to sour the lentil soup, although this constituted one of the IEC lessons. The post dietary intake survey among Working Girls in Unit Two showed a mean increase of 8 g in the consumption of fruit – not necessarily lime. The huge increase in Vitamin C or ascorbic acid came almost entirely from the Gooseberry Juice at the **Workplace**. There was a highly significant increase of 1.50 Hb g/dl. The same trend of more severe the anemia – better the response was noticed here also. In the two cases of severe anemia, the mean enhancement was 4.30 g Hb g/dl. In the next category of moderately anemic, the mean enhancement was also 3.50 Hb g/dl. In the mildly anemic category, the mean increase in Hb values was 1.20 Hb g/dl. And in the Normal category, the mean increase was a mere 0.30 g/dl. The Gooseberry Juice was as good as deworming + medicinal iron supplementation, where overall the mean increase in both Units Two and Three was 1.50 Hb g/dl.

- An analysis of the increase in Hb values in the married (n=38) and unmarried (n=42) group was undertaken. In the marrieds, it was 1.50 Hb g/dl Vs 1.48 Hb g/dl in the unmarrieds. There was no significant difference between the values.

3. Clinical Assessment for Nutritional Status : (Table 6)

I) For Iron Deficiency Anemia (IDA) :

There was a significant reduction in the clinical indicators of IDA, such as pale nails, conjunctiva, or chronic menstrual bleeding among Working Girls in all the four Units. The more subjective indicators of tiredness, listlessness, breathlessness and body aches also significantly reduced in the first three Units. 'Lack of appetite' was a frequent complaint among the Working Girls in all the four Units. Appetite improved, not only by clinical assessment, but as judged by food and nutrient intake (please see section B of this chapter for more

data on Food and Nutrient Intake). We are surprised at the reduction in clinical signs of IDA, except that many after the Baseline survey did go to private doctors.

II) **For Vitamin A Deficiency (VAD) :**
Clinical signs of Vitamin A deficiency, namely Night blindness, (XIV) and/or conjunctival xerosis (XIA), where present, significantly reduced, especially so in Unit Two (Gooseberry Juice intervention).

III) **URI and ARI :**
Upper Respiratory Infection (URI) was a problem in Unit Two at the Baseline survey. It was significantly reduced at Endline survey. Acute Respiratory Infection (ARI) was a problem in Unit Three, at Baseline survey and was significantly reduced at Endline survey. We can say that IEC had definite impact where worm eradication was concerned in Units One and Two. In Unit Three, where deworming tablets were personally given by Dr. Arathi Singh, a tremendous reduction from 73% to 3% was seen. A significant reduction from 69% to 59% was also seen in Unit Four, which we cannot explain, except that perhaps medical help was saught.

IV) **Vitamin C Deficiency :**
It significantly reduced in the three units where food – based + IEC or deworming + medicinal iron supplementation was done.

4. Anthropometric Status : (Tables 7, 8 and 9)

I) **Weight :** From Table 7, it can be seen, that there was a mean and statistically significant weight gain in all the Working Girls in all the four Units. The mean weight gain was 3.4 Kg; 2.4 Kg; 2.7 Kg and 1.4Kg respectively. This was possibly due to a combination of growth spurt, better appetite, and a higher intake of daily food, especially in Unit One (fermented food) where in addition to their packed lunch, there was a bonus of the *iddli* lunch from the **Employer**. The free *iddli* lunch was about 200 Kcal. However, the majority of the Working Girls were below the Indian Standard of 50 Kg (ICMR, 1998). Many of the thin and skinny Working Girls asked us repeatedly for "get-fat-quick" recipies. Most of the South Indian female stars are buxom. The local TV was a big influence (**Table 7**).

II) **Height :** There were non-significant height increase in all the four Units. The mean height of the Working Girls just about cleared the Indian Standard of 150 cm (ICMR, 1999), (**Table 8**).

III) **Body Mass Index :** From Table 9, it is seen that the mean BMI (Body Mass Index Wt/Ht^2), was above the accepted value of 18.5 as being the cut off for Normal female adults in Units One, Two and Three. In Unit Four, all the girls were young (mean age of 20 years) and unmarried. In Unit One, Two and Three the mean age was 22 years. Generally, a woman puts on weight after having a child or two. Even in Unit Four, the mean BMI of 19.7 (Post-intervention) was above the cut off of 18.5 (**Table 9**).

Further, the Working Girls in this study were in between the Moderate and Heavy Work category.

Conclusion :

This again indicates that food-based interventions to improve the iron status of the **Working Girls** either through the reduction of inhibitors (phytic acid in the *iddlis*) or through enhancers, namely, ascorbic acid – rich – foods augumented by focussed IEC, does significantly increase the hemoglobin values of the target population (Working Girls) in a relatively short period of time (six months) and at an extremely affordable cost.

SECTION - D

Table 1 : General health of the Working Girls :

Characteristic or Indicator	UNIT 1 (Iddli or fermented food)		UNIT 2 (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
Population Size N	72		80		70		80	
Intervention	Before	After	Before	After	Before	After	Before	After
Chronic Illness in % Yes No	32(23) 68(49)	28(20)* 72(52)	45(36) 55(44)	22(18)* 78(62)	59(41) 41(29)	50(35)* 50(35)	70(56) 30(24)	68(54) NS 32(26)
General : Worms (%)	43(31)	24(17)*	36(29)	19(15)*	74(52)	3(2)**	51(41)	81(65) NS
URI (%)	10(7)	7(5)	12(8)	1(1)*	Nil	Nil	5(4)	8(6) NS
No Illness (%)	43(31)	69(49)	61(49)	80(64)	26(18)	97(68)	41(33)	14(11)

Note : n is in brackets; Based on Chi-square test of significance
$p < 0.05$ = *
$p < 0.001$ = **
NS = not significant.

Table 2 : Absolute Hemoglobin values in the four groups Before and After the Interventions :

Degree of IDA	UNIT 1 (Iddili)		UNIT 2 (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
	N = 72		N = 80		N = 70		N = 80	
	Before	After ***	Before	After ***	Before	After ***	Before	After NS
Overall Mean Hb	11.10 ± 2.1	12.30 ± 1.0	11.2 ± 1.9	12.7 ± 1.1	11.5 ± 1.3	13.0 ± 1.3	10.9 ± 1.4	10.9 ± 1.5
Severe Anemia <7 g/dl	5.70 (1)	*** 10.7 (1)	6.9±0.1 (2)	*** 11.2± 0.5 (2)	6.0±0.0 (2)	*** 7.5±0.0 (2)	6.4±0.0 (2)	*** 8.9±0.0 (3)
Moderate Anemia 7g to 9.9 g/dl	8.9± 0.70 (21)	*** 11.30± 0.90 (21)	8.80± 0.90 (17)	*** 12.30 ±1.20 (17)	NO CASES	NO CASES	9.40± 0.70 (18)	NS 9.70± 1.20 (18)
Mild Anemia 10g to 11.9g/dl	11.0± 0.60 (29)	*** 12.30± 0.60 (29)	11.20± 0.50 (36)	*** 12.40 ±0.80 (36)	10.90± 0.50 (37)	*** 12.40± 0.50 (37)	10.80± 0.90 (44)	NS 11.00±0. 60 (44)
Normal 12 or more g/dl	13.80± 0.90 (21)	* 13.20± 0.60 (21)	13.20± 0.90 (25)	NS 13.50 ±0.90 (25)	12.50± 0.30 (31)	*** 14.00± .030 (31)	12.70± 0.70 (16)	NS 12.80± 0.50 (16)

Note : $p < 0.05$ = *
$p < 0.01$ = **
$p < 0.001$ = ***
The Student's `t' test was applied.
NS = Non Significant.

Unit One : Each subject was given 2 iddlis (fermented food) per day/3 times a week x 180 days.
Unit Two : Each subject was given 40 ml Gooseberry Juice 3 times a week x 180 days.
Unit Three : Each subject was give deworming once + 60 mg Ferrous Sulphate once a week x 180 days.
Unit Four : No intervention at all.

Table 3 : Percentage Prevalence of the Different Grades of Anemia Before and After the Interventions :

Degree of IDA	UNIT 1 (Iddili)		UNIT 2 (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
	N = 72		N = 80		N = 70		N = 80	
	Before	After	Before	After	Before	After	Before	After
Severe Anemia <7 g/dl	1 (1)	0	3 (2)	0 (0)	3 (2)	0 (0)	3 (2)	0 (0)
								*
Moderate Anemia 7g to 9.9 g/dl	29 (21)	1 (1)	21 (17)	1 (1)	0 (0)	3 (2)	23 (18)	30 (24)
		***		***		***		NS
Mild Anemia 10g to 11.9g/dl	40 (29)	32 (23)	45 (36)	25 (20)	53 (37)	10 (7)	55 (44)	50 (40)
		***		***		***		NS
Normal 12 or more g/dl	30 (21)	67 (48)	31 (25)	74 (59)	44 (31)	87 (61)	20 (16)	20 (16)

Note : $p < 0.05$ = *
$p < 0.01$ = **
$p < 0.001$ = ***
NS = Non Significant.

Table 4 : Inter relationship between IEC + Supervised *Iddli* Intervention and Severity of Anemia in the Pre and Post Intervention periods :

DEGREE OF IDA	PRE (N=72)	POST (N=72)	INC/DEC In Hb level
Mean no. of idlis eaten per worker over 6 months	121	121+156=277	
Overall mean Hb (g/dl) (N=72)	11.10±2.10 g/dl	12.30±1.00 g/dl	+ 1.20 g/dl
Mean no. of Iddlis eaten over 6 months by **severely anemic** (< 7 g/dl)	204	204+156 =360	
Mean Hb of the group (N = 1)	5.7 g/dl	10.7 g/dl ***	+ 5.00 g/dl
Mean no. of Iddlis eaten over 6 months by the **moderately anemic** (7 to 9.9 g/dl)	114	156+114=270	
Mean Hb of the group (N = 21)	8.90±0.70 g/dl	11.30±0.90g/dl ***	+ 2.50 g/dl
Mean no. of Iddlis eaten over 6 months by the **mildly anemic** (10 to 11.9 g/dl)	127	156+127=283	
Mean Hb of the group (N = 29)	11.00±0.60 g/dl	12.30±0.60 g/dl ***	+ 1.69 g/dl
Mean no. of Iddlis eaten over 6 months by the **Normal** (12 or more g/dl)	114	156+114=270	
Mean Hb of the group (N = 21)	13.80±0.90 g/dl	13.20±0.60* g/dl	- 0.60 g/dl

Table 5 : Interrelationship between IEC + Supervised Gooseberry Juice Intervention and Severity of Anemia in the Pre and Post Intervention periods :

DEGREE OF IDA	PRE (N=80)	POST (N=80)	INC/DEC In Hb level
Overall quantity of the Gooseberry juice consumed over 6 mths	_	3120 ml	
Overall Mean Hb (g/dl) (N=80)	11.20 g/dl	12.70 g/dl	+ 1.50 g/dl
Gooseberry juice consumed by the **severely anemic** (< 7 g/dl)	-	3120 ml	
Mean Hb of the group (N = 2)	6.90 g/dl	11.20 g/dl	+ 4.30 g/dl
Gooseberry juice consumed by the **moderately anemic** (7 to 9.9 g/dl)	-	3120 ml	
Mean Hb of the group (N = 17)	8.80 g/dl	12.30 g/dl	+ 3.5g/dl
Gooseberry juice consumed by the **mildly anemic** (10 to 11.9 g/dl)	-	3120 ml	
Mean Hb of the group (N = 36)	11.20 g/dl	12.40 g/dl	+ 1.2. g/dl
Gooseberry juice consumed by the **Normal** (12 or more g/dl)	-	3120 ml	
Mean Hb of the group. (N = 25)	13.20 (g/dl)	13.50 (g/dl)	+ 0.30 g/dl

Table 6 : Clinical Assessment of the Micronutrient Status of the Working Girls :

Characteristic or Indicator	UNIT 1 (Iddli or fermented food)		UNIT 2 (Goosebery Jui)		UNIT 3 (Medi. Supp)		UNIT 4 (Neg. Control)	
Population Size N	72		80		70		80	
Intervention	Before	After	Before	After	Before	After	Before	After
IDA – Tiredness	63(45)	28(20) **	43(34)	15(12) **	73(51)	24(17) **	61(49)	56(45) NS
Listlessness	50(36)	4(3)***	31(25)	5(4)**	23(16)	7(5)*	34(27)	32(25) NS
Breathlessness	28(20)	3(2)	24(19)	1(1)**	40(28)	3(2)**	9(7)	8(6) NS
Body aches	31(22)	19(14)*	46(37)	8(6)**	43(30)	23(16)*	30(24)	30(24) NS
Lack of Appetite	44(32)	17(12)**	60(48)	13(10) ***	54(38)	40(28)*	51(41)	29(23)*
Pale Nails	68(49)	3(2)***	48(38)	4(3)**	79(55)	11(8) ***	50(40)	35(28)*
Leucorrhoea	42(30)	22(16)**	45(36)	19(15)*	76(53)	1(1) ***	80(64)	58(46)*
IDA	64(46)	21(15)**	30(24)	12(10)	71(50)	13(9)**	40(32)	39(31) NS
VAD – Night Blindness	1(1)	1(1)	15(11)	2(1)*	20(14)	1(1)*	5(4)	5(4) NS
Conjuctival Xerosis	13(9)	7(5)*	18(14)	3(2)*	7(5)	7(5)	21(17)	29(23) NS
URI	1(1)	1(1)	30(24)	4(3)*	3(2)	2(1) NS	3(2)	7(6) NS
ARI	1(1)	4(3) NS	4(3)	4(3)	29(20)	1(1)**	Nil	Nil
Worms	49(35)	14(10) **	30(24)	10(8)*	73(51)	3(2)***	69(55)	59(47)*
Vitamin C Deficiency Bleeding gums (%)								
Yes	17(15)	6(4)*	11(10)	3(2)*	17(12)	1(1)*	14(12)	15(13) NS
No	83(57)	94(68)	89(70)	95(76)	83(58)	99(69)	86(68)	85(67)

Note : n is in brackets; Based on Chi-square test of significance
$p < 0.05$ = *
$p < 0.01$ = **
$p < 0.001$ = ***
NS = not significant.

Table 7 : Anthropometric Status of the Working Girls (Mean Weight and SD) :

Characteristic or Indicator	UNIT 1 (Iddli or fermented food)				UNIT 2 (Goosebery Jui)				UNIT 3 (Medi. Supp)				UNIT 4 (Neg. Control)			
Population Size N	72				80				70				80			
Intervention	Before		After		Before		After		Before		After		Before		After	
In Kgs	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
18 – 23 years	44.3	8.7	47.7*	7.9	44.4	9.5	46.8*	9.6	45.7	7.9	48.4*	7.1	42.7	6.7	44*	6.4

Note : Based on Student t test (difference of means for small samples and large samples)

$p < 0.05$ = *

$p < 0.01$ = **

NS = not significant.

Table 8: Anthropometric Status of the Working Girls (Mean Height and SD) :

Characteristic or Indicator	UNIT I (Iddli or fermented food)				UNIT 2 (Goosebery Jui)				UNIT 3 (Medi. Supp)				UNIT 4 (Neg. Control)			
Population Size N	72				80				70				80			
Intervention	Before		After		Before		After		Before		After		Before		After	
In Cms	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
18 – 23 years	153.1	6.2	153	6.1	149.9	5.9	150	5.7	151.8	5.0	152.4*	4.9	151.8	6.4	152.8	6.4

Note : Based on Student t test (difference of means for small samples and large samples)
$p < 0.05$ = *
$p < 0.01$ = **
NS = not significant.

Table 9: Percentage Distribution of Body Mass Index of the Working Girls :

Characteristic or Indicator	UNIT 1 (Iddli or fermented food)				UNIT 2 (Goosebery Jui)				UNIT 3 (Medi. Supp)				UNIT 4 (Neg. Control)			
Population Size N	72				80				70				80			
Intervention	Before		After		Before		After		Before		After		Before		After	
In Cms	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
18 – 23 years	19.5	4.3	20.5*	3.9	20.1	4.2	21.7 **	4.1	20.3	3.2	21.0*	3.1	18.6	3.1	19.7 *	3.2

Note Based on Student t test (difference of means for small samples and large samples)

$p < 0.05$ = *

$p < 0.01$ = **

NS = not significant.

Chapter Seven – SUSTAINABILITY :

Sustainability of any intervention or action-research-study is the most difficult question to answer. The three important Stake Holders in this study were : The **Employer**; the Working Girl or **Employee** and the last but not the least – the person who cooks at home and controls the kitchen. I have consequently discussed Sustainability from each Stake Holder's perspective.

A. Sustainability from the Employer's perspective :

i. **Unit One (intense IEC + the fermented food) :** The **Employer** straight away recognized the potential of enhanced Hb levels in their Working Girls translating into better productivity at the **Workplace**. They further saw the opportunity cost of each Working Girl getting full medical checkups twice in that year (1999) at the **Workplace**. The IEC given every week by committed and expert doctors was also considered as plus points. Hence, we could say that there was an almost instantaneous and positive **behaviour change** even before the commencement of the study. Although it cost the **Employer** of a small enterprise Rs. 11,232/- (260 USD) for the *iddli* or fermented food intervention – we were delighted to see they did not grudge this expenditure. Further, the Employer cooperated with us in all respects from start to finish. We found that the **Owner/Employer** of these small units to be far more approachable, willing to listen and willing to implement than the Management of the large State or Central Government undertakings. However, on the flip side was the fact that they have not continued with the fermented food intervention after we exited.

Conclusion : Any Public Health intervention, be it food-based + IEC or IEC alone, can if at all succeed and be sustainable at the **Workplace**. Cost-effectiveness, cultural acceptability of the food-based intervention, frequency of consumption of the said food, ease of distribution and its accountability are all factors to be considered for its potential sustainability in a scaled-up situation.

B. Sustainability from the Employee's perspective :

The response to the IEC plus the fermented food, was overwhelmingly positive from the Employee's side as well. Those who were in control of the kitchen did make and consume more of the fermented food. They also acted on the other IEC messages. Over 75% said they would continue to make and eat the *iddlis*, whether or not the **Employer** gave it to them free of charge.

One could sense smouldering anger in the Working Girls (**Employees**), that they got very few welfare benefits from the **Employer**. All that the **Employer** had to do as per law was to pay their accident and health insurance as the Employees' State Insurance (ESI). It was the first time they had got two free medical check ups in a year, the IEC and the free *iddlis*. Could not the **Employer** and TCS continue to do what we (TCS) had started? We tried to reason with them that they could also form a cooperative and pay the outside food contractor. This advise was met with a sullen silence.

Conclusion : In our considered opinion the Working Girls may slip into their old routine of *iddlis* or fermented food on Mondays. They certainly were eating many more *iddlis* on Monday i.e. once a week. Whether this will result in enhanced Hb levels could form the basis of another research study.

C. Sustainability from the Stake-holder's (who does the cooking) perspective :

If the Stake-holder is in charge of the Kitchen, sustainability may be ensured. Otherwise not.

ii. Unit Two (IEC +Gooseberry juice intervention) : This food based intervention was definitely the best as far as procurement, distribution, cost and efficacy were concerned.

Unfortunately, neither the **Employer** nor the **Employee** was prepared to continue once we exited.

Conclusion : The Gooseberry juice intervention is worth persuing at the **Workplace**, if the costs could be shared by the **Employer** and the **Employee**.

iii. Unit Three (deworming + medicinal iron supplementation) : If the **Employer** desires to improve the health of his/her workforce, this is probably the simplest and most effective non-food-based intervention to support at the **Workplace**. We have had consistent and sustainable success with the above (**4, 5**).

Conclusion :

Finally, it may be noted by inference, that it did not make much difference in KAP whether IEC was given at the intense level (once a week), or the less intense level (once a month). Hence, a **concrete intervention at the Workplace such as the fermented food or the gooseberry juice may be more efficacious or effective in enhancing Hb levels of the Working Girls – with or without IEC.**

Chapter Eight – DISCUSSION, CONCLUSINONS AND RECOMMENDATIONS :

INTRODUCTION :

We start this chapter by re-stating the key hypothesis of this Efficacy Trial. It was, namely, to assess whether individuals could be convinced enough to alter their dietary practices relating to the bio-availability of dietary iron. If so, within a very short period, a significant difference in the Hb levels could be achieved. **In short, dietary practices to enhance the bio-availability in the typical food stuffs consumed by the study population was the essential focus of this specific dietary intervention cum IEC study.**

Fermented Cereal and Pulse Foods : The strategy was **to reduce the phytic acid levels in food stuffs that are eaten in large quantities regularly.** Phytic acid or phytate, an inhibitor in cereals and pulses greatly reduces the bio-availability of iron.

Ascorbic acid-rich Gooseberry Juice : Ascorbic acid is a well known **enhancer** of dietary iron and makes it much more bio-available. However, consumption of fruits in general and citrus fruits in particular, at the household level is minimal. This strategy was included as it was likely to be affordable by the **Employer** at the **Workplace.** The cost of delivering 40 mg of Ascorbic acid via gooseberry juice per worker per day was approximately the cost of one cup of tea. Tea is supplied by the **Employer**, adlib, in all **offices and workplaces**.

We shall pose a series of questions relating to the above and shall defend the same, primarily from the Results of this study, as well as other recent or appropriate ones.

Q. 1 Which are the food stuffs consumed in quantity, day-in and day-out?

In this study as well as others done in South India, it is very definitely huge quantities of rice, a much lesser quantity of ragi (*elusine coracana)*, and a small quantity of wheat. The major reason for doing so is the cheap cost of the staples versus that of pulses, fats/oils, flesh foods, fruits and vegetables (**2, 6**).

Q. 2 What is the bio-availability of iron in a typical Indian meal?

The bio-availability of iron in a typical Indian meal is extremely low. Narasinga Rao conducted a number of invitro studies which revealed

the following picture, which may be relevant to our study. A meal of Ragiballs, Potato and Tea has a bio-availability of only 0.9. Rice, Dal, Potato and Milk raised the bio-availability of iron to 4.5 % (**42**). Such studies, unfortunately are not available to our knowledge for a meal including Indian fermented foods, such as *iddli, dosai, appam*, or *dhokla*. **It would appear that our present IEC study is the first to demonstrate invivo, that the mean Hb status of the Working Girls did go up by 1.20 g/dl, when an average of 20 – 30 *iddlis* were consumed per subject, per week. It would be interesting to further study whether intermittant or once a week consumption of *iddlis* would raise Hb levels?**

Q. 3 How then did you propose to make the staple cereals bio-available?

It is well known that cereals have a high content of **phytic acid, a significant inhibitor of dietary iron**. We, therefore, considered a culturally accepted, habitually practiced and a traditional food processing procedure, namely, **auto-fermentation of cereal and pulses**. Fermented foods such as *iddli, dosai* and *appam* are eaten practically every day as a breakfast food or as a '*tiffin*' (snack food) at tea time, in the affluent South Indian households. Our dietary and nutrient intake surveys revealed that the poor households **made *iddlis* once or at the most twice a week, but in large quantities. Hence, we decided to capitalize on this established food practice in this region of India.**

Gibson etal in their recent work in Malawi, Africa, have described several dietary interventions to prevent zinc deficiency, one being fermentation as being the simplest and most effective at the household level. (**12, 13**). Several other studies, mostly conducted in Africa have shown the effectiveness of reducing the phytic acid content of maize, sorghum, other millets or dry pulse grains by the simple process of just soaking the cereals in water for a few hours to overnight (**8, 14**).

Fermentation : *Iddli*, a fermented food, which is a day-in and day-out breakfast food, is a very simple procedure for most South Indians. Generally, one measure of raw rice (Rs. 10/- to Rs. 20/- per Kg), one measure of parboiled rice (Rs. 10/- to Rs. 20/- per Kg), one measure of black gram dal (*Phaseolus mungo roxb.*) at Rs. 40/- per Kg are the main ingredients for *iddli*. The rice and blackgram dal are washed and soaked separately in water with about two inches of water

standing over the raw ingredients for about 6 – 8 hours. The rice is ground coarse. The lentil is ground fine. Both are mixed well. Salt and cooking soda is added to taste. The batter is allowed to ferment overnight (10 – 12 hours). This results in the souring of the batter and in the lowering of the pH. The batter is poured into greased moulds and steamed either in a pressure cooker or *iddli* steamer for 8 – 10 minutes. The steamed dumplings are served with spicy lentil soup and coconut chutney. 2 Kgs of rice grain plus 1 Kg of blackgram dal (raw ingredients) would yield about 60 to 70 *iddlis*.

The Low Income families use much **less** of the expensive lentil but add much more cooking soda. It would be useful to conduct **invitro** and **invivo** studies on the bioavailability of iron from different recipies of *iddli*. The most practical, cost-effective and sustainable recipe could then be promoted to the **Employers** as their contributory lunch to their **Employees** at the **Workplace**.

Since, the Working Girls claim to eat anywhere from 2 – 8 *iddlis* per time, an equivalent of 100 g raw rice plus pulse (for 2 *iddlis*); to 400 g of raw rice plus pulse (for 8 *iddlis*) would be consumed per *iddli* meal (**43**). At the Baseline Survey, *iddlis* were the packed Monday lunch for most of our Working Girls. At Post Survey, *iddlis* were still a Monday treat, but the quantity consumed was far greater. We were astonished at the quantity of cooked cereal food the Working Girl could consume at a meal at home. Generally less of cooked rice was eaten at the **Workplace**.

Steeping cooked rice in water overnight : An even simpler method to increase the bio-availability of iron for cereals would be to soak the cooked rice in water overnight. The next morning, drain off the water, add curd (yogurt), and carry it to work as a `packed lunch'. As stated earlier, this was considered to be something that the `very poor' did. Our IEC poster on this did not find favour. It was considered infradig. The Working Girls further told us that all the cooked food was consumed on that very day itself. So where was there any leftover cooked rice? Our advice that more rice could be cooked for steeping later on, was not received well.

Gibson and coworkers have recommended soaking of maize, the staple cereal of Malawi, Africa, as being the most practical method of reducing the level of phytic acid (**12, 13**). Svanberg and coworkers list the advantages of soaking and fermentation of non-tannin and

high-tannin cereals which certainly support our IEC attempt to popularize the 'curd-steeped rice lunch' for Working Girls in South India (**44**).

Q. 4 How does fermentation induce phytase hydrolysis of phytic acid (myo-inositol hexaphospate in cereals and pulses)?

Most plant-based foods contain some phytase enzymes. However, this enzyme that hydrolyses the phytic acid finally to inorganic orthophosphate and myo-inositol, is in a dormant state in dry grains and pulses. Phytase is activated in the **moist state**. It has been reported that phytate reductions may be as high as 98% for a variety of fermented products based on *cassava, cocoyam, maize, sorghum, **rice**, soyabeans, cowpeas and lima beans* consumed in West Africa, depending on the conditions of perparation, storage and cooking (**10**).

Gibson and Ferguson list the other advantages of fermentation as : (i) it reduces amount of fuel energy required for cooking the fermented products; (ii) It improves the safety of the final food product as it inhibits the growth of diarrhoeal pathogens; and (iii) Antimicrobial substances may also be produced during fermentation (**12**).

Commercial phytase enzymes can be prepared from *Aspergillus oxyzae* or *A. niger* which are stable over a fairly wide pH range (3.5 – 7.8), and temperature range. However, they are extremely expensive **at the present time** (**45**).

Q. 5 What about iron bio-availability enhancers like ascorbic-acid-rich foods?

The present study found that an enhancer like gooseberry juice is excellent in increasing the mean Hb levels of our target Working Girl subjects. Other recent studies have shown that guava fruit was successful in raising the Hb levels of college girls in a short time (**15**). In fact, in this present study, it proved to be superior to the fermented food as the mean Hb increase was 1.20 g/dl Vs 1.50 g/dl in the gooseberry juice group. All dietary sources of Vitamin C are very expensive and quite beyond the economic reach of our subjects. If **Industry**, in this case Smithkline Beecham, Bangalore; the **Employer** (Mr. Wahid of Unit Two) and the **Working Girls** could have shared the cost of the gooseberry juice, it would have been an **extremely feasible** and **sustainable** strategy.

This is a good strategy as it would **counteract** the inhibitory effect of the tannins and polyphenols in the cups of tea imbibed at the **Workplace**. Alternatively, if the big Tea Houses namely, Tata Tea and/or Brooke Bond could be persuaded to invest in R & D that would lead to the enrichment or fortification of loose tea with Vitamin C. This would be a fine gesture on their part (**46**).

Q. 6 How do enhancers such as ascorbic acid (Vitamin C) improve the bio-availability of iron?

Enhancers such as ascorbic acid form soluble or chelated complexes with iron and prevents the iron from percipitating or polymerizing. Ascorbic acid also reduces ferric iron to ferrous iron at pH values greater than pH3 as found the duodenum and small intestine. Apparently ascorbic acid is dose related and can act even in the presence of inhibitors (**47**). Although the consumption of lime and lime juice did increase at the household level, it is a matter of conjecture whether the dose level of ascorbic acid would have been sufficient to have resulted in a mean increase of 1.50 Hb g/dl per worker, in the Working Girl population.

Q. 7 How successful was this IEC study in propogating the use of iron woks for cooking?

Recent reports have indicated that Ethiopian children were fed food cooked in iron pots, had significant increase of 1.7 Hb g/dl (over 12 months intervention period) versus those fed food from aluminium pots (increase of 0.4 Hb g/dl). Similar results have been reported by other investigators (**24**). In our study there was outright rejection to the idea of replacing aluminium cooking vessels with those of iron. Food cooked fast in aluminium vessels, they were easy to clean and easy to maintain. Pressure cookers were made of aluminium. 75% of the Working Girls in Unit Two were intrigued by our IEC poster advising them to put the Iron Key into the lentil soup as it cooked and had tried to do so a few times at their homes. However, the men in the household objected strongly stating that the food tasted `strange' and `bad'. Although this was not true, the few who were enterprising and courageous enough to try, had to stop.

Q. 8 Can IEC, as a free standing intervention have brought about a positive and sustainable impact in the Hb status of the Working Girls?

A study by Kanani and Agarwal (**41**), indicates a positive impact in Hb status among school girls in the age group of 8 – 13 years. The

investigators state that over a one year's intervention the mean increase in the Experimental Group was 0.80 Hb g/dl Vs –0.27 Hb g/dl in the Control Group.

In Unit One, (our present study), the **Working Girls** received IEC once a week plus the supervised fermented food intervention. In Unit Two, the **Working Girls** received the supervised gooseberry juice intervention plus IEC once a month. Yet, in the later group, there mean Hb increase was 1.50 g/dl over a 6 months intervention. In Unit Three the Working Girls received supervised deworming plus medicinal iron supplementation and **no IEC**. Yet, their mean Hb increase was 1.50 g/dl over a 6 months intervention.. In Unit Four, our Negative Control, the Working Girls neither received IEC or a concrete intervention. The Pre-Post Hb levels were more or less stagnant, in spite of their Post knowledge levels regarding IDA being high. The interpretation from the result of our study is :

- First target and orient the IEC at the **Employer**. Behavioural change will be instant or not at all.
- Concrete dietary or medicinal intervention at the **Workplace**, if given free of cost, appears to give the best results as far as reduction in IDA is concerned.
- The Working Girl, especially if she is unmarried, has very real constraints of money, time and NO control over her kitchen.
- Both the **Employer** and **Employee** need Organizational and Managerial help to implement and sustain such a programme.

CONCULSIONS/RECOMENDATIONS :

i. First **orient or educate** the **Employer** rather than the **Employee** with respect to the improvement of the health and iron-status of the latter. **Expected behaviour change** was almost instantaneous in the **Employer**.

ii. A concrete **intervention at the Workplace plus IEC** would be the best choice.

iii. The **Employees do appreciate the IEC and do implement** the **dietary injunctions** to the extent possible. However, their **time** and **economic constraints** are the real limitations to total behaviour change or sustainability.

iv. **Control of the kitchen** is a paramount factor in the **Employee**, where much greater consumption of fermented foods is concerned.

v. In Urban India, aluminium cooking pots/vessels have come to stay. Hence, iron woks **will not** be used.

vi. Tea will be drunk 2 – 6 times a day at the **Workplace**. No amount of IEC will change this. Perhaps approaching the big tea manufacturer to enrich or fortify their loose tea or cheap brands with ascorbic acid (at the very least) may partially solve the problem of widely prevalent IDA in the Working Girls.

vii. The **Employer** of such small industrial units is generally a small enterpreneur with small resources. This was the reason for non-continuance of the dietary-based interventions in Units One and Two. But small cooperative efforts between **Employer** and **Employee** will work. *Iddli* (fermented food) is an extremely popular food eaten by all sections of South India. A retired **Employee** can be put in charge of making this popular dish everyday and a small amount may be cut from the **Employee's** salary.

viii. Although, the fermented food (*iddli*) did not increase the mean Hb levels (1.20 Hb g/dl) to the extent that the Gooseberry Juice or the Medicinal Supplementation interventions (1.50 Hb g/dl) did, yet, it was the food-based –*iddli* intervention that was most appreciated.

ix. Enhancing the Hb levels of the Working Girls makes good economic sense. Such a strategy brings about good labour relations apart from the established rewards of greater productivity, better reproductive health, better cognition and an all round better working atmosphere.

x. The Working Girl and or Working Woman is the phenomenon of this millennium in India. Large population – based surveys are required on the 'total health' of this girl/woman. This should also include her occupational health; her psyco-social or emotional health; her nutritional health; and her reproductive health.

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ABBREVIATIONS

ARI : Acute Respiratory Tract Infections.
BMI : Body Mass Index.
Dosai/Appam : Fermented Foods from Cereal – pulse fermented batters.
ESI : Employees' State Insurance.
GLVs : Green Leafy Vegetables.
Hb : Hemoglobin.
ICMR : Indian Council of Medical Research.
IDA : Iron Deficiency Anemia.
IDD : Iron Deficiency Disorder.
Iddli : Fermented pancakes made out of cereal – pulse fermented batter.
IEC : Information – Education – Communication.
KAP : Knowledge – Attitude – Practice.
LIG : Low Income Group.
PDS : Public Distribution System.
PRA : Participatory Research Assessment.
RDA : Recommended Daily Allowance.
SPSS : Statistical Package for Social Sciences.
TCS : Tara Consultancy Services, Bangalore, India.
TRF : Thrasher Research Fund, Utah, U.S.A.
URI : Upper Respiratory Tract Infections.
USD : United States Dollar.
VAD : Vitamin A Deficiency.
WHO : World Health Organisation.

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1. Consultancy for Micronutrient Initiative, Ottawa, Canada, 2000-2001.

2. An "IEC Project for Working Girls (18 – 23 years) on Cultural Dietary Practices to Increase the Iron Content of Their Everyday Diets" – for Thrasher Research Fund, Utah, U.S.A., 1998 – 2000.

3. Consultancy for CARE – India for "Addressing Nutritional Gaps in Children Under Two in Rural India", 1998.

4. "A Multinutrient Package for Tea Plantation Workers for Better Health, Productivity and Profitability" for OMNI – ILSI, 1996 – 1998.

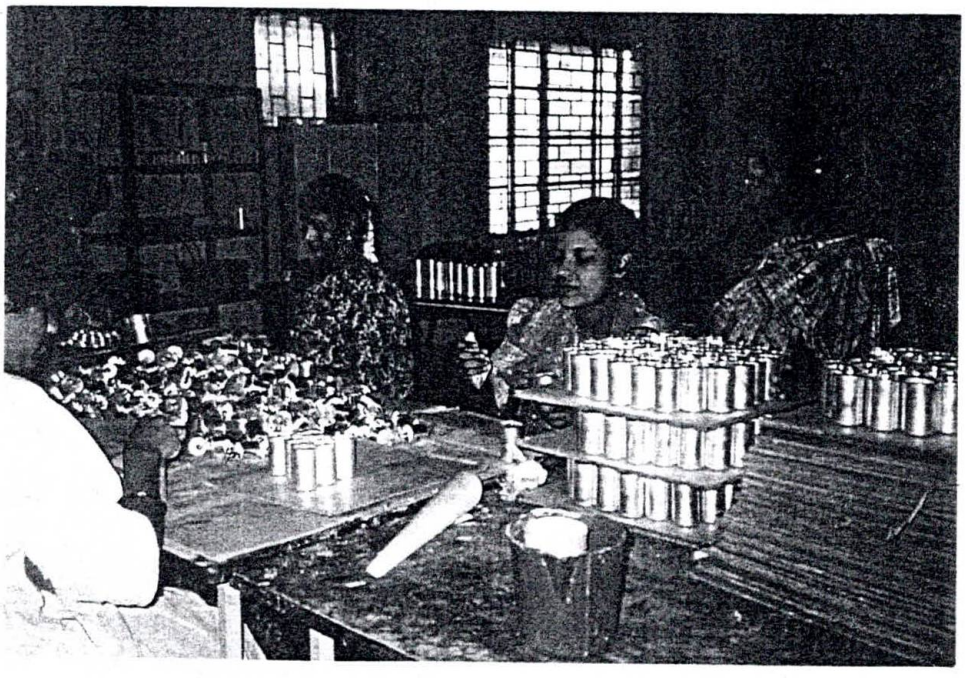
5. Consultancy for the National Assessment and Accreditation Council of India on "What are the Perceptions of Quality in Higher Education by the Stake Holders, Namely, the Students, Parents and Employers?", 1996-1998.

6. A Technical Workshop for Smithkline Beecham on "Imperative Need to Integrate Deworming and Micronutrient Supplementation into the National Mid-Day-Meals Programmes (MDMP)", 1996.

7. Global Partner for Partnership for Child Development, Oxford University, U.K. Executed a series of 4 research projects from 1993 to 1996.

8. Consultancy for the Department of Women and Child, Ministry of Human Resource Development, Govt. of India, 1994.

9. Consultancy for UNICEF, Delhi and the Department of Women and Child, Rajasthan (1992 – 1993).



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