

**IMPACT OF SHIFT WORK ON NUTRITIONAL STATUS,  
LIFESTYLE AND HEALTH STATUS  
OF SHIFT WORKERS**

Thesis submitted to the  
University of Agricultural Sciences, Dharwad  
in partial fulfillment of the requirements for the  
Degree of

**Master of Home Science**

**In**

**FOOD SCIENCE AND NUTRITION**

**By**

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**MAY, 2010**

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# CONTENTS

| Sl. No. | Chapter Particulars   |
|---------|---|
|         | CERTIFICATE   |
|         | ACKNOWLEDGEMENT   |
|         | LIST OF TABLES  |
|         | LIST OF FIGURES   |
|         | LIST OF PLATES  |
|         | LIST OF APPENDICES  |
| 1       | INTRODUCTION  |
| 2       | REVIEW OF LITERATURE  |
|         | 2.1 Food habits of shift workers.   |
|         | 2.2 Shift work and Body Mass Index (BMI).   |
|         | 2.3 Shift work and Lifestyle.   |
|         | 2.4 Health Problems of Shift workers.   |
| 3       | MATERIAL AND METHODS  |
|         | 3.1 Location.   |
|         | 3.2 Selection of the Sample.  |
|         | 3.3 Schedule and Data collection.   |
|         | 3.4 Analysis of Data.   |
| 4       | RESULTS   |
|         | 4.1 General Information   |
|         | 4.2 Nutritional Status  |
|         | 4.3 Dietary Survey  |
|         | 4.4 Biochemical Assessment  |
|         | 4.5 Food Habits   |
|         | 4.6. Health Problems  |
|         | 4.7 Associations between Shift Work and Food Habit                                      |
|         | 4.8 Association between Shift Work with Lifestyle Factors                               |
| 5       | DISCUSSION  |
|         | 5.1 Nutritional Status of Software Engineers  |
|         | 5.2 Lifestyle of the Software Engineers   |
|         | 5.3 Impact of Shift Work and Associated factors on the Health of the Software Engineers |
| 6       | SUMMARY AND CONCLUSIONS   |
|         | REFERENCES  |
|         | APPENDICES  |

## LIST OF TABLES

| Table No. | Title  |
|-----------|--|
| 1         | General Information of the Subjects  |
| 2         | Mean anthropometric measurements of subjects   |
| 3         | Classification of subjects based on BMI  |
| 4         | Classification of subjects based on WHR  |
| 5         | Mean weight of the subjects at the time of Joining and at present  |
| 6         | Association of Income with BMI   |
| 7         | Mean food intake of the subjects   |
| 8a        | Mean nutrient intake of the subjects   |
| 8b        | Mean fat intake of the subjects  |
| 9         | Biochemical Parameters of Subjects   |
| 10        | Consumption pattern of high energy foods   |
| 11        | Fluid consumption pattern of the subjects  |
| 12        | Food consumption habits of the subjects  |
| 13        | Smoking patterns of the subjects   |
| 14        | Alcohol consumption pattern of the subjects  |
| 15        | Exercise habits of the subjects  |
| 16        | Sleep pattern of the subjects  |
| 17        | Social and Family life of the subjects   |
| 18        | Health Problem Experienced By the Subjects   |
| 19a       | Association between shift work and food habit  |
| 19b       | Association between shift work and food habit  |
| 20a       | Association between shift work with Lifestyle factors (BMI and Exercise)   |
| 20b       | Association between shift work with Lifestyle factors (Smoking habits, Alcohol consumption and Sleep disturbances) |
| 20c       | Association between shift work with Lifestyle factors (Number of cigarette smoked & quantity of alcohol consumed)  |

## LIST OF FIGURES

| Figure No. | Title  |
|------------|--|
| 1          | Plan of Work (Sample and Data Collection)  |
| 2          | Pie- diagram showing the distribution of subjects according to BMI                           |
| 3          | Mean weight of the subjects at the time of Joining and at present                            |
| 4          | Percent nutrient adequacy of the subjects  |
| 5          | Biochemical Parameters of the subjects   |
| 6          | No of subjects smoking before joining the job and at present                                 |
| 7          | Quantity of alcohol consumed by the subjects before joining the job and at present situation |
| 8          | Health Score of the subjects based on life style indicators                                  |

## LIST OF PLATES

| Plate No. | Title                               |
|-----------|-------------------------------------|
| 1         | Data collection                     |
| 2         | Anthropometric measurements         |
| 3         | Diet survey                         |
| 4         | Drawing the blood from the Subjects |

## LIST OF APPENDICES

| Appendix No. | Title   |
|--------------|---|
| I            | Nutritional Profile For Shift Workers             |
| II           | Nutritive value of some of the energy dense foods |

# 1. INTRODUCTION

Generally work schedules follow the sun. But working at nights or at irregular times has become a regular phenomenon in recent years. This phenomenon is known as shift work, which is the need and demand of modern society. Shift work is an employment practice designed to make use of the 24 hours of the clock, rather than a standard working day in normal day light hours (i.e. 9am to 5pm).

Shift work involves hours of employment during non-standard or alternative hours, and for Saturday and Sundays, i.e., work outside of typical day schedule of 8 am to 5 pm from Monday-Friday (Presser, 2003). Shift work may be of 8 hours in duration, which includes working on morning, evening and night shift. The duration of a shift could also be of 12 hours with one day shift and the night shift.

Shift work can be organised around fixed or rotating patterns. If fixed, the employee works, in the evenings or nights on a continuing basis. In rotating shift, the employee may work alternately between day, evening and night shifts. On-call shift, is a special form of shift work, where in case of emergency; the particular group of workers are called for their duties. Split shift, is the shift where the workers work for four hours in the morning and four hours in the evening. The most wide spread shift system is of eight hours, commonly morning, evening and night shifts.

According to International Labour Office, shift work is defined as ; “a method of work organisation under which groups or crews of workers succeed each other at the same work stations to perform the same operations, each crew working a certain schedule or shift”.

Essential services provided by police departments (military, police and security), fire brigades, ambulance officers and hospital employees have traditionally, always operated throughout a 24 hour period. Increasingly other services such as restaurants, petrol stations, and convenience stores, Business Process Outsourcing (BPOs), customer service (call centres, help desks and receptions), soft ware companies, bars, restaurants, transportations, television and radio broadcasting, repair centres etc. are open 24 hours in order to meet the demand of the population worldwide.

The past few decades have witnessed a tremendous growth in the population of shift workers, especially in developed and highly industrialised countries. Developing countries are also not free from experiencing this phenomenon. Approximately 14.5 million full time workers regularly work an alternate shift, i.e, they work in night, evening, rotating or split shifts. This is almost 15% of work force, which represents a substantial portion. In Netherland and France, the shift workers were estimated to be around 19% and 21% respectively. In Canada, at present about 2 million people (23%) of the 8.5 million full time workers, work in shifts. (Shift work survey, 1999). Industrialization in India and in other countries has lead to the widespread adoption of 24 hour continuous operations in a number of industries. This has resulted in an increase in the proportion of the population routinely engaged in shift work. Although the effect of shift work on health has been studied extensively in other countries, in India very few studies have been carried out.

Human body's “biological” clock helps in maintaining complex internal functions throughout a 24-hour day. A number of physiological functions show distinct rhythmic changes in the course of a 24 hour period, known as circadian rhythms. The human body is meant to be active during the day time hours and in night, it is meant to sleep, which allows it to recover and replace energy. Working at night and sleeping during the day is opposite to the body's biological clock. This makes sleeping difficult; it may also mean that the body cannot recover as quickly from physical and mental exertion/ demands. Many other functions of the body including temperature, digestion, heart rate and blood pressure fluctuate throughout the day.

Circadian rhythms have been found to be associated with changes in mental and physical performances. Circadian rhythms may partly explain why job performance can vary over a 24-hr period, with a low point occurring very late at night or very early in the morning. Shift work has been shown to have deleterious effects on the health of the employees. These effects may be substantial, such as sleep disruption, decreased alertness resulting in poor

performance, long-term effects may include chronic fatigue, sleep disorders and psychological and physical illness.

Around twenty percent of individuals in the industrialized countries have irregular work hours, a situation that causes changes in their feeding cycle. There is only limited knowledge on the metabolic and endocrine responses to these changes. The endocrine milieu may therefore be less suitable for food intake during the night and the nocturnal hormonal pattern might be involved in the high incidence of obesity and cardiovascular diseases in shift workers. ( Holmback *et al*, 2003)

As people work in irregular hours, their daily routine is interrupted; regular eating and exercise habits are difficult to maintain. Studies also showed shift workers have a higher prevalence of being overweight. Study on weight and BMI in day and shift workers, found similar Body Mass Indices in day and shift workers, but reported more centrally deposited adipose tissue in shift workers. Changes in lifestyle, particularly dietary habits (such as eating fewer meals and more snacks), have been suggested as explanations for finding links of shift work with BMI. Other recent evidence suggests that shift workers take smaller amount of energy and nutrients than day workers. Evidences also suggested that changed eating habits and other life style changes (including reduced exercise), among shift workers may lead to increase in BMI, which in turn contribute to higher level of hypertension and cardiovascular risk associated with shift work.

In addition, shift workers also have more adverse life style behaviours, such as higher tendency to smoke and drink alcohol. These daily habits (diet, exercise, smoking and alcohol consumption) and their immediate consequences (e.g obesity) are the fundamental cause of chronic diseases. An unhealthy diet often leads to overweight which leads to Circulatory diseases, Diabetes mellitus and various forms of cancers. Lack of exercise is closely associated with food related ill health and obesity. Cigarette smoking has been identified as a classical risk factor for coronary heart disease. Alcohol consumption levels and drinking patterns seem to vary between different industries and workplaces and there may be differences in alcohol use between different work environments within the same branch of industry. Alcohol habits also appear to vary between day workers and shift workers. Shift workers have reported higher levels of alcohol consumption, frequency of heavy drinking, and proportion of alcohol-related problems. So, the impact of shift work on people's daily health habits and adverse health outcomes should be well understood.

Shift workers also reported more interference to their family lives, especially in terms of time available to spend with their wives and children. Studies found significant association between the extent to which shift workers perceived that their work schedule interfered with their ability to fulfil roles as spouses or parents and self-reported psychological and psychosomatic disturbances.

Currently, about 25% of the labor forces in industrialized countries are involved in some form of shift-work. While there are many advantages in having greater availability of around-the-clock services, such as increase in productivity and profit, there are disadvantages associated with shift-work. Night-shifts in particular, disturb the sleep/wake patterns of individuals as they are often required to sleep during the daylight hours. Past research has suggested that daytime sleep is typically 2–4 hours shorter in duration than that of night-time sleeps. Furthermore, field studies have shown that many shift workers report higher levels of sleepiness during night-shifts as compared to day-shifts. (Jay *et al*, 2006)

Some of the most common health problems identified in shift workers are gastrointestinal complaints including constipation, diarrhoea, excessive flatulence, abdominal pain and heart burn. These ailments are two to three times more frequent among them. The causes are poor eating or diet high in saturated fats. Too much fast food is consumed because of constant tiredness and lack of time to prepare healthy foods. Also the body secretes certain hormones like adrenaline, which is required to cope with stressful situations. These hormones are secreted more during day time and late nights taking a toll on a person's physical and mental wellbeing.

Heart disease is an added risk. Increased consumption of fast foods, especially those high in fats, can increase cholesterol levels in the blood stream, leading to coronary heart disease. Higher levels of smoking among shift workers exacerbate the danger. Studies found

that over a five year period, rotating shift workers had a 40 to 50per cent increased risk of heart disease compared to day workers.

Studies also suggested that, working night shift is associated with higher rate of cancer. This may be due to alteration in circadian rhythm. The production of melatonin, a known tumour suppressant, generally produced at night is disrupt in late shifts. The World Health Organization's international agency for research on cancer listed "shift work that involves circadian disruption" as a possible carcinogen in 2007.

Unfortunately, shift work is the part and parcel of today's fast life in the working atmosphere- be it call centre, Business Process Outsourcing (BPOs) or even soft ware companies, which needs people working nights to provide technical expertise for their clientele abroad.

Over the past century there has been a large decline in individual physical activity. Computer-related occupations have become more common and it involves high levels of sitting time and lower demand for physical activity. These types of jobs may play a role in the growing problem of overweight and obesity. The negative impact of shift work on individual shift pattern, eating habits, physiological disorders and psychological disorders, called for the present study with following objectives:

1. To assess the nutritional status of shift workers
2. To assess the life style in shift workers
3. To document their health problems

## 2. REVIEW OF LITERATURE

Shift work is an employment practice designed to make use of the 24 hours of the clock, rather than a standard working day. Shift work may be of many types. The rotational shift work is where a day may be divided into three shifts, each of eight hours having starting time 6.30 am for the morning shift, 2.30 pm for the evening shift and 10.30 pm for the night shift.

Shift work exerts major influences on the physiological, psychological and pathological functions of the human body. Now a day's, shift work related disorders are common medical problems. Therefore a distinct field of research has focused on the identification of specific shift work related issues. The strongest evidence exists for an association of shift work and food habits, BMI, life style and certain medical conditions are mentioned below. The reviews are being classified under the following headings

2.1 Food habits of shift workers.

2.2 Shift work and Body Mass Index (BMI).

2.3 Shift work and Lifestyle.

2.4 Health Problems of Shift workers.

### 2.1 FOOD HABITS OF SHIFT WORKERS

In order to maintain optimum nutrition, an individual must consume diet, which supply adequate amount of all nutrients. Excess consumption of nutrient can lead to obesity. Below are some reviews which show the food intake practices of shift workers.

Romon *et al.* (1993) in France studied a circadian variation of energy expenditure in response to Diet Induced Thermogenesis (DIT) that could favour weight gain among night workers, who used to eat snacks at night. Nine young men were given the same meal at 9.00am in the morning session, at 5.00pm during the afternoon session, at 1.00am during the night session. Their energy expenditure was measured and Diet Induced Thermogenesis (that is increase in heat production by the body after eating) was also calculated. Morning DIT was significantly higher than afternoon which was higher than night. So in conclusion, the time when a meal is consumed, affects the thermogenic response and favours weight gain among night workers.

A study was conducted by Lennernas *et al.* (1995) to know the impact of work hours on eating habits and the dietary intake of 96 male industrial workers on day work and two and three shift work was investigated in Sweden. Results suggested that, the energy intake and the quality of food intake were not affected by shift work, although the intake of carbohydrates was lower in day and three shift workers during off days.

A cross sectional study was conducted by Lasfargues *et al.* (1996) to investigate dietary intake, behavioral habits and clinical and metabolic differences in 1200 night workers and compared to day workers in France. Findings supported that night workers had poorer dietary habits and metabolic profiles compared to day workers.

Lund *et al.* (2001) investigated the responses to standard meals at different circadian times in a group of night shift scientists and support workers at Halley Bay in Antarctica. Twelve healthy subjects (10 men and 2 women) aged 24-34 years ( $28 \pm 1.9$  years) and weighing between 60-88 kg ( $74.3 \pm 6.5$  kg) were studied, their post prandial hormone and metabolic responses to an identical mixed test meal of 3330KJ were measured on 3 different occasions i.e. i) during normal day time working ii) at the beginning of night shift work and iii) day time on return from night shift to day work. Results indicated a significant increase in integrated post prandial glucose, insulin and Triacylglycerol (TAG) during the night shift compared to the day shift.

Study on effect of shift work on nutrient intakes in 44 day time workers and 93 weekly rotating shift workers in UK was conducted by Sudo and Ohtsuka. (2001). Results revealed that the shift workers (late shift workers) took smaller amounts of energy and nutrients than day workers.

An Investigation on the endocrine responses in relation to the time of the day during a 24h period in Sweden was done by Holmback *et al.* (2003). Seven males (26-43years and BMI 19.9-26.6 kg/ m<sup>2</sup>) were studied in a cross over design. The subjects were kept awake for 24 h in a metabolic unit and were served an isocaloric meal described as high-carbohydrates (HC; 65E% carbohydrates and 20E% fat) or high-fat (HF; 40E% carbohydrates and 45E% fat) every 4-h. Results showed insulin, Pancreatic Polypeptide (PP), Thyroid Stimulating Hormone (TSH), free thyroxin (fT4), cortisol and leptin responses to meal intake differed with respect to time of day. The decreased evening /nocturnal responses of cortisol and PP to meal intake indicate that nocturnal eating and night work might have health implications.

A study was conducted by Waterhouse *et al.* (2003) on 50 day workers and 43 night workers in Liverpool, UK to assess the difference in eating habits between night and day workers. Results found that night workers evidenced a significantly altered food intake with a greater frequency of cold rather than hot foods.

Naimi *et al.* (2004) compared the metabolic effect of snacks/meals as normally be consumed throughout a period of night or day shift work in UK. Eight healthy non obese men (20-33 years, BMI 20-25 kg/m<sup>2</sup>) were selected for the study. They were kept awake for 24 hour and served with the meals and snacks at every 6 hours. Results indicated significant effects of shift work on plasma TAG (triacylglycerol), plasma glucose with higher levels on simulated night shift compared to day shift.

Pasque *et al.* (2004) conducted a study aiming at verifying the nutritional status of fixed shift workers at a transport company in the city of Saopaulo, Brazil. The study was conducted on 28 workers of three fixed work (morning, afternoon, and night) shifts of mean age 32.8 (SD  $\pm$ 5.3). No statistically significant relationship of shift schedule was found on nutritional status as measured by BMI.

Reeves *et al.* (2004) conducted a study with the aim to investigate the effect of shift work on food intake and eating habits in 36 shift workers in US. The results revealed that night shift workers did not eat as much as day workers but ate smaller meals and snacks over a greater time frame. It can be summarized that shift work is a factor in the timing of food consumption, and lead to poor eating patterns.

An investigation was carried out by Jay *et al.* (2006) on the suitability of a caffeinated energy drink for night shift workers in Australia. In a randomized cross-over design, 15 young adults participated in a simulated night shift protocol in 2 conditions, Functional Energy Drink (FED) and Non-Functional Energy Drink (Non FED) and the sleepiness was assessed. Results explored a decrease in 29.1 minutes in total sleep time in the FED condition.

Love *et al.* (2007) investigated the alertness in shift workers after consumption of medium-fat, medium-carbohydrate meals in University of Alberta, Edmonton. Six subjects (4 men, 2 women) aged 19-44 years working in night shift (at baseline and during test period) were taken for study. Results pointed out that after consumption of test meal (987 Kcal, 46% carbohydrate, 42% fat) the score improved significantly compared to baseline low-fat, high-carbohydrate meal (1335 Kcal, 56% carbohydrate, 28% fat). This shows meal composition during night shift may affect cognitive performances.

The effect of shift work on nutrient intake was evaluated in Japan by Morikawa *et al.* (2008). The study population included 2,254 male workers 20-59 years of age and classified as i) fixed day workers, ii) shift workers without mid night shifts, iii) shift workers with mid night shifts, employed in a factory. In conclusion there were no significant differences in nutrient intakes between fixed day workers and shift workers without mid night shift, but the nutrient intake was affected in case of shift workers with mid night shift.

So from the above few studies it can be summarized that the eating pattern is affected more in case of shift workers compared to the day workers ultimately leading to poor eating habits.

## 2.2 SHIFT WORK AND BODY MASS INDEX (BMI)

The Body Mass Index (BMI) is a recent valid index to assess the nutritional status of individual. Below are the few studies which describe the association between shift work and BMI.

Niedhammer *et al.* (1996) studied 469 nurses for 5 years and found that weight gains (more than 7 kg) were more frequent among nurses on night work than on day time work.

An effort was made to determine whether weight gain was more prevalent in workers on late shifts than on day shifts in New York, USA by Geliebter *et al.* (2000). Data were analyzed for 85 subjects, (36 day shift, 49 late shift). The results showed mean weight gain of 4.3 kg in late shift workers compared to 0.9 kg for day shift group. Late shift workers reported eating fewer meals ( $1.9 \pm 0.9$  SD) than day shift workers ( $2.5 \pm 0.9$ ).

A study was conducted to know the shift pattern and its interaction with age, BMI on 787 day shift or day –night shift workers in Oxford University by Parkes *et al.* (2002). The results revealed the significant interaction effect with day-night shift with increase in BMI.

Croce *et al.* (2007) conducted a study to assess the difference in BMI between day and shift workers, in relation to diet quality and physical activity in Italy. The study included 341 male subjects (165 day workers and 176 shift workers). Results indicated that shift workers had higher BMI than day workers ( $27.6 \pm 3.9$  Vs  $26.7 \pm 3.6$ ). The diet quality was better in the shift workers and physical activity was similar in the two groups.

A research was conducted by Morikawa *et al.* (2007) on 1529 male blue collar workers, aged 19-49 yrs working in a sash and zipper factory in Japan to know the effect of shift work on metabolic disturbances. Results indicated mean increase in BMI was  $1.03 \text{ kg/m}^2$  for shift workers compared to day workers.

Boyea *et al.* (2008) determined relationship between BMI, weight gain, ergonomics and exercise variables in 395 United States call center employees. Results demonstrated a substantial weight gain over a period of 8 months in the participants

From the above studies it can be conceptualized that weight gain is a common problem in case of shift workers. Changes in the dietary habits (such as eating fewer meals and more snacks) have been associated with shift work and increase in BMI.

## 2.3 SHIFT WORK AND LIFESTYLE

Life style reflects both work and leisure behavior patterns like individual's basic activities, attitudes, interests etc. It also includes the daily health habits measured in terms of exercise, smoking or alcohol consumption, sleeping habits, family and social activities. Below are some studies showing the association between shift work and its life style.

### 2.3.1 Shift work and Alcohol consumption

Increase in physical and social availability of alcohol increases the rate of consumption and alcohol related problems. Physical availability refers to the extent to which there is access to alcohol or cost associated with it. Social availability refers to the degree of normative support for drinking within one's social environment. Though, it is now a days a common problem very few studies are available in this field, which are given below.

Smart *et al.* (1979) made an effort to know the relationship between drinking problems and shift work, in 993 persons in Durban, Toronto. The study showed the highest levels of alcohol related problems and symptoms in shift workers. It also reported more drinking in shift workers.

Hermansson *et al.* (2003) in their study investigated, whether there is any difference between permanent day and shift workers in high risk alcohol consumption, in Sweden. Out of 990 employees (day, two shift and three shift workers) 194 (20%) were positive. There was no significant difference in the screening results between the day and shift workers but more subjects from two shift work schedule (odds ratio = 0.5, 95% confidence interval = 0.3–0.9) screened positive. Thus higher alcohol consumption was reported by two shift workers group.

Uetani *et al.* (2006) conducted a study to clarify the influence of shift work and other factors on serum Uric Acid (UA) levels in Japanese workers. For the study 15,871 workers of the telecommunication company were taken. Results clarified that in males shift work, BMI, consumption of alcohol and little consumption of vegetables were positively associated with the development of increased serum UA ( $\geq 8 \text{ mg/dl}$  in males,  $\geq 6 \text{ mg/dl}$  in females). In case of females, age, BMI and smoking were positively associated with the development of increased serum UA.

So from the above studies it can be summarized that shift workers have reported higher levels of alcohol consumption, frequency of heavy drinking, and higher incidence of alcohol-related problems.

### 2.3.2 Shift work and Smoking Habits

Cigarette smoking is widely practiced all over the world by all classes of people. Excess indulgence in smoking is believed to be injurious to health. Public concerns in recent years over the increasing prevalence of smoking had prompted the researchers to try and determine the relation of shift work and smoking.

Yamada *et al.* (2001) compared the psychosomatic health and unhealthy behavior between 338 workers in clean rooms producing electronic parts in 12 hours shifts and 95 workers in 8 hours shifts and 284 in day time management, clerical and engineering workers, Uchinada, Japan. Results suggested that 12 hours shift workers showed significantly lower fitness level, compared to 8 hours shift workers and day time workers. The tendency to have higher cigarette and alcohol consumption were observed in the 12 hours shift workers. So it can be noted that the 12 hour shift work may have contributed to unhealthy behavior resulting in low physical fitness.

Amelsvoort *et al.* (2005) in The Netherlands conducted a research to assess whether smoking is more frequent among shift workers as compared to day time workers. A total of 7819 employees (out of them 2039 were shift workers) were taken for the study. Results showed shift workers are more often smokers and have significantly higher risk to take up smoking as compared to day workers.

Lin *et al.* (2005) assessed the prevalence of cigarette smoking in female employees of two Taiwanese micro- electronics companies. Total 1950 female employees (day workers and shift workers) were surveyed for their smoking habits. The prevalence of smoking in shift workers was found to be 14 per cent. The result indicated that shift work was an important factor in determining cigarette smoking in study participants.

From the above studies it can be concluded that shift workers differ from day workers in term of alcohol and smoking habits.

### 2.3.3 Family and social life of Shift workers

Due to non standard work schedule the workers don't get enough time to spend with spouse. This will lead to child care related problems, higher divorce rate. Below are the few studies which describe the family and social life of shift workers.

A research was carried out by Staines *et al.* (1984) on 1090 workers working in nonstandard pattern of days. The study was carried out by American Psychological Association. Results supported the significant association between nonstandard pattern work (shift work) with less time by family roles, higher levels of conflict in family life and lower levels of family adjustments.

White *et al.* (1990) studied 1668 married women and men to assess the notion that shift work damages the marital quality. Results suggested that shift work was found to increase the probability of divorce from 7 per cent to 11 per cent over the three year period.

Smith and Folkard. (1993) surveyed 74 female partners of United Kingdom nuclear power shift workers to know their spouse's shift work affected them personally. Results showed 53.3% rated themselves to be fairly unhappy or very unhappy about husband's shift work, which was significant.

A study conducted in the University of Maryland by Presser.(2000) on 3474 married couples to examine the extent to which working in the evening, night or rotating schedules affects the likelihood of marriages ending in separation or divorce within 5 years. Results indicated that, among men those who were working fixed night shifts, the chances of separation or divorce was 6 times more than their day counterparts. In case of women the chances are 3 times more.

Preston *et al.* (2000) made an effort to examine how rotating shift schedule shaped house hold strategies with regard to child care and unpaid domestic work. Study sample included 90 male newsprint mill-workers and their spouses in Canada. The findings revealed

that adjusting to shifts fell mainly on the spouses of the mill workers who felt constrained regarding childcare by the demanding regimen of their partner's shift.

Grosswald (2003) conducted study on a representative sample of 2,429 United States workforces to study the relationship between shift work and work to family spillover. Results revealed that among evening, night, rotating and split shifts the rotating shift work showed a significant strong, positive relationship to high negative work to family spillover.

A study was designed by Demerouti *et al.* (2004) to test the impact of rotation and timing of shifts on work-home conflict, job attitudes, health and absenteeism among military police, in The Netherlands. A total of 3122 employees participated in the study. Results identified that job rotation was mostly related to unfavourable job attitudes, where as timing was clearly related to increase work-home conflict.

In summary shift workers find difficulty in child care, less time for children. They even have not enough time to spend with spouse and have higher divorce rates compared to day workers.

## 2.4 HEALTH PROBLEMS OF SHIFT WORKERS

Shift work is associated with symptoms such as general health symptoms such as sleep disturbances, fatigue, common infections etc. Changes in eating habits and lifestyle (reduced exercise) also contribute to higher chances of cardiovascular risk, hypertension, cancer, digestive disorders. Below are few reviews where the focus is on major diseases related to shift work.

### 2.4.1 General Health problems of Shift workers

Below are few studies which show the impact of shift work on people's daily health habits and adverse health outcomes.

Kandolin. (1993) conducted a study on 124 mental health nurses and 162 nurses of mentally handicapped persons, among them 52 per cent were in three-shift work and other half worked in two shifts in Vantaa, Finland. The objective was to analyze the psychological stress of nurses in two and three shift work. Results explored that female nurses in three shift work reported more stress symptoms and had ceased to enjoy their work more often than women in two shift work.

Khaleque. (1998) compared the quantity and quality of sleep, health and well being of 60 industrial shift workers in The Netherlands. Results suggested that night shift is the most disruptive of all the shifts in terms of sleep deficiency and health complaints.

Furnham *et al.* (1999) examined psychological correlates of night work on different television workers in UK. 312 participants working night shift or day shift were studied for job satisfaction. Results indicated that night workers compared to day workers reported lower job satisfaction.

A study by Boggild *et al.* (2001) was conducted on 5940 employees in Denmark and collected information on work schedule (permanent day work , two shift or fixed evening and three shift or fixed night ), length of work week, physical factor (smoking, repetitive task etc.), psychological factors( conflict, job insecurity etc.) Results stressed that conflicts at work and low decision latitude were higher among all group of shift workers.

Harma *et al.* (2002) studied the occurrence of an irregular shift system in Finland. A total of 126 randomly selected male train drivers (Tdrs) and 104 railway traffic controllers (Tcos) were investigated. Severe sleepiness was reported in 49per cent (Trds) and 15 per cent (Tcos) of night shifts and in 20% (Tdrs) and 15% (Tcos) of the morning shifts.

Kim *et al.* (2002) performed a study to investigate the effect of shift work, in terms of general health concepts, insomnia, stress, quality of life and psychological health, at several manufacturing plants, Korea. Data was collected from 850 shift workers (Study group) and 550 non shift workers (Control group). Results indicated that shift workers suffered from physical and psychological distresses sleep problems (200 shift workers were classified as insomnic, in non shift workers the figure was 84) and stressed than non shift workers.

Melamed *et al.* (2002) examined the possible association between Excessive Daytime Sleepiness (EDS) and risk of occupational injuries in non shift day time workers in Israel. The participants were 532 non-shift day time workers. Results stated 22.6 per cent workers had experienced EDS and it was associated with an increase risk of sustaining a work injury (Odds Ratio= 2.23, 95% Confidence Interval) even after controlling the environmental conditions.

The prevalence of common infections among employees in different work schedules in The Netherlands was studied by Mohren *et al.* (2002). Data was collected from n=12,140 day and shift workers. It was revealed that shift work was associated with a higher risk for common infections compared to day work.

Eight hundred and seventeen (n=817) staff members of a psychiatric hospital, U.S.A. were examined by Ohayon *et al.* (2002) to evaluate sleep and mental disorders. The samples included fixed day time workers (n=442), rotating daytime shifts (n=323), night workers (n=52). Results indicated that rotating daytime shifts reported difficulty in initiating sleep (20.1%) compared to fixed daytime workers (12.1 %). Sick leaves in past 12 months were more in rotating shift workers (62.8%), followed by 51.9 per cent in night shift workers and 38.5 per cent in dayshift, workers.

Jansen *et al.* (2003) described the prevalence of fatigue among employees in different work schedules (day work, three-shift, five shifts and irregular shift work) in Netherlands. Data was collected from n=12095 workers for consecutive four months period from a coherent study. Results elucidated that the prevalence of fatigue was 18.1 per cent in day workers, 28.6 per cent in three shift, 23.7 per cent in five shift and 19.1per cent in irregular shift workers.

Amelvoort *et al.* (2004) conducted a study on 95 workers in forward rotating three-shift-work and 681 workers in backward-rotating three shift work in Netherlands. Results pointed out a backward rotation schedule was related to an increased need for recovery (relative risk 2.88, 95% Confidence Interval) and poor general health (RR 3.21, 95% Confidence Interval) as compared with forward rotation schedule.

Drake *et al.* (2004) studied 360 people working in rotating shifts, 174 people working in nights and 2036 working in days of metropolitan Detroit, Michigan. Results suggested that the prevalence of shift work sleep disorder was approximately 10 per cent of the night and rotating shift work population.

Keneko. (2004) examined the effect of shift work on the life style of female factory workers for three consecutive years, (n=488, 2000; n=386, 2001; n=159, 2002) in Japan. Male subjects were also included for the study. Results indicated female shift workers faced more difficulty to maintain healthy habits in comparison to women who don't do shift work.

Lac and Chamoux *et al.* (2004) conducted a study on sixteen day workers served as reference group, 16 shift workers of age group 23- 56 years from a same company in France. All subjects had comparable age and BMIs. Results indicated that shift workers expressed a higher stress level and frequency of health problems and a lower satisfaction at work than the control group.

The relationship between shift work and job stress was assessed by Harda *et al.* (2005). Subjects were 4962 male workers (3078 day workers and 1884 shift workers) aged 18-60 years, Japanese steel company. The study revealed that the three shift system increased work related stress.

An investigation by Nishitani *et al.* (2006) was carried out to know the relation between subjective poor sleep and white blood cell (WBC) count. The subjects were 208 male Japanese workers in a synthetic fiber-manufacturing plant. The WBC count was greater in shift workers than day workers and shift workers complained of poor sleep more frequently.

Tamagawa *et al.* (2007) explored the criteria for shift work tolerance from eighty nine (89) policemen and policewomen in Newzealand. Results suggested that tolerance of shift work was associated with anxiety repressive emotional style and mood. During night shift, anxiety was the most influential personality factor for the somatic health.

An examination was conducted by Zhao *et al.* (2008) to know the association between shift works and people's daily health habits. The targeted populations were working adults engaged in shift work, in Australia. The results confirmed that shift work affects negatively on daily health habits and can lead to adverse health outcomes.

The studies described the adverse effect of shift work in terms of sleep disturbances, fatigue, depression, mood changes; stress etc. sleep loss can lead to chronic fatigue, anxiety and decrease alertness.

#### 2.4.2 Shift work and cardiovascular disease

Working in irregular hours, including shift work, has been found to be associated with higher levels of lipid. These are some of the reviews which show the relationship between shift work and the possible risk of developing atherosclerotic changes. Shift workers are more likely to suffer from variety of diseases including cardiovascular disease.

Theorell *et al.* (1976) conducted study with the objective to observe changes in cholesterol, uric acid, glucose and potassium in serum in two groups of railway workers (n=16 and n=17) on day and night work, New York. Results pointed out significant elevations in serum levels of cholesterol, glucose, uric acid and potassium in night workers.

Alfredsson *et al.* (1982) carried out a study on 334 shift workers and 882 control groups, by random sample technique to assess the risk of myocardial infarction in Sweden. Results identified that shift work was associated with myocardial infarction (relative risk (RR) =1.25, 95% Confidence Interval).

A study was designed by Knutsson *et al.* (1990) to assess changes in diet and serum lipoprotein in 12 shift workers and 13 day workers in Sweden. Results focused on the increase in ratio between Apo B and Apo A-1 lipoproteins by 18 per cent in shift workers compared to 5per cent in day workers.

Romon *et al.* (1992) studied the relationship between shift work and Serum lipid levels in 109 persons, from the 2 plants of northern France: a chemical and nuclear power station. Results revealed that shift workers had significantly higher levels Serum triglycerides (1.26 mmol/L versus 1.03 mmol/L), but cholesterol and HDL levels were similar for the two groups and day workers had higher alcohol intake (15.64 g/d versus 9.3g/d) compared to shift workers.

Nakamura *et al.* (1997) studied three-shift workers (n=33) and two shift workers (n=27) and compared them with day workers to determine the association between shift work and risk factors for coronary heart disease (CHD) in Japan, male blue collar workers. The average age of shift workers and day workers were 34.5 (SD=7.1) and 32.7 (SD=7.6) respectively. Serum total cholesterol levels of three shift, two shift and day workers were 5.70 (SD=1.19) mmol/ L, 4.81 (SD=1.01) mmol/L, 4.98 (SD=0.95) mmol/L respectively and the cholesterol level of three shift workers were significantly higher than other workers.

Amelsvoort *et al.* (2004) investigated the risk of cardiovascular disease in shift workers. The study sample included 239 shift workers and 157 daytime workers in USA. Results pointed out that there is significant decrease in LDL/HDL ratio (-0.33), Cigarettes smoked per day increased significantly in shift compared with day time workers (+ 1.42 and - 1.03).

Ellingsen *et al.* (2007) investigated the relation of shift work on CHD in a cohort of men from Asian races working in a fertilizer plant in the Middle East. The medical records of 2562 staffs (648= shift workers, 1914=day time workers) were surveyed and 223 employees had cardiovascular event. Results suggested that CHD is significantly higher in shift workers (13.5%) compared with daytime workers (7.1%).

Nazari *et al.* (2007) examined the relationship between shift work and dyslipidaemia among 148 male workers from one factory in Kota Bharu, Malaysia. The prevalence of hypercholesterolaemia (47.4%) and hyper triglyceridaemia (42.1%) were significantly higher among shift workers compared to day workers.

An evaluation by Rahman *et al.* (2007) to find the change in serum lipid profile in apparently 30 healthy shift workers and 30 non shift workers, aged ranged from 20-50years to identify the risk of atherosclerosis in Bangladesh. Results mentioned that the mean serum

total cholesterol and LDL- cholesterol levels were significantly higher in shift workers compared to those of non shift workers.

Male workers (n=5510) were surveyed by Dochi *et al.* (2008) to know the influence of shift work on total cholesterol levels in Japan. The results showed shift work was a potential risk factor for hyper cholesterolaemia among male Japanese workers.

Sakata *et al.* (2008) assessed the effect of shift work on the serum cholesterol levels in male Japanese workers in a steel company (n=5510) workers. The odd ratio (OR) for shift work with respect to the onset of hypercholesterolemia was 1.01 and other significant covariates were age, BMI, HbA1c, gamma-GTP and alcohol consumption.

Dochi *et al.* (2009) conducted a study with the objective to assess the effect of shift work on serum total cholesterol as an index of lipid metabolism in day workers (n=4079) and alternating shift workers (n=2807) in a Japanese steel company. The significant odds ratios of alternating shift work tended to be higher for serum total cholesterol affecting adversely the lipid metabolism.

The impact of shift work on metabolic syndrome in a population of 98 strictly rotating shift workers (3X8h) compared to paired counter part of 100 regular day workers in France was studied by Esqurol *et al.* (2009). Results indicated rise in triglycerides, free fatty acids and gamma glutamyl trans peptidase and lower HDL cholesterol.

The studies explored that shift work influences the lipid metabolism and the alternating between day shifts and night shifts may be particularly deleterious to the health of the worker. These reviews say that shift work directly reduces cardiovascular health. Broken sleep, lifestyle problems and increased stress are thought to be potential mechanisms through which shift work increases the risk of CVD. Several studies have reported that elevated serum triglycerides and lower concentration of HDL-cholesterol tend to occur more frequently in shift workers than in fixed day time workers.

#### 2.4.3 Shift work and Hypertension

Hypertension is an elevation of blood pressure. It is often called high blood pressure. Now a day's hypertension is seen much more frequently at very younger age in shift workers. Obesity and diabetes also contribute along with shift work. Below are some reviews on the association of shift work with hypertension.

Yamasaki *et al.* (1998) conducted study on 99 nurses working in day shift (n=61), evening shift (n=11) and night shift (n= 27) to evaluate effect of shift work on the diurnal rhythm of blood pressure. Regression analysis indicated that evening and night shift workers had a 5.4mm Hg smaller drop than day shift workers.

The influence of shift work on metabolic and cardiovascular risk factors in 319 glucose tolerant male subjects aged 35-60 years working in Apulia, Southern Italy was examined by Lorenzo *et al.* (2003). Results opined that shift work was directly responsible for increased body fat and indirectly associated with higher blood pressure levels.

Sakata *et al.* (2003) assessed the effect of shift work on the onset of hyper tension in 5338 worker in a Japanese Steel Company. The odds ratio of the onset of hypertension in shift worker for day time workers was 1.10 and significant.

Oishi *et al.* (2005) investigated whether shift work affects progression from mild hypertension to severe hypertension in 6495 male workers in a Japanese steel company. Findings demonstrated, job schedule was significantly associated with progression from mild to severe hypertension.

A research was conducted by Yang *et al.* (2006) to know the association between shift work and hypertension in California. The shift workers working for i.e. 40 hours per week, 41 to 50 hours per week and more than 51 hours per week were compared with those working between 11 and 39 hours per week. Results revealed that, individuals working 40 hours per week were 14 per cent more likely to report hypertension, who worked between 41 and 50 hours per week were, 17 per cent more likely to report hypertension and > 51 hours per week were 29 per cent more likely to report hypertension.

Chen *et al.* (2008) studied to determine the hemodynamic effects of 12 hours shift on blood pressure and heart rate variability (HRV), in Taiwan. 15 male shift workers with a mean age of 32.9 years were studied and results showed 12 hours night shift work may be associated with delayed BP recovery.

Nazari *et al.* (2008) examined the relationship between shift work and hypertension among 148 male workers from one factory in Kota Bharu, Malaysia. The prevalence of hypertension was significantly higher among shift workers (22.4%) compared to day workers (4.2%).

Suwazono *et al.* (2008) conducted study to clarify the effect of shift work on blood pressure in Japanese men in day workers (n=2748) in a Steel Company. Study revealed that altering shift work was a significant independent risk factor for an increase in blood pressure.

From the above studies it is clear that the prevalence of hypertension was significantly higher among shift workers compared to day workers.

#### 2.4.4 Shift work and Diabetes Mellitus

Diabetes Mellitus is a chronic metabolic disorder that is the result of an abnormal insulin metabolism. Changes in the dietary habits and life style (such as eating fewer meals, more snacks, and alcohol or cigarette consumption) have been associated with shift work and increase in BMI ultimately raises the chances of diabetes. Below are few reviews describing the association of shift work with diabetes.

A cohort study by Morikawa *et al.* (2005) was conducted on 2860 male fixed day blue collar workers, shift blue-collar workers and white collar workers in a sash and zipper factory in Japan for the risk factor of diabetes mellitus. Among the 2860 workers, there were 87 cases of new onset of diabetes, resulting in an incidence rate of 4.41 per 1000 person per year. The relative risk of diabetes mellitus for the two-shift workers and the three shift workers compared with the fixed day time workers was 1.73 and 1.33 respectively.

Suwazono *et al.* (2006) investigated the effect of alternating shift work (ASW) on the onset of diabetes mellitus, in a steel company, Japan. Longitudinal study included day shift workers (DSW) (n=3203) and alternate shift work (ASW) (n=2426). Subjects were studied for a period of 10 years. The odds ratio for development of diabetes mellitus in the ASW group compared with DSW group was 1.35, indicating that shift work is a risk factor for the development of diabetes mellitus.

Results from the above studies suggested that serum concentration of glucose increased during night work. The prevalence of diabetes was found to increase with increasing exposure to shift work.

#### 2.4.5 Shift work and gastrointestinal problems

Gastrointestinal symptoms are very common in the general population. Below are few reviews which state the association of shift work with gastrointestinal problems.

Koller *et al.* (1978) investigated 300 workers at an Austrian oil refinery and found that the prevalence of endocrine and metabolic disease was 3.5% in shift workers and 1.5% in day workers.

In Japan Segawa *et al.* (1987) examined 11657 employees in factories, bank and school by endoscope. The prevalence of gastric ulcers was 2.38 per cent in shift workers as compared with 1.03 per cent in day workers. For duodenal ulcers, the prevalence was 1.37 per cent and 0.69 per cent for shift workers and day workers respectively.

A study was conducted by Wolfhagent *et al.* (1994) to describe the pattern of gastric pH, food intake, cortisol levels during changing shifts, in Europe. For the study 12 shift workers, 16 healthy controls and 15 patients with active duodenal ulcer were chosen. Results indicated no significant difference in median pH between either the different shifts or group of subjects. The pH value of < 3 was observed in shift workers which was in between the value observed between the control and duodenal ulcer patients.

Caruso *et al.* (2004) in a cross-sectional survey of 343 US auto factory workers, examined the relationship between work schedules and GI symptoms, medications, and

diagnoses. Findings suggest that evening shift and widely varying work times may increase risks for GI disturbances.

However, the studies pointed out that gastrointestinal disorder are more common in shift workers than in day workers as a result of irregular eating habits. Shift workers were at higher risk of experiencing ulcers, indigestion, and loss of appetite.

#### 2.4.6 Shift work and Cancer

Shift work also includes physical and mental changes; changes in hormone secretion caused by circadian rhythm are a contributory factor of cancer risk. Here are few studies showing the relation of shift work with the risk of cancer.

Davis *et al.* (2001) investigated shift workers (n=813, having experience of working at night), aged 20-72 years and control subjects (n=793), of same age group to analyze the relationship between exposure to light at night and risk of breast cancer in women, Farmington. Results indicated that, the exposure to light at night suppresses the melatonin production and increases the risk of breast cancer.

Schernhammer *et al.* (2004) conducted a study with the objective to know the effect of light exposure during night work on melatonin production and association of risk cancer with night work, Boston, Massachusetts. For the study the morning urinary measurements of 6-sulfatoxymelatonin was assessed in 80 premenopausal women who were on long term shift work. Results identified that women who work on rotating night shifts seem to experience changes in hormone levels that may be associated with increased cancer risk among night shift workers.

A study on 44 workers with a rotational shift schedule by Sharifian *et al.* (2005) was conducted, to evaluate the effect of night shift working on total plasma antioxidant capacity, Tehran, Iran. The mean age of samples were 36.57 years (SD: 10.18) and mean BMI 26.06 (SD: 4.37). The mean reduction of total plasma antioxidant capacity after the night shift was 105.8 mmol/L (SD: 146.39).

Kubo *et al.* (2006) studied the association between shift work and risk of prostate cancer among 14052 working men in Japan, in a large scale prospective cohort. The subjects were classified as day workers, rotating shift workers and fixed night workers. Results indicated that rotating shift workers were significantly at a risk for prostate cancer, (relative risk= 3.0, 95% confidence interval) compared with day workers, whereas fixed night work was associated with a small and non significant increase in risk

Viswanathan *et al.* (2007) conducted a study with the hypothesis that night workers may have an increased risk of endometrial cancer. In a prospective cohort study, 53487 women nurses surveyed, who were on rotating shift in US were included. Out of which a total 515 women had confirmed medical record of endometrial cancer. It was observed that women who worked 20+ years of rotating night shifts had a significantly increased risk of endometrial cancer.

Studies showed that low levels of melatonin along with exposure to light at night increased the risk of cancer.

#### 2.4.6 Shift work and Hormonal changes

A number of physiological functions show distinct rhythmic changes in a course of 24 hour period. There is change in the heart rate, body temperature and changes in different hormonal levels. Below are few studies which elucidate the effect of night work on certain hormones.

Axelsson *et al.* (2003) conducted a study to compare satisfied and dissatisfied shift workers with respect to major hormones. Total 42 shift workers were studied in Sweden. Results indicated that dissatisfied shift workers had lower morning testosterone than satisfied one.

Lac. and Chamoux (2003) conducted a study on 63 rotating shift workers for whom adaptation to shift work was evaluated through measurement of salivary cortisol levels at intervals of 2 hour during morning, evening and night shifts in France. Results showed that

there was rise in cortisol which was due to the sleep deprivation as a result of rapidly rotation shift pattern of morning, evening and night.

A study was conducted by Borugian *et al.* (2005) on hospital office staffs (n= 5) and nurses (n=17), in Canada working either rotating night shift or day shift to measure melatonin levels. Results indicated that rotating shift workers exhibited higher than normal melatonin levels.

Marilyn *et al.* (2005) conducted a study on 5 office workers and 17 nurses working either day or rotating night and day shifts to measure the melatonin levels, in Canada. Results focused that rotating shift workers had abnormally high melatonin levels on arising and during the day times, and normal or abnormally low melatonin levels during sleep.

A cross sectional study by Grundy (2008) was conducted among 61 rotating shift nurses at Kingston, Canada to know the light intensity exposure and melatonin levels. A statistically significant inverse association between light exposure and urinary melatonin levels was observed, how ever there was no significant relationship with shift schedule.

Above studies summarized that due to night shift there are changes in the internal hormone levels, which also suggests that people are not well suited for night work.

### **3. MATERIAL AND METHODS**

A study entitled “The Impact of Shift Work on Nutritional Status, Lifestyle and Health Status of Shift workers” was carried out during 2009-2010 at various software industries in Bhubaneswar, Orissa. The details of the materials used and methods adopted in the present study are described here under the following headings.

- 3.1 Location.
- 3.2 Selection of the Sample.
- 3.3 Schedule and Data collection.
- 3.4 Analysis of Data.

#### **3.1 LOCATION**

The present cross-sectional study was conducted in five software industries namely Infosys Technologies Limited, Satyam Computers, Tata Consultancy Services (TCS), Reliance Telecom Limited (RTL) and Tatwa Technologies in Bhubaneswar, Orissa.

#### **3.2 SELECTION OF THE SAMPLE**

A total of 80 subjects in the age group of 22-33 years, belonging to software profession were considered for the study, with 40 members in each shift work (study group) and permanent day work (control group) category. Finally 70 filled in questionnaires were obtained (36 day workers and 34 shift workers) out of 80 subjects. All the subjects were male workers as there were no female workers working in shifts due to safety reasons (Fig. 1).

All the shift workers followed an irregular rotating work schedule. The starting times of three shifts were 6.30 am for the morning shift, 2.30 pm for the evening shift and 10.30p.m for the night shift. The subjects selected for the study were having at least shift work experience from 6 months to 1½ years.

Permanent Day workers were the workers of typical day schedule who work for 8 hours. They were all in the same age range and from the same profession doing the same work. These workers did not have shift work in the last 1½ years.

#### **3.3 SCHEDULE AND DATA COLLECTION**

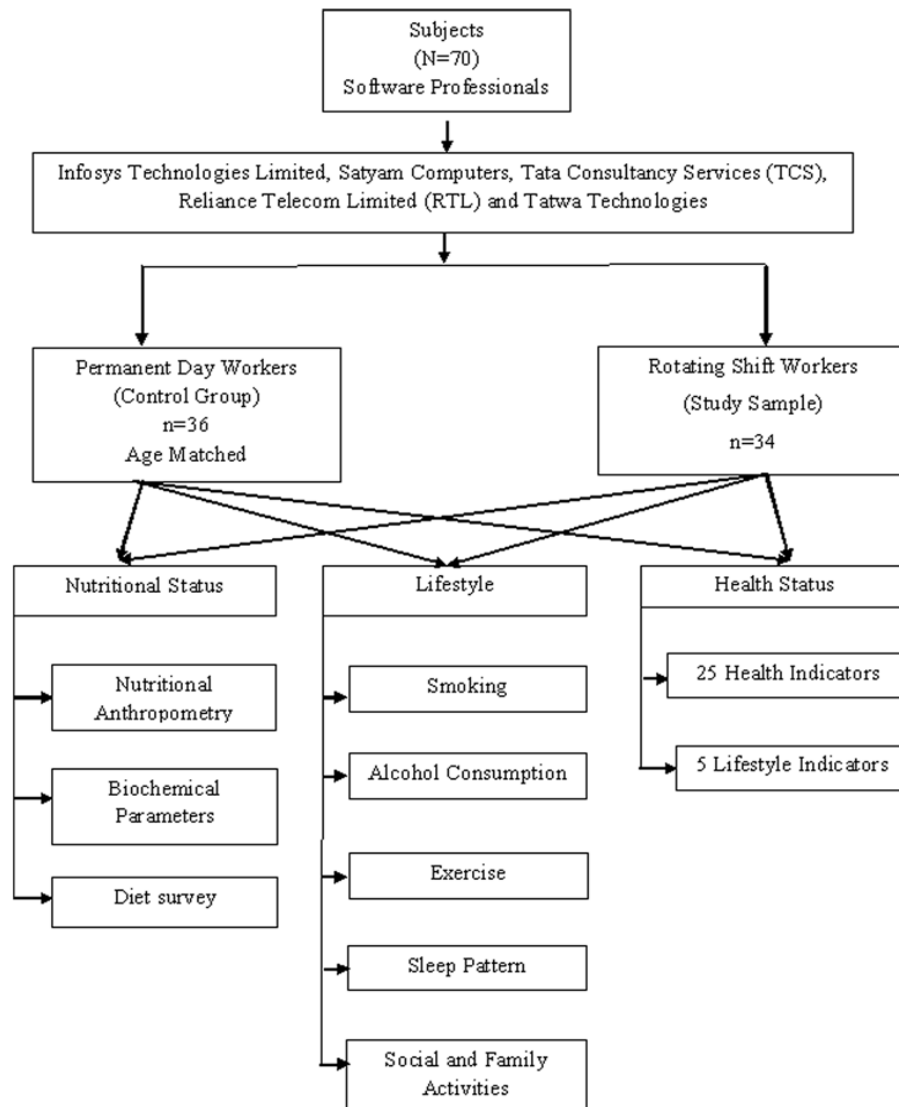
Keeping in view, the objective of the study, a detailed schedule was formulated to elicit the information on various aspects related to the assessment of various nutritional and health factors, which influence the nutritional status of the employees (Fig. 1 and Plate 1).

The schedule was pre-tested and modified wherever necessary. The final schedule consists of 5 parts as follows

- 3.3.1 General Information
- 3.3.2 Nutritional Status
- 3.3.3 Food Habit
- 3.3.4 Lifestyle Indicators
- 3.3.5 Health Status

##### **3.3.1 General information**

General information of subjects such as age, education, occupation, duration of work, timing of work, residence, family type, family size, marital status, with whom living, nativity, since how long the person has been in that shift, were collected by structured pretested questionnaire through personal interview method. Based on the age and income the subjects were classified into three different groups by using the formula, Mean  $\pm$  SD (0.425). Depending upon the number of family members, they were classified into small, medium and large as indicated below ACRIP (CD, 2000).



**Fig.1. Plan of Work (Sample and Data Collection)**

Figure.1. Plan of work (Sample and Data Collection)



Plate.1. Data Collection

| Category      | Number of members |
|---------------|-------------------|
| Small family  | ≤ 4               |
| Medium family | 5-8               |
| Large family  | ≥ 9               |

### 3.3.2 Nutritional status assessment

The nutritional status of subjects was assessed by nutritional anthropometry and diet survey.

#### 3.3.2.1 Nutritional Anthropometry

The anthropometric measurements viz., height, weight before joining the job and at present, waist and hip circumference were recorded as per the guideline suggested by Jelliffe (1966). The height was measured using an anthropometer nearest to 0.1 cm. A portable platform balance (spring) was used to measure weight in kilogram nearest to 0.5kg. Subjects stood without support, with casual clothing and without shoes while taking the weight. Waist and hip circumference were measured using a non-stretchable measuring tape in centimeters (Plate 2).

The anthropometric data was further used for computing BMI, by the formula expressed as the ratio of weight in kgs to height in square meters. The Body Mass Index a recent valid index of health status has been calculated to know the relationship between shift work and BMI.

$$\text{BMI} = \frac{\text{Weight (Kgs)}}{(\text{Height})^2 \text{ m}}$$



Plate.2. Anthropometric measurements

Further individuals were classified into different classes based on the BMI.

| BMI Classification | Presumptive Diagnosis |
|--------------------|-----------------------|
| <18.5              | Under Weight          |
| 18.5-22.9          | Ideal BMI             |
| >23                | Over Weight           |
| >25                | Obese Grade-I         |
| >30                | Obese Grade-II        |

Source: BMI classification for Asian Adults (WHO, 2002)

The abdominal obesity was judged by waist to hip ratio (Lean *et al.* 1995)

Males      $\leq 0.95$    Normal  
                   $> 0.95$    Obese

### 3.3.2.2 Biochemical Parameters

Biochemical investigation represents the most objective assessment of nutritional status of an individual, frequently throwing light on the subclinical status. The levels of fasting blood glucose, total-cholesterol, triglycerides, HDL- cholesterol, VLDL were estimated by taking subsamples of 15 subjects from each group.

#### 3.3.2.2.1 Analysis of blood sample

The level of total cholesterol, HDL-cholesterol and triglyceride were analyzed by using swemed diagnostic kits. All tests were performed by BTR-820/ Humalyser-3000, Biochemical Analyzer.

#### 3.3.2.2.2 Collection of blood sample

For the estimation of biochemical parameters 5ml of fasting venous blood was drawn from the respondents by a trained lab technician. The blood drawn was allowed to coagulate and the serum was separated by centrifuging and used for biochemical estimation (Plate 3).

#### 3.3.2.2.3 Estimation of serum triglycerides

Serum triglyceride was estimated by enzymatic single reagent method. Triglyceride from serum was hydrolyzed by lipase and the glycerol liberated reacts enzymatically to give highly coloured quinonemine dye, which has an absorbance max at 546 nm. The intensity of colour produced is directly proportional to the concentration of triglyceride in sample.

Reference range (Males) : 36-165 mg/ dl

#### 3.3.2.2.4 Estimation of serum total cholesterol

Cholesterol esters in the serum were hydrolyzed to cholesterol by cholesterol esterase, which further oxidized to cholester-3-one and hydrogen peroxide, this with phenol by peroxides converts to highly colored quinonemine dye. Absorbance of quinonemine measured at 505 nm is proportional to cholesterol concentration in the specimen.

Reference range (Males) : 150-250 mg/ dl

#### 3.3.2.2.5 Estimation of HDL-cholesterol

HDL-cholesterol estimated by polyethylene Glycol-CHOD-PAP two reagent method.

Low and very low- density lipoproteins are precipitated by a saturation containing PEG 6000, leaving behind the high density lipoproteins in solution. HDL-cholesterol is estimated in supernatant by a series of enzymatic reactions, which were initiated, by the oxidation of cholesterol to cholestenone by cholesterol oxidase, accompanied by the formation of hydrogen peroxide. In a second reaction catalyzed by peroxides, 4-aminoantipyrin and phenol reacts with hydrogen peroxide to form red coloured quinonemine. Absorbance data at 505nm is directly proportional to HDL-cholesterol concentration.

Reference range (Males) : 35-70 mg/ dl

### 3.3.2.2.6 Calculation of LDL-cholesterol and VLDL- cholesterol

Low density lipoprotein and very low density lipoprotein cholesterol was computed using the formula

$$\text{LDL-cholesterol (mg/dl)} = \text{Total cholesterol- triglyceride/5} - \text{HDL-cholesterol}$$

Reference range (Males) : 150-250 mg/ dl

$$\text{VLDL-cholesterol (mg/dl)} = \text{Triglyceride/5}$$

Reference range (Males) : Up to 50 mg/ dl

### 3.3.2.3 Dietary Survey

The intake of food was assessed by 24 hour recall method using a set of pre standardized vessels (Plate 4).

Information on the type of preparation, actual ingredients used and amount consumed by each subject were recorded on the scheduled designed for the purpose. Individual consumption of each food stuff was assessed showing appropriate weights of different food stuffs in various vessel sizes. The nutrients such as protein, fat, carbohydrate, fiber and energy value of the diet consumed by each subject was calculated by using food composition tables (Gopalan *et al.* 2007)

#### 3.3.2.3.1 Nutrient intake and nutrient adequacy ratio

The raw food equivalents of cooked food were computed from the standardized cups. The nutrients present in the food were computed from Annapurna VAR 3 a software developed by M.R.Chandrashekar of Bangalore. Recommended Dietary Allowance for Indian adult sedentary worker was considered for computing percent adequacy of food, NIN (Anon.,1998) and nutrients, ICMR(Anon.,1994). The percent adequacy of food for each subject was computed using the formula

$$\text{Food adequacy} = \frac{\text{Food Intake}}{\text{RDA of the food}} \times 100$$

The percent adequacy of nutrients for each subject was computed using the formula

$$\text{Nutrient adequacy} = \frac{\text{Nutrient intake}}{\text{RDA of the nutrient}} \times 100$$

### 3.3.3 Food habit survey

Structured and pre-tested questionnaire was used to assess the food habit *viz.*, type of food habit, consumption of various high energy foods, mainly sweets, bakery and confectionary, fried products, fast foods, desserts, fresh fruits, flesh foods and its relative frequencies, fluid intake per day mainly water, tea, coffee, milk, soft drinks, fruit juices, number of meals per day, meal skipping habits, habit of eating outside and its frequency, choice of food, *etc* were collected.

Based on the quantity of consumption of the above mentioned fluids per day, the subjects were classified into three different groups by using the formula, Mean  $\pm$  SD (0.425). The frequencies of consumption of the high energy foods were given the scores and average score for both the group was calculated.

| Category     | Score |
|--------------|-------|
| Daily        | 3     |
| Weekly       | 2     |
| Occasionally | 1     |



Plate.3. Drawing the blood from the subjects



Plate.4. Diet Survey (24 hour recall method)

### 3.3.4 Life style

The information on lifestyle habits were collected under five subheadings namely

3.3.4.1 Smoking.

3.3.4.2 Alcohol Consumption.

3.3.4.3 Exercise

3.3.4.4 Sleep Pattern

3.3.4.5 Social and Family activities.

#### 3.3.4.1. Smoking

Information on smoking habits *viz.*, age when smoking was started, number of cigarettes per day or per week, places where they smoke most often, if they have any idea to quit smoking, factor which will motivate to quit smoking were collected by the same structured questionnaire. Based on the number of cigarettes smoked per week, the subjects were classified into three different groups by using the formula, Mean  $\pm$  SD (0.425).

#### 3.3.4.2 Alcohol consumption

Information on alcohol consumption *viz.*, age at which started drinking alcohol, frequency of drinking: daily, once a week, occasionally, reason behind alcohol consumption, quantity consumed, brand preferred, snacks preferred with alcohol, any health problem due to alcohol consumption was collected. Based on the quantity of consumption of alcohol per week, the subjects were classified into three different groups by using the formula, Mean  $\pm$  SD (0.425).

#### 3.3.4.3 Exercise

Information on daily exercise, type of exercise, hours of physical activity, play habits: before joining the job and in present and membership in club or gym, and mode of travelling to the office were collected by the help of structured questionnaire.

#### 3.3.4.4 Sleep pattern

Information on time of going to bed, time taken to fall asleep, wake up in the middle of night, satisfied feeling of rest after a full night sleep, weekend sleeping pattern were collected

#### 3.3.4.5 Social and family activities

Totally, there are 14 statements under this category which are related to social and family activities *viz.*, personal life, social relationship, child care practices and friendship/family relationship for which subjects had to answer in term of 'yes' or 'no'. It was used to assess the social and family life of the shift workers.

### 3.3.5 Health status

Information on the lifestyle related diseases as perceived by the subjects was collected.

#### 3.3.5.1. Health Indicators

A set of self designed questions were also used to assess the general health problems of the shift workers. It consisted of 25 statements. It was a 4 point scale having alternatives 'never', 'rarely', 'occasionally' and 'always'. The average health score was calculated by the following scorings.

| Category     | Health Score |
|--------------|--------------|
| Never        | 4            |
| Rarely       | 3            |
| Occasionally | 2            |
| Always       | 1            |

### 3.3.5.2. Lifestyle Indicators

To assess the health status, five lifestyle indicators were used advocated by Belloc and Breslow (1972). Scoring system was used to assess the health status. For every positive answer one point was given and for every negative answer zero was given.

| Indicators          | Health score criteria<br>(Add one for each positive answers) |
|---------------------|--|
| BMI                 | 18.5 < BMI > 23  |
| Meal Skipping       | No   |
| Smoking             | Non Smoker   |
| Alcohol Consumption | Non drinker  |
| Exercise            | Yes  |

### 3.3.4 Statistical analysis

The responses were quantified, classified and tabulated and expressed in frequencies and percentages. The results obtained were analyzed employing different statistical methods.

- Tabular analysis i.e. frequency and percentages were computed to interpret the demographic profile of the subjects
- Mean and standard deviation were calculated for anthropometric, dietary and nutritional adequacy of the subjects.
- The student 't' test was used to test the significance of mean nutrients intake, mean per cent adequacy of nutrients, mean anthropometric, mean biochemical measurements, mean fluid consumption.

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{S^2 \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

$$\text{Where, } S^2 = \frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{(n_1 + n_2 - 2)}$$

$\bar{X}_1$  = mean of the first group

$\bar{X}_2$  = mean of the second group

$n_1$  = number of observation in the first group

$n_2$  = number of observation in the second group

$s_1^2$  = variance of the first group

$s_2^2$  = variance of the second group.

$S^2$  = Pooled variance of  $s_1$  and  $s_2$

- Paired 't' test was carried out to know the difference in body weight before joining the job and at present situation.

$$t = \frac{\bar{d}}{s_d / n}$$

$$s_d^2 = \sqrt{1/n - 1 \sum (d_i - \bar{d})^2}$$

Where,  $d_i$  = difference in the initial and final weight.

$\bar{d}$  = mean difference in the weight.

e) Chi-square test was carried out to know the association between incidence of shift work and different habits viz., BMI, exercise practices, smoking or alcohol consumption, sleeping habit, snacking habits, health habits.

$$\chi^2 = \sum_{i=1}^r i \sum_{j=1}^c j \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

$\chi^2$  Values are compared with table values for (r-1) (c-1) degrees of freedom.

Where,

$E_{ij}$  = Expected frequency of (i, j)<sup>th</sup> cell

$O_{ij}$  = Observed frequency of (i, j)<sup>th</sup> cell

r = number of rows

c = number of columns

f) Modified Chi-square-non parametric test of independence was applied to determine the association between dependent and independent variables, wherever the frequencies were less than five. Test of independence was applied to determine the association between dependent and independent variables using the formula:

$$\left[ 1 - \frac{1}{n} (1 - d^{-1/2}) \right] x^2$$

Where,

$\chi^2_{d(0.05)}$  = Table  $\chi^2$  value at 'd' degrees of freedom for 5 per cent level of significance.

n = Sample size.

## 4. EXPERIMENTAL RESULTS

The results of the study conducted between 2009-10 on, Impact of shift work on nutritional status, life style and health status of shift workers are presented in this chapter. The results related to general information, nutritional anthropometry, food habits, life style and health problems of the subjects are included in this chapter.

### 4.1 GENERAL INFORMATION

For the study a total of 80 subjects were selected. Out of which thirty seven were permanent day workers (control group) and thirty four were shift workers (study group). In the investigation efforts were made to study the background characteristics of subjects such as age, education, income, duration of work, shift timings, family type, family size, marital status, residence of work, since how long working in the particular shift, nativity and the data has been presented in table 1.

#### 4.1.1 Age

Age wise distribution of the subjects reveals that majority of the day workers (41.7%) were in the age group of 25 to 27 years followed by 33.3 per cent in less than 25 years and 25 per cent were in greater than 27 years age group. Among 34 shift workers equal percentage (35.5%) were in the age group of less than 25 years and 25 to 27 years followed by 29 per cent in greater than 27 years and group.

#### 4.1.2 Education

Among the day workers (80.6%) and shift workers (70.6%) higher percentage were graduates, whereas 19.4 per cent of day workers were post graduates and 29.4 per cent of shift workers were postgraduates.

#### 4.1.3 Income

Thirty three per cent the day workers and 29.4 per cent of shift workers were found to earn less than Rs. 27,000/-, followed by 47.2 per cent day workers and 41.2 per cent shift worker earning between Rs. 27,000/- to Rs. 30,000/-. Nineteen per cent of day workers and 29.4 per cent shift workers found to earn more than Rs.30, 000/- per month.

#### 4.1.4 Duration

Among the day workers (61.1%) and shift workers (61.8%), higher percentage worked for ten hours a day, whereas 27.8 per cent of day workers and 17.6 per cent of shift workers were working for more than ten hours a day and 11.1 per cent of day workers and 20.6 per cent of shift workers were working for eight hours a day.

#### 4.1.5 Shift timing

All the day workers (100%) were in the morning standard work schedule. But in the study group, 47.1 per cent were in night shift, followed by 29.4 per cent in the evening shift and rests were in morning shift (23.5%).

#### 4.1.6 Family type

Higher percentage of day workers (77.8%) and shift workers (79.4%) belonged to nuclear family and 22.2 per cent of day workers and 20.6 per cent of shift workers were found to be from joint family.

#### 4.1.7 Family size

Regarding the family size majority of the day workers (52.8%) and shift workers (64.7%) belonged to small sized family, followed by 36.1 per cent of day workers and 32.4 per cent of shift workers were from the medium size family and least percent of day workers (11.1%) and only one shift worker was found to be from large size family.

#### 4.1.8 Marital status

Higher percentage of day workers (80.6%) and shift workers (76.5%) were unmarried. In case of day workers 19.4 per cent and 23.5 per cent in shift workers were married.

Table 1. General Information of the Subjects

N=70

| Characteristics       | Category         | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|-----------------------|------------------|-----------------------|------------|-------------------------|------------|
|                       |                  | Frequency             | Percentage | Frequency               | Percentage |
| Age (years)           | <25              | 12                    | 33.3       | 12                      | 35.5       |
|                       | 25-27            | 15                    | 41.7       | 12                      | 35.5       |
|                       | >27              | 9                     | 25.0       | 10                      | 29.0       |
| Education             | Graduate         | 29                    | 80.6       | 24                      | 70.6       |
|                       | Post graduate    | 7                     | 19.4       | 10                      | 29.4       |
| Income (Rs)/<br>month | < 27,000/-       | 12                    | 33.3       | 10                      | 29.4       |
|                       | 27,000/-30,000/- | 17                    | 47.2       | 14                      | 41.2       |
|                       | > 30,000/-       | 7                     | 19.4       | 10                      | 29.4       |
| Duration<br>(hours)   | 8                | 4                     | 11.1       | 7                       | 20.6       |
|                       | 12               | 22                    | 61.1       | 21                      | 61.8       |
|                       | >12              | 10                    | 27.8       | 6                       | 17.6       |
| Shift timings         | Morning          | 36                    | 100        | 8                       | 23.5       |
|                       | Evening          | -                     | -          | 10                      | 29.4       |
|                       | Night            | -                     | -          | 16                      | 47.1       |
| Family type           | Nuclear          | 28                    | 77.8       | 27                      | 79.4       |
|                       | Joint            | 8                     | 22.2       | 7                       | 20.6       |
| Family Size           | ≤ 4(Small)       | 19                    | 52.8       | 22                      | 64.7       |
|                       | 5-8 (Medium)     | 13                    | 36.1       | 11                      | 32.4       |
|                       | ≥ 9 (Large)      | 4                     | 11.1       | 1                       | 2.9        |
| Marital status        | Married          | 7                     | 19.4       | 8                       | 23.5       |
|                       | Unmarried        | 29                    | 80.6       | 26                      | 76.5       |
| Residence             | House            | 10                    | 27.8       | 11                      | 32.4       |
|                       | Apartment        | 3                     | 8.3        | 2                       | 5.9        |
|                       | Rented Rooms     | 23                    | 63.9       | 21                      | 61.7       |
| Living status         | Parents          | 15                    | 41.7       | 16                      | 47.1       |
|                       | Spouse           | 3                     | 8.3        | 3                       | 8.8        |
|                       | Friends          | 15                    | 41.7       | 12                      | 35.3       |
|                       | Alone            | 3                     | 8.3        | 3                       | 8.8        |
| Duration of<br>shift  | 6mth-1 year      | -                     | -          | 20                      | 58.8       |
|                       | 1 - 1½ years     | -                     | -          | 8                       | 23.5       |
|                       | 1½ - 2 years     | 14                    | 38.9       | 6                       | 17.7       |
|                       | 2 – 3 years      | 16                    | 44.4       | -                       | -          |
|                       | 3 - 4 years      | 6                     | 16.7       | -                       | -          |
| Nativity              | Orissa           | 21                    | 58.4       | 28                      | 82.4       |
|                       | Other States     | 15                    | 41.6       | 6                       | 17.6       |
| Food habit            | Vegetarian       | 9                     | 25.0       | 10                      | 29.4       |
|                       | Non-Vegetarian   | 27                    | 75.0       | 24                      | 70.6       |

#### 4.1.9 Residence

Highest percentage of day workers (63.9%) and shift workers (61.7%) lived in rented rooms, followed by 27.8 per cent of day workers and 32.4 per cent of shift workers lived in their own houses. Only 8.3 per cent of day workers and 5.9 per cent of shift workers lived in apartment.

#### 4.1.10 Living status

Regarding living status equal percentage (41.7%) of day workers were living with parents and friends. In case of shift workers 47.1 per cent were living with parents followed by 35.3 per cent with friends. In both the group the number of subjects living with spouse and living alone was same (approximately 8%).

#### 4.1.11 Duration of shift

Majority of day workers (44.4%) were in that particular shift since 2-3 years, followed by 38.9 per cent workers working since ½-2 years. Sixteen per cent subjects working since 3-4 years. In shift workers 58.5 per cent were in shift within one year, 23.5 per cent working from 1 to ½ years and 17.7 per cent since 1½ - 2 years.

#### 4.1.12 Nativity

Among the day workers more than half (58.4%) and majority of shift workers (82.4%) were from Orissa, 41.6 per cent of day workers and 17.6 per cent of shift workers were from other states namely Bihar, Jharkhand, Westbengal, Andhrapradesh, Madhyapradesh, Uttarpradesh, Kerala and Tamil Nadu.

#### 4.1.13 Food habit

Among the day workers 25 per cent subjects and 29.4 per cent shift workers were found to be vegetarian. Nearly about 70.6 per cent shift workers and 75 per cent of day workers were non-vegetarian.

### 4.2 NUTRITIONAL STATUS

#### 4.2.1 Nutritional Anthropometry

Table 2 indicates the mean anthropometric measurement of day and shift workers.

When the mean height was considered, it was slightly higher in shift workers ( $168.91 \pm 0.07\text{m}$ ) compared to day workers ( $168.02 \pm 0.05\text{ m}$ ). But much higher difference was noticed in mean weight of the shift workers ( $73.67 \pm 9.92\text{ Kg}$ ) in comparison to the day workers ( $67.52 \pm 8.32\text{ Kg}$ ), which was statistically significant. Similar results were observed with respect to BMI. The mean BMI of the shift workers was  $25.82\text{ Kg/m}^2$  which was higher than that of day workers,  $23.37\text{ Kg/m}^2$  and this difference was statistically significant. The mean waist circumference was higher in shift workers ( $86.83 \pm 7.76\text{ cm}$ ) compared to day workers ( $84.51 \pm 6.64\text{ cm}$ ). With reference to mean hip circumference it was higher in day workers ( $96.59 \pm 4.18\text{ cm}$ ) compared to shift workers ( $97 \pm 6.48\text{ cm}$ ). When WHR was considered, it was statistically significant for shift workers ( $0.91 \pm 0.03$ ) compared to day workers ( $0.87 \pm 0.04$ ).

#### 4.2.2 Body Mass Index

The subjects classified on the basis of the BMI categories are presented in table 3 and Fig.2.

When the BMI of the day workers and shift workers were compared, higher percentage of day workers were found to be in ideal body weight group (41.7%), followed by 33.3 per cent in over weight group, 19.4 per cent belonged to obese grade-I and 5.6 per cent were reported to be obese-grade II. But in case of shift workers, majority of subjects (55.9%) were in obese grade-I group, followed by equal percentage of subjects (17.6%) in over weight and ideal BMI group and least (8.8%) subjects were in obese grade II group.

Table 2. Mean anthropometric measurements of subjects

| Groups               | Height (m)   | 't' value          | Weight (kg) | 't' value | BMI        | 't' value | Waist circumference (cm) | 't' value          | Hip circumference (cm) | 't' value          | WHR           | 't' value |
|----------------------|--------------|--------------------|-------------|-----------|------------|-----------|--------------------------|--------------------|------------------------|--------------------|---------------|-----------|
| Day Workers (n=36)   | 168.02±0.05  | 0.57 <sup>NS</sup> | 67.52±8.32  | 2.77*     | 23.87±2.99 | 2.64*     | 84.51±6.64               | 1.34 <sup>NS</sup> | 96.59±4.18             | 1.44 <sup>NS</sup> | 0.87<br>±0.04 | 3.94**    |
| Shift Workers (n=34) | 168.91 ±0.07 |                    | 73.67±9.92  |           | 25.82±2.99 |           | 86.83±7.76               |                    | 94.7±6.48              |                    | 0.91<br>±0.03 |           |

Values are expressed in terms of Mean ± S.D

\* - Significant at 5% level

\*\* - Significant at 1% level

NS - Non-Significant

### 4.2.3 Waist to Hip Ratio

The subjects classified on the basis of the WHR are presented in table 4.

Higher percentage of day workers (97.33%) and shift workers (91.17%) were having normal waist to hip ratio. Two per cent day workers and 8.83 per cent shift workers were having abdominal obesity.

### 4.2.4 Mean weight of the subjects at the time of joining and at present

Table 5 and Fig.3 highlights the mean weight of the subjects at the time of joining and at present.

The result showed the mean weight at the time of joining were almost similar, 58.27 kg and 59.44 kg in day workers and shift workers respectively. But at present there was increase in weight. In control group weight increased to 67.52 kg and in study group it was found to be 73.67 kg which was statistically significant. The pooled weight at the time of joining was found to be 58.54 kg and at present it was also reported to be 70.51 kg, significant statistically.

### 4.2.5 Association of income with BMI

Association of income and BMI is presented in table 6. The chi-square value showed the significant association between income and Body mass Index at 1% level of significance. That showed that with increase in income the BMI was found to increase significantly.

## 4.3 DIETARY SURVEY

### 4.3.1 Mean food intake of the subjects

When day workers and shift workers were compared the mean cereal intake of day workers ( $280 \pm 141.66$ ) was found to be higher than shift workers ( $274.97 \pm 81.54$ ), table 7. The mean pulse intake was slightly higher in ( $47.22 \pm 45.73$ ) in day workers compared to shift workers ( $43.32 \pm 25.71$ ). The intake of leafy vegetables (82 g), other vegetables (137 g), fruits (102 g), milk and its product (406 g), fish and fleshy foods (144 g), fats and oils (99.68 g) and sugar or jaggery (43.32 g) was higher in day workers compared to shift workers. Among these food groups the intake of leafy vegetables and fruits was statistically significant.

### 4.3.2 Mean nutrient intake of the subjects

When day workers and shift workers were compared the mean energy intake of day workers ( $2190 \pm 418.80$  Kcal) was found to be higher than shift workers ( $2064 \pm 397.9$  Kcal), table 8 a. The mean carbohydrate intake was slightly higher ( $248.40 \pm 36.08$  g) in day workers compared to shift workers ( $245.41 \pm 34.06$  g). The intake of protein (59.90 g),  $\beta$ -carotene ( $1694.66 \mu\text{g}$ ), vitamin A ( $482.78 \mu\text{g}$ ), folic acid ( $175.79 \mu\text{g}$ ), and vitamin C (105.07 mg) were higher in day workers compared to shift workers. Among these nutrients the protein intake was statistically significant. Between the two groups iron intake of day workers was found to be 14.70 mg and in shift workers 11.22 mg, which was statistically significant. The intake of sodium was similar for both the groups (291 mg), but potassium intake was higher in day workers (1436.58 mg) than shift workers (1299.87 mg). Whereas fiber intake was higher in day workers (22.68 g) compared to shift workers (20.35 g).

The adequacy of energy, iron, carotene, vitamin A was less than recommended dietary allowances (RDA) for both the groups (Fig. 4).

The adequacy of energy was more than 90 per cent in day workers and 85 per cent in shift workers. Protein adequacy rate was 100 per cent in day workers and 86 per cent in shift workers. The adequacy of fat was more than 500 per cent in both the group and similar results were observed with the adequacy of vitamin C (approximately 260%). The adequacy of carotene was 70 per cent in day workers and 58 per cent in shift workers. Vitamin-A adequacy was found to be 80 per cent in day workers and 70 per cent in shift workers. The adequacy of folic acid was 175 per cent and 166 per cent in day and shift workers respectively.

Table 3. Classification of subjects based on BMI

N=70

| BMI Classification | Presumptive Diagnosis | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|--------------------|-----------------------|-----------------------|------------|-------------------------|------------|
|                    |                       | Frequency             | Percentage | Frequency               | Percentage |
| 18.5-22.9          | Ideal BMI             | 15                    | 41.7       | 6                       | 17.6       |
| >23                | Over Weight           | 12                    | 33.3       | 6                       | 17.6       |
| >25                | Obese Grade-I         | 7                     | 19.4       | 19                      | 55.9       |
| >30                | Obese Grade-II        | 2                     | 5.6        | 3                       | 8.8        |

\* < 18.5 Under weight No subjects

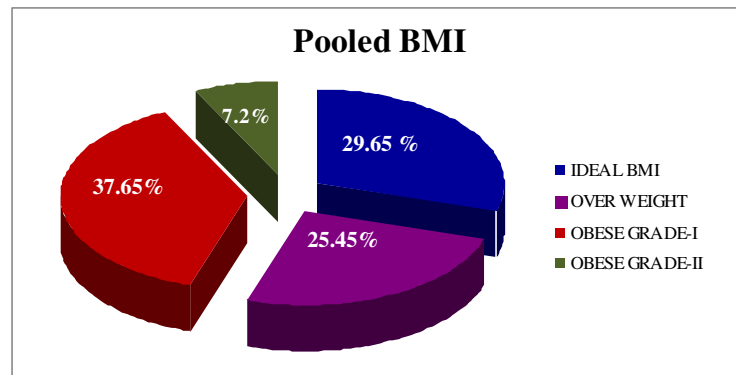
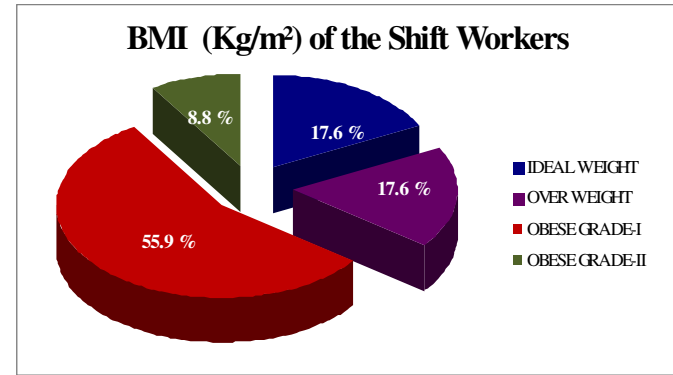
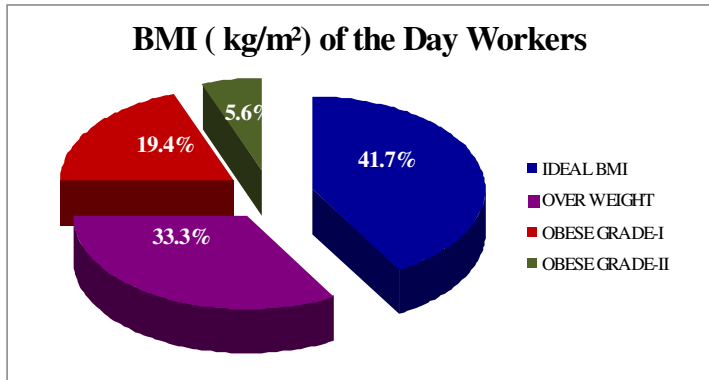


Figure.2. Pie-diagram showing the distribution of subjects according to BMI

Table 4 Classification of subjects based on WHR

N=70

| Gender | Classification                       | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|--------|--------------------------------------|-----------------------|------------|-------------------------|------------|
|        |                                      | Frequency             | Percentage | Frequency               | Percentage |
| Male   | Normal<br>( $\leq 0.95$ )            | 35                    | 97.33      | 31                      | 91.17      |
|        | Abdominal<br>Obesity<br>( $> 0.95$ ) | 1                     | 2.67       | 3                       | 8.83       |

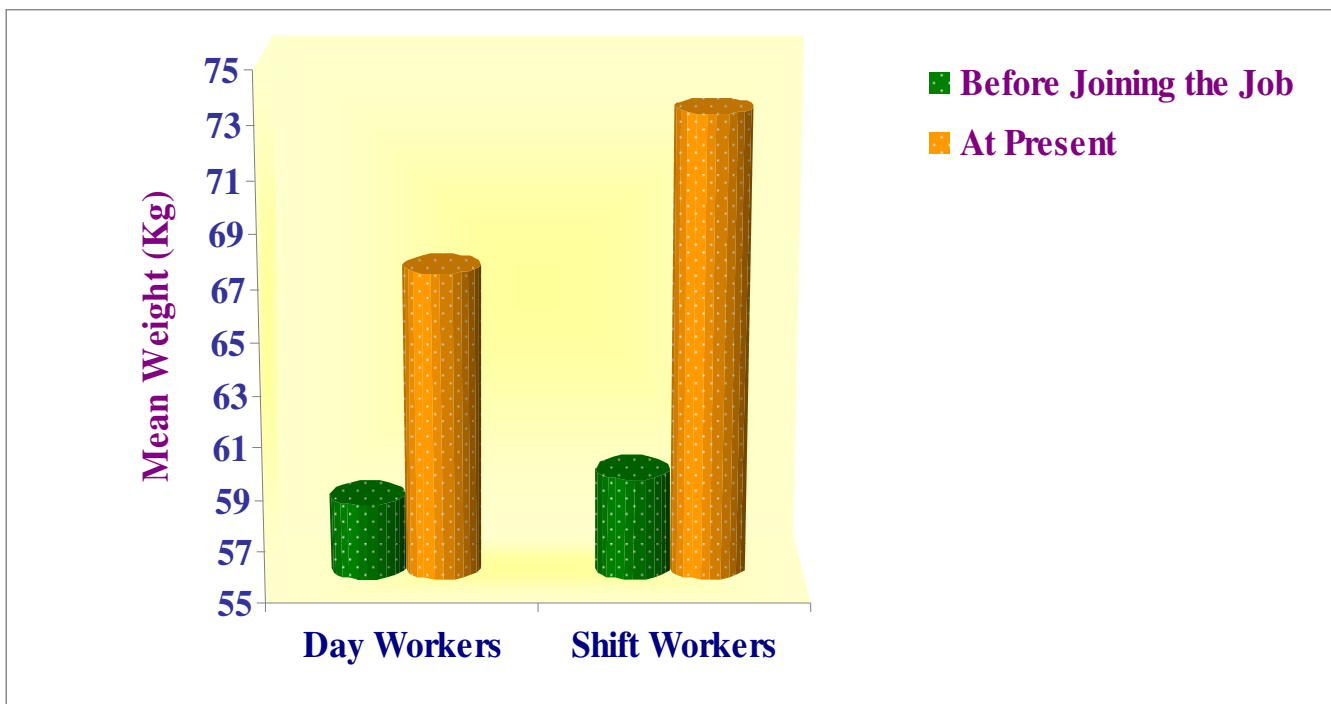
Table 5. Mean weight of the subjects at the time of Joining and at present

N=70

| Weight                 | Day Workers<br>(N=36) | Shift Workers<br>(N=34) | Pooled Weight<br>(N=70) |
|------------------------|-----------------------|-------------------------|-------------------------|
| At the time of joining | 58.27 $\pm$ 2.67      | 59.44 $\pm$ 4.22        | 58.84 $\pm$ 3.96        |
| At present             | 67.52 $\pm$ 8.32      | 73.67 $\pm$ 9.92        | 70.51 $\pm$ 9.58        |
| Paired 't' test        | 9.75**                | 12.07**                 | 14.50**                 |
| % change in weight     | 15.87                 | 23.94                   | 19.83                   |

Values are expressed in terms of Mean  $\pm$  S.D

\*\* Significant at 1% level



**Fig. 3. Mean weight of the subjects at the time of joining and at present**

Fig.3. Mean weight of the subjects at the time of joining and at present

Table 6. Association of Income with BMI

N=70

| Income           | BMI       |             |               |                |       | x <sup>2</sup> (Modified) |
|------------------|-----------|-------------|---------------|----------------|-------|---------------------------|
|                  | Ideal BMI | Over Weight | Obese Grade-I | Obese Grade-II | Total |                           |
| < 27,000/-       | 10        | 4           | 5             | 2              | 21    | 3.76**                    |
| 27,000/-30,000/- | 8         | 10          | 12            | 2              | 32    |                           |
| > 30,000/-       | 3         | 4           | 9             | 1              | 17    |                           |
| Total            | 21        | 18          | 26            | 5              | 70    |                           |

\*\* Significant at 1% level

Table 7. Mean food intake (g/day) of the subjects

N= 70

| Food Stuffs          | SDA (g/day) | Day Workers (n=36) | Shift Workers (n=34) | Percent Adequacy (Day Workers) | Percent Adequacy (Shift Workers) | 't' test           |
|----------------------|-------------|--------------------|----------------------|--------------------------------|----------------------------------|--------------------|
| Cereals              | 361         | 280±141.66         | 274.97±81.54         | 77.56                          | 76.38                            | 0.17 <sup>NS</sup> |
| Pulses               | 49          | 47.22±45.73        | 43.32±25.71          | 96.36                          | 88.40                            | 0.39 <sup>NS</sup> |
| Leafy Vegetables     | 21          | 82.61±7.88         | 70.88±12.88          | 393.38                         | 337.5                            | 4.52**             |
| Other Vegetables     | 89          | 137.47±45.45       | 127.19±37.63         | 154.4                          | 142.91                           | 0.99 <sup>NS</sup> |
| Fruits               | 66          | 102±2.88           | 83.5±19.73           | 154.5                          | 126.51                           | 4.54**             |
| Milk and its product | 250         | 406.09±56.83       | 395.23±55.61         | 162.4                          | 158                              | 0.54 <sup>NS</sup> |
| Fish and Flesh Foods | 22          | 144±9.25           | 113.91±11.07         | 654.54                         | 517.77                           | 0.02 <sup>NS</sup> |
| Fat & oils           | 35          | 99.68±16.27        | 95.62±16.21          | 284.8                          | 273.2                            | 0.70 <sup>NS</sup> |
| Sugar/ Jaggery       | 31          | 43.33±14.22        | 39.93±17.51          | 139.77                         | 128.80                           | 0.58 <sup>NS</sup> |

Values are expressed in terms of Mean ± S.D

\*\* Significant at 1% level

NS Non Significant

Table 8a. Mean nutrient intake of the subjects

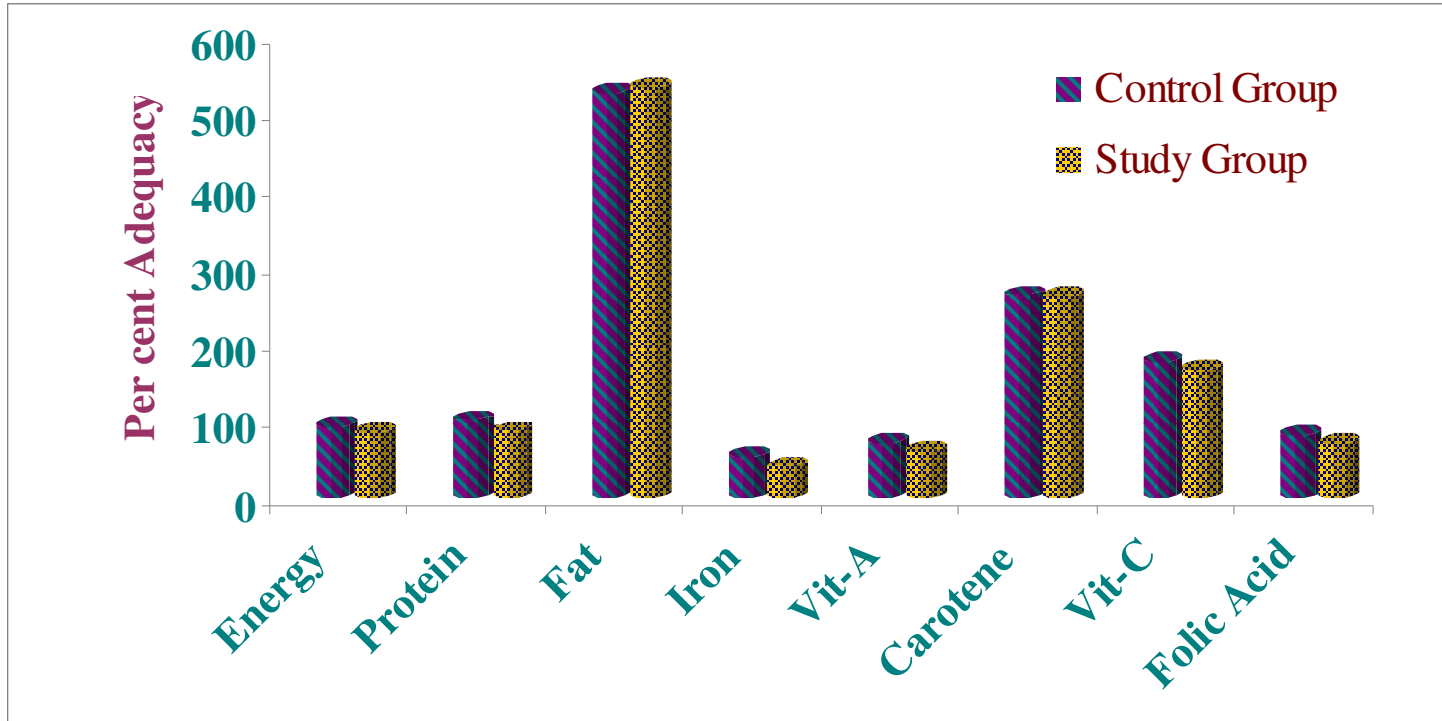
N=70

| Nutrients           | Day Workers<br>(n=36) | Shift Workers<br>(n=34) | 't' Value          |
|---------------------|-----------------------|-------------------------|--------------------|
| Energy (kcal/d)     | 2190 ± 418.80         | 2064 ± 397.9            | 1.29 <sup>NS</sup> |
| Carbohydrates (g/d) | 248.40 ± 36.08        | 245.41 ± 34.06          | 0.35 <sup>NS</sup> |
| Proteins (g/d)      | 59.90 ± 16.01         | 51.66 ± 17.66           | 2.04*              |
| β-Carotene (μg/d)   | 1694.66 ± 651.85      | 1408.68 ± 606.1         | 1.90 <sup>NS</sup> |
| Vitamin A (μg/d)    | 482.78 ± 186.36       | 423.69 ± 242.96         | 1.13 <sup>NS</sup> |
| Folic Acid (μg/d)   | 175.79 ± 42.63        | 166.73 ± 53.38          | 0.78 <sup>NS</sup> |
| Vitamin C (mg/d)    | 105.07 ± 44.39        | 104.10 ± 39.74          | 0.09 <sup>NS</sup> |
| Iron (mg/d)         | 14.70 ± 4.57          | 11.22 ± 3.41            | 3.61*              |
| Sodium (mg/d)       | 291.92 ± 149.87       | 291.14 ± 174.91         | 0.02 <sup>NS</sup> |
| Potassium (mg/d)    | 1436.58 ± 390.38      | 1299.87 ± 318.05        | 1.61 <sup>NS</sup> |
| Fiber (g/d)         | 22.688 ± 3.96         | 20.35 ± 3.54            | 2.59*              |

Values are expressed in terms of Mean ± S.D

\* Significant at 5% level

NS Non Significant



**Fig. 4. Per cent nutrient adequacy of the subjects**

Fig.4. Per nutrient adequacy of the subjects

### 4.3.3 Mean Fat intake of the subjects

The saturated fat intake was higher in shift workers (24.66 g) compared to day workers (19.07 g) and the t test value showed it was statistically significant. With regard to MUFA it was slightly higher in day workers (26.5 g) than shift workers (25.53 g), but PUFA intake was slightly higher in shift workers (52.7 g) compared to day workers (50.02 g). The mean cholesterol intake was high in shift workers (147.23 g) compared to day workers (120.94 g), table 8 b.

## 4.4 BIOCHEMICAL ASSESSMENT

### 4.4.1 Biochemical profile of the subject

Table 9 and Fig.5 indicates the biochemical profile of the day and the shift workers.

When day workers and shift workers were compared with respect to fasting blood sugar, day workers represented a lower value 91.84 mg/dl, compared to shift workers 97.10 mg/dl and it was statistically significant for shift workers compared to day workers. Among the day workers the serum triglycerides value was found to be 150.08 mg/dl and in the shift workers it was higher ( $159.65 \pm 51.59$  mg/dl). The mean total cholesterol was noticeably higher 195.33 mg/dl in shift workers compared to 173.32 mg/dl for day workers. With regard to HDL-C, when the day workers and shift workers were compared, the day workers were having higher value  $44.96 \pm 5.44$  mg/dl than the shift workers ( $39.62 \pm 7.57$ mg/dl) and it was statistically significant. The VLDL-C value was found to be 30.45 mg/dl in day workers and 36.32 mg/dl among the shift workers. The mean LDL-C value revealed that the shift workers were having higher LDL-C ( $125.48 \pm 27.75$  mg/dl) than day workers ( $114.17 \pm 24.08$  mg/dl). The ratio of total cholesterol and HDL-C was found to be higher ( $5.03 \pm 1.00$ ) in shift workers compared to day workers ( $3.05 \pm 1.15$ ) which was significant.

## 4.5 FOOD HABITS OF THE SUBJECTS

### 4.5.1 Consumption pattern of high energy foods

Table 10 highlights the information on the type of snacks consumed by the subjects and its frequencies. Total 8 categories of food items were given and the subjects were expected to answer their frequency of consumption in terms of daily, weekly, occasionally and never. As very less subjects had answered never these values were merged with the frequency of occasionally. Average score was calculated based on these frequencies and both the groups were compared based on these mean values.

Among the sweets, rasgulla was consumed by 26.5 per cent shift workers and 8.3 per cent day workers regularly. Approximately 36 percentages of subjects consumed it weekly followed by 35.3 per cent shift workers and 55.6 per cent day workers consuming it occasionally. With regard to Kajuburfi, 5.9 per cent shift workers and 2.8 per cent day workers consumed it daily, followed by 17.6 per cent shift workers and 27.8 per cent day workers consuming it weekly and majority of shift workers (76.5%) and day workers (69.4%) consumed it occasionally. More than 60 per cent subjects from both the group consumed gulab jamun occasionally followed by 23.5 per cent shift workers and 16.6 per cent day workers consuming gulab jamun weekly. Only 11.8 per cent shift workers and 14 per cent day workers consumed it daily. With regard to the overall sweet consumption the average score showed that shift workers were found to consume more sweets compared to day workers. The consumption of rasgulla was statistically significant in shift workers ( $1.91 \pm 0.79$ ) compared to day workers ( $1.52 \pm 0.65$ ).

Among the bakery and confectionary items, cakes and pastries were found to be preferred by 20.6 per cent shift workers and 8.3 per cent day workers daily, followed by 35.3 per cent shift workers and 27.9 per cent day workers weekly. Forty four per cent shift workers and 63.8 per cent day workers preferred it occasionally. Biscuit was consumed by 50 per cent of shift workers and 33.3 per cent day workers daily. Approximately 25 per cent of subjects from both the groups were found to consume it weekly, 23.5 per cent of shift workers and 41.7 per cent of day workers were consuming it occasionally.

Pizza was consumed daily by 2.8 per cent of subjects in both the groups, followed by 19.4 per cent day workers and 32.4 per cent shift workers consuming it weekly, 80.5 per cent

Table 8 b. Mean fat intake of the subjects

N=70

| Total Fat<br>(g/d) | Day Workers<br>(n=36) | Shift workers<br>(n=34) | t' Value           |
|--------------------|-----------------------|-------------------------|--------------------|
| Fat                | 105.28 ± 32.99        | 106.80±26.27            | 0.21 <sup>NS</sup> |
| Saturated Fat      | 19.07 ±9.76           | 24.66 ± 11.79           | 2.16*              |
| MUFA               | 26.58 ± 8.09          | 25.53 ± 8.84            | 0.51 <sup>NS</sup> |
| PUFA               | 50.02 ± 15.05         | 52.7 ± 16.2             | 0.71 <sup>NS</sup> |
| Cholesterol        | 120.94 ± 149.99       | 147.23 ± 236.17         | 0.55 <sup>NS</sup> |

Values are expressed in terms of Mean ± S.D

\* Significant at 5% level

NS Non Significant

Table 9. Biochemical Parameters of Subjects

N=30

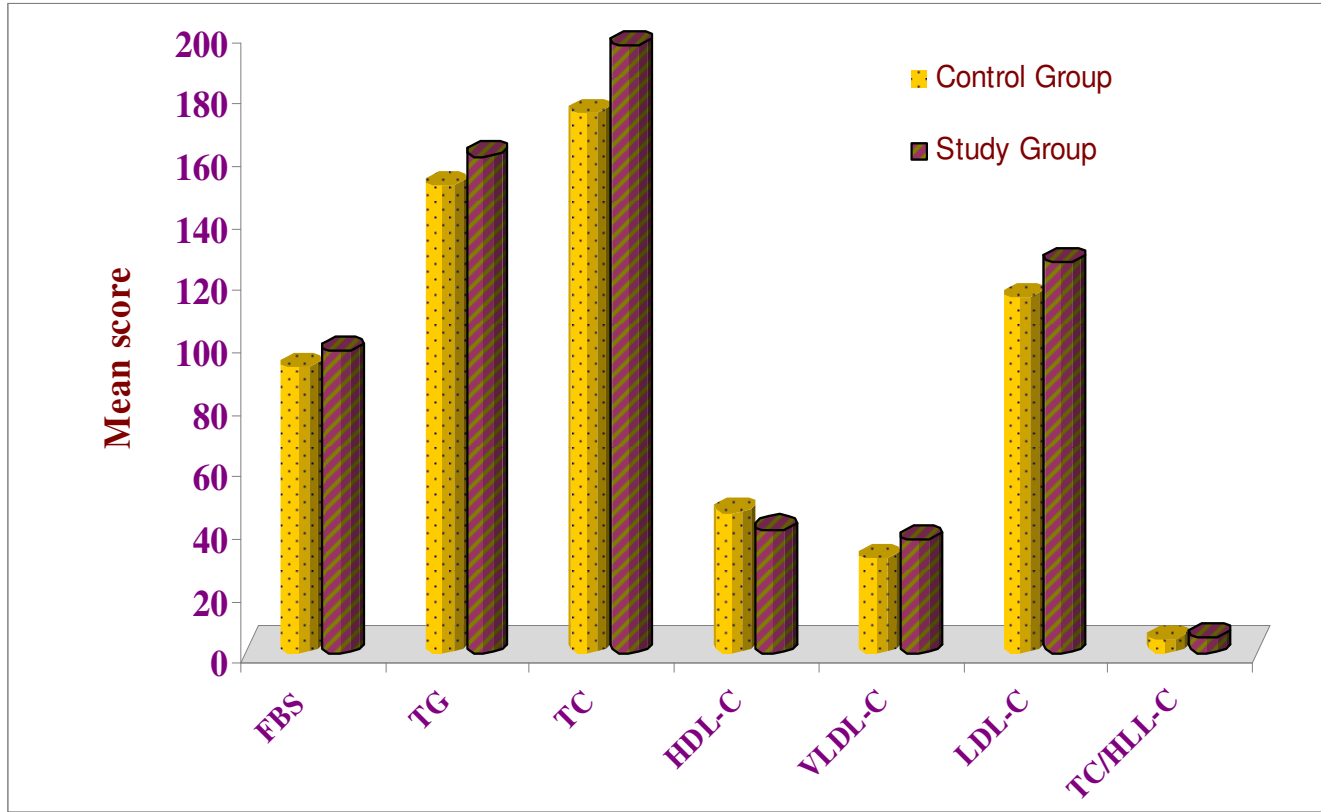
| Lipid Profile                | Normal levels<br>(mg/dl) | Day Workers<br>(N=15) | Shift Workers<br>(N=15) | t' Value           |
|------------------------------|--------------------------|-----------------------|-------------------------|--------------------|
| Fasting Blood Sugar<br>(FBS) | 60-110                   | 91.84 ± 4.38          | 97.10± 4.90             | 3.09**             |
| Triglycerides (TG)           | <150                     | 150.08±25.71          | 159.65±51.59            | 0.64 <sup>NS</sup> |
| Total Cholesterol (TC)       | <200                     | 173.43±33.06          | 195.33±27.56            | 1.96 <sup>NS</sup> |
| HDL-C                        | >40                      | 44.96±5.44            | 39.62±7.57              | 2.21*              |
| VLDL-C                       | ≤30                      | 30.45±5.58            | 36.32±13.21             | 1.58 <sup>NS</sup> |
| LDL-C                        | <100                     | 114.17±24.08          | 125.48±27.75            | 1.19 <sup>NS</sup> |
| TC/HDL-C                     | <5                       | 3.95±1.15             | 5.03±1.00               | 2.71*              |

Values are expressed in terms of Mean ± S.D

\* Significant at 5% level

\*\* Significant at 1% level

NS Non Significant



**Fig. 5 Biochemical parameters of the subjects**

Fig.5. Biochemical parameters of the subject

day workers and 61.8 per cent shift workers were found to consume it occasionally. Burger and patties was consumed by 11.8 per cent shift workers and 2.8 per cent day workers daily, followed by 19.4 per cent day workers and 35.3 per cent shift workers consuming it weekly. Majority of day workers (77.7%) and shift workers (55.9%) reported to consume it occasionally. About 69.4 per cent day workers and 47.1 per cent shift workers answered that they consumed sandwich occasionally, followed by 22.2 per cent day workers and 14.7 per cent shift workers consuming it weekly and 32.8 per cent shift workers and 8.3 per cent day workers consuming daily. Chocolates were preferred by 36.1 per cent day workers and 53.0 per cent shift workers daily. It was weekly preferred by 22.2 per cent day workers and 2.6 per cent shift workers. Forty one per cent day workers and 26.4 per cent shift workers consumed it occasionally. Among the bakery and confectionary items higher score was noticed in case of shift workers compared to day workers. Cakes/ pastries, burger/patties, sandwich consumption was statistically significant.

Among the fried products, chips was consumed daily by 23.5 per cent shift workers and 8.3 per cent day workers daily, followed by 47.2 per cent day workers and 41.2 per cent shift workers consuming it weekly, 44.4 per cent day workers and 35.3 per cent shift workers consumed it occasionally. pakodas were consumed by 20.6 per cent shift workers and 19.4 per cent day workers daily, followed by approximately 44 per cent of day workers 47 per cent of per cent shift workers reported to eat it weekly. Thirty six per cent day workers and 32.4 per cent shift workers were reported to consume pakodas occasionally. Majority of shift workers (53.0%) and 33.3 per cent day workers reported to consume vada daily, followed by 35.2 per cent shift workers and 27.8 per cent day workers consuming it weekly. Approximately 39 per cent day workers and 11.7 per cent shift workers reported to consume it occasionally. The average score showed that, among these fried foods vada consumption was found to be significant statistically in shift workers ( $2.41 \pm 0.70$ ) compared to day workers ( $2.0 \pm 0.86$ ).

With regard to fast foods, noodles was consumed by approximate 11 per cent subjects from both the group daily, followed by 35.9 per cent day workers and 56 per cent shift workers consuming it weekly, 47.7 per cent day workers and 32.3 per cent shift workers consumed it occasionally. Rolls were consumed by 44.4 per cent day workers and 2.6 per cent shift workers daily, followed by 50 per cent day and 47 per cent shift workers consuming it weekly. Occasionally 5.6 per cent day workers and 32.5 per cent shift workers consumed rolls. Gobimanchurian was consumed by 2.8 per cent day workers and 5.8 per cent shift workers daily, followed by 33.3 per cent day workers and 29.4 per cent shift workers consuming it weekly. More than 60 per cent subjects from both the group consumed it occasionally. Panipuri was consumed by 23.6 per cent shift workers and 2.8 per cent day workers daily, followed by 32.3 per cent shift workers and 55.6 per cent day workers consuming it weekly, approximately 40 per cent subjects from both the groups consumed it occasionally. Chats were preferred by 27.8 per cent day workers and 11.7 per cent shift workers daily, followed by 66.7 per cent day workers and 23.6 per cent shift workers consuming it weekly, 5.6 per cent day worker and 64.7 per cent shift workers were reported to consume it occasionally. The mean score, for fast foods was found to be higher in shift workers compared to day workers and these differences were not significant statistically.

Among desserts, ice cream was consumed only by 8.9 per cent shift workers daily. 38.9 per cent day workers and 44.1 per cent shift workers were reported to consume it weekly, followed by 61.1 per cent day worker and 47 per cent shift workers consuming it occasionally. Fruit salad was consumed by 11.1 per cent day workers and 8.9 per cent shift workers daily, weekly it was preferred by 36.1 per cent day workers and 32.3 per cent shift workers. Half of the subjects (approx. 50%) were consuming it occasionally. The mean score, for desserts was found to be higher in shift workers compared to day workers and these differences were not significant statistically.

Among fruits, banana was consumed by 29.4 per cent day workers and 22.2 per cent shift workers daily, followed by 27.8 per cent day workers and 26.4 per cent shift workers consuming it weekly. Half of the day workers and 44.2 per cent shift workers reported to consume it occasionally. Approximately equal percentage (8.3%) of subjects reported to consume guava daily, weekly it was preferred by 19.4 per cent day workers and 32.4 per cent shift workers. Majority of day workers (72.2%) and shift workers (58.8%) consumed it occasionally. Apple was consumed by 23 per cent of subject in both the group daily followed by 27.8 per cent day workers and 41.1 per cent shift workers consuming it weekly.

Occasionally 47.2 per cent day workers and 35.3 per cent shift workers consumed apples. Oranges were consumed by 13.9 per cent day workers and 8.8 shift workers daily, 22.2 per cent day workers and 38.2 per cent shift workers reported to consume it weekly, followed by 63.9 per cent day workers and 52.9 per cent shift workers occasionally consuming it. The average score for fruits was found to be higher in day workers than shift workers and the difference was statistically non significant.

Results of the fleshy foods consumption, depicted that 25 per cent day and 29.4 per cent shift workers were found to be non vegetarian. Approximately 17 per cent subjects in both the group consumed chicken daily, followed by 55.6 per cent day workers and 44.1 per cent shift workers consuming it weekly. Only 2.8 per cent day workers and 3.9 per cent shift workers consumed it occasionally. Mutton was consumed weekly by 22.2 per cent day workers and 17.6 per cent shift workers. More than 50 per cent subjects consumed it occasionally. Twenty five per cent day workers and 29.4 per cent shift workers never consumed mutton. With regard to fish, it was reported to consume daily by 16.7 per cent day workers and 14.7 per cent shift workers, followed by 55.6 per cent day workers and 38.2 per cent consuming it weekly. Occasionally it was consumed by 11.7 per cent shift workers. Twenty nine per cent day workers and 35.2 per cent shift workers never found to consume fish. The score indicated that the consumption of fleshy foods was higher in day workers compared to shift workers. These difference was found to be non significant except for mutton consumption.

#### 4.5.2 Fluid consumption pattern of the subjects

The data on the fluid consumption of the subjects in presented in Table 11.

##### 4.5.2.1 Plain water

Among the day workers, 41.7 per cent were drinking less than 2.1 litre water, followed by 30.6 per cent drinking 2.1 to 3.2 litre and 27.8 per cent drinking more than 3.2 litres. In case of shift workers, 32.4 per cent were drinking less than 2.1 litres, water 50 per cent were drinking 2.1 to 3.2 litres water and only 17.6 per cent were drinking more than 3.2 litres water per day.

##### 4.5.2.2 Tea/coffee

Among the day workers 22.2 per cent and in shift workers 5.9 per cent did not consume tea or coffee at all. In day workers, majority (61%) were reported to consume less than 2 cups of tea. Where as in case of shift workers, 61.8 per cent consumed more than 4 cups of tea a day. In day workers no one consumed more than 4 cups a day. Equal percentage of subjects (approximately 17%) in both the group consumed 2 to 4 cups per day and 14.7 percent of shift workers consumed less than 2 cups of tea or coffee per day.

##### 4.5.3.3 Milk

Majority of the day workers (61.6%) and shift workers (70.6%) never consumed milk. Eleven percent of day workers were drinking less than 300 ml of milk and equal percentage of subjects were drinking 300 to 500 ml of milk per day. In case of shift workers, nobody was in less than 300 ml category and 20.6 per cent shift workers drank between 300 to 500 ml, 16.7 per cent day workers and 8.6 per cent shift workers drank more than 500 ml of milk.

##### 4.5.4.4 Soft drinks

Among day workers, 25 per cent and 29.4 per cent of shift workers drank less than 350 ml of soft drinks per day, followed by three day workers (8.3%) and 10 shift workers (29.4%) drank more than 600 ml of soft drinks. Majority of day workers (66.7%) and 41.2 per cent of shift workers reported never to consume soft drinks.

##### 4.5.5.5 Fruit juice

Higher per cent of day workers (44.4%) and shift workers (64.7%) did not drink fruit juices, whereas 19.4 per cent were drinking less than 250 ml, followed by 27.8 per cent drinking 250 to 400 ml and 8.3 per cent drinking more than 400 ml. In case of shift workers equal per cent (17.6%) of subjects were taking less than 250 to 400 ml and more than 400 ml of juices per day respectively.

Table 10. Consumption pattern of high energy foods

N=70

| Products                          | Categories   | Day Workers  | Shift Workers | Average Score             |                             | t' test            |
|-----------------------------------|--------------|--------------|---------------|---------------------------|-----------------------------|--------------------|
|                                   |              | Frequency    | Frequency     | Day Workers<br>(Mean ±SD) | Shift Workers<br>(Mean ±SD) |                    |
| <b>Sweets</b>                     |              |              |               |                           |                             |                    |
| Rasgulla                          | Daily        | 3<br>(8.3)   | 9<br>(26.5)   | 1.52 ±0.65                | 1.91 ± 0.79                 | 2.20*              |
|                                   | Weekly       | 13<br>(36.1) | 13<br>(38.2)  |                           |                             |                    |
|                                   | Occasionally | 20<br>(55.6) | 12<br>(35.3)  |                           |                             |                    |
| Kajuburfi                         | Daily        | 1<br>(2.8)   | 2<br>(5.9)    | 1.29±0.57                 | 1.33±0.53                   | 0.29 <sup>NS</sup> |
|                                   | Weekly       | 10<br>(27.8) | 6<br>(17.6)   |                           |                             |                    |
|                                   | Occasionally | 25<br>(69.4) | 26<br>(76.5)  |                           |                             |                    |
| Gulab jamun                       | Daily        | 5<br>(14)    | 4<br>(11.8)   | 1.44±0.73                 | 1.47±0.70                   | 0.15 <sup>NS</sup> |
|                                   | Weekly       | 6<br>(16.6)  | 8<br>(23.5)   |                           |                             |                    |
|                                   | Occasionally | 25<br>(69.4) | 22<br>(64.7)  |                           |                             |                    |
| <b>Bakery &amp; confectionary</b> |              |              |               |                           |                             |                    |
| Cake/<br>pastry                   | Daily        | 3<br>(8.3)   | 7<br>(20.6)   | 1.44± 0.65                | 1.85± 0.74                  | 2.43*              |
|                                   | Weekly       | 10<br>(27.9) | 12<br>(35.3)  |                           |                             |                    |
|                                   | Occasionally | 23<br>(63.8) | 15<br>(44.1)  |                           |                             |                    |
| Biscuit/<br>cookies               | Daily        | 12<br>(33.3) | 17<br>(50.0)  | 1.91±0.87                 | 2.26±0.82                   | 1.71 <sup>NS</sup> |
|                                   | Weekly       | 9<br>(25.0)  | 9<br>(26.5)   |                           |                             |                    |
|                                   | Occasionally | 15<br>(41.7) | 8<br>(23.5)   |                           |                             |                    |
| Pizza                             | Daily        | 1<br>(2.8)   | 1<br>(2.9)    | 1.22±0.48                 | 1.41±0.55                   | 1.51 <sup>NS</sup> |
|                                   | Weekly       | 6<br>(16.7)  | 12<br>(35.3)  |                           |                             |                    |
|                                   | Occasionally | 29<br>(80.5) | 21<br>(61.8)  |                           |                             |                    |

Table 10. Contd.....

| Products           | Categories   | Day Workers  | Shift Workers | Average Score          |                          | 't' test           |
|--------------------|--------------|--------------|---------------|------------------------|--------------------------|--------------------|
|                    |              | Frequency    | Frequency     | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Burger/<br>Patties | Daily        | 1<br>(2.8)   | 4<br>(11.8)   | 1.25±0.50              | 1.55±0.70                | 2.10*              |
|                    | Weekly       | 7<br>(19.4)  | 11<br>(32.4)  |                        |                          |                    |
|                    | Occasionally | 28<br>(77.7) | 19<br>(55.9)  |                        |                          |                    |
| Sandwich           | Daily        | 3<br>(8.3)   | 13<br>(32.8)  | 1.38±0.64              | 1.97±0.93                | 3.00**             |
|                    | Weekly       | 8<br>(22.2)  | 5<br>(14.7)   |                        |                          |                    |
|                    | Occasionally | 25<br>(69.4) | 16<br>(47.1)  |                        |                          |                    |
| Chocolate          | Daily        | 13<br>(36.1) | 18<br>(53.0)  | 1.97±0.90              | 2.26±0.86                | 1.37 <sup>NS</sup> |
|                    | Weekly       | 8<br>(22.2)  | 7<br>(20.6)   |                        |                          |                    |
|                    | Occasionally | 15<br>(41.7) | 9<br>(26.4)   |                        |                          |                    |
| Fried products     |              |              |               |                        |                          |                    |
| Chips              | Daily        | 3<br>(8.3)   | 8<br>(23.5)   | 1.63±0.63              | 1.88±0.76                | 1.43 <sup>NS</sup> |
|                    | Weekly       | 17<br>(47.2) | 14<br>(41.2)  |                        |                          |                    |
|                    | Occasionally | 16<br>(44.4) | 12<br>(35.3)  |                        |                          |                    |
| Pakoda             | Daily        | 7<br>(19.4)  | 7<br>(20.6)   | 1.88±0.70              | 1.94±0.69                | 0.31 <sup>NS</sup> |
|                    | Weekly       | 16<br>(44.4) | 16<br>(47.0)  |                        |                          |                    |
|                    | Occasionally | 13<br>(36.1) | 11<br>(32.4)  |                        |                          |                    |
| Vada               | Daily        | 12<br>(33.3) | 18<br>(53.0)  | 2.0±0.86               | 2.41±0.70                | 2.19*              |
|                    | Weekly       | 10<br>(27.8) | 12<br>(35.2)  |                        |                          |                    |
|                    | Occasionally | 14<br>(38.8) | 4<br>(11.7)   |                        |                          |                    |

Table 10. Contd.....

| Products        | Categories   | Day Workers  | Shift Workers | Average Score          |                          | t' test            |
|-----------------|--------------|--------------|---------------|------------------------|--------------------------|--------------------|
|                 |              | Frequency    | Frequency     | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Fast foods      |              |              |               |                        |                          |                    |
| Noodles         | Daily        | 5<br>(13.9)  | 4<br>(11.7)   | 1.69±0.70              | 1.79±0.64                | 0.61 <sup>NS</sup> |
|                 | Weekly       | 14<br>(38.9) | 19<br>(56.0)  |                        |                          |                    |
|                 | Occasionally | 15<br>(41.7) | 11<br>(32.3)  |                        |                          |                    |
| Rolls           | Daily        | 16<br>(44.4) | 7<br>(20.6)   | 1.36±0.54              | 1.47±0.66                | 0.75 <sup>NS</sup> |
|                 | Weekly       | 18<br>(50.0) | 16<br>(47.0)  |                        |                          |                    |
|                 | Occasionally | 2<br>(5.6)   | 11<br>(32.5)  |                        |                          |                    |
| Gobi manchurian | Daily        | 1<br>(2.8)   | 2<br>(5.8)    | 1.36±0.54              | 1.41±0.60                | 0.36 <sup>NS</sup> |
|                 | Weekly       | 12<br>(33.3) | 10<br>(29.4)  |                        |                          |                    |
|                 | Occasionally | 23<br>(63.9) | 22<br>(64.8)  |                        |                          |                    |
| Panipuri        | Daily        | 1<br>(2.8)   | 8<br>(23.6)   | 1.61±0.54              | 1.79±0.80                | 1.10 <sup>NS</sup> |
|                 | Weekly       | 20<br>(55.6) | 11<br>(32.3)  |                        |                          |                    |
|                 | Occasionally | 15<br>(41.7) | 15<br>(44.1)  |                        |                          |                    |
| Chats           | Daily        | 10<br>(27.8) | 4<br>(11.7)   | 2.19±0.57              | 1.47±0.70                | 4.68 <sup>**</sup> |
|                 | Weekly       | 24<br>(66.7) | 8<br>(23.6)   |                        |                          |                    |
|                 | Occasionally | 2<br>(5.6)   | 22<br>(64.7)  |                        |                          |                    |

Table 10. Contd.....

| Products    | Categories   | Day Workers  | Shift Workers | Average Score          |                          | 't' test           |
|-------------|--------------|--------------|---------------|------------------------|--------------------------|--------------------|
|             |              | Frequency    | Frequency     | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Desserts    |              |              |               |                        |                          |                    |
| Ice cream   | Daily        | -            | 3<br>(8.9)    | 1.38±0.49              | 1.61±0.65                | 1.64 <sup>NS</sup> |
|             | Weekly       | 14<br>(38.9) | 15<br>(44.1)  |                        |                          |                    |
|             | Occasionally | 22<br>(61.1) | 16<br>(47.0)  |                        |                          |                    |
| Fruit salad | Daily        | 4<br>(11.1)  | 3<br>(8.9)    | 1.58±0.69              | 1.5±0.66                 | 0.51 <sup>NS</sup> |
|             | Weekly       | 13<br>(36.1) | 11<br>(32.3)  |                        |                          |                    |
|             | Occasionally | 19<br>(52.8) | 20<br>(58.8)  |                        |                          |                    |
| Fruits      |              |              |               |                        |                          |                    |
| Banana      | Daily        | 10<br>(29.4) | 8<br>(22.2)   | 1.85±0.85              | 1.72±0.81                | 0.65 <sup>NS</sup> |
|             | Weekly       | 10<br>(27.8) | 9<br>(26.4)   |                        |                          |                    |
|             | Occasionally | 18<br>(50.0) | 15<br>(44.2)  |                        |                          |                    |
| Guava       | Daily        | 3<br>(8.3)   | 3<br>(8.8)    | 1.5±0.66               | 1.36±0.63                | 0.89 <sup>NS</sup> |
|             | Weekly       | 7<br>(19.4)  | 11<br>(32.4)  |                        |                          |                    |
|             | Occasionally | 26<br>(72.2) | 20<br>(58.8)  |                        |                          |                    |
| Apple       | Daily        | 9<br>(25.0)  | 8<br>(23.6)   | 1.88±0.76              | 1.77±0.83                | 0.54 <sup>NS</sup> |
|             | Weekly       | 10<br>(27.8) | 14<br>(41.1)  |                        |                          |                    |
|             | Occasionally | 17<br>(47.2) | 12<br>(35.3)  |                        |                          |                    |
| Oranges     | Daily        | 5<br>(13.9)  | 3<br>(8.8)    | 1.5±0.73               | 1.41±0.65                | 0.52 <sup>NS</sup> |
|             | Weekly       | 8<br>(22.2)  | 13<br>(38.2)  |                        |                          |                    |
|             | Occasionally | 23<br>(63.9) | 18<br>(52.9)  |                        |                          |                    |

Table 10. Contd.....

| Products     | Categories   | Day Workers  | Shift Workers | Average Score             |                             | 't' test           |
|--------------|--------------|--------------|---------------|---------------------------|-----------------------------|--------------------|
|              |              | Frequency    | Frequency     | Day Workers<br>(Mean ±SD) | Shift Workers<br>(Mean ±SD) |                    |
| Fleshy foods |              |              |               |                           |                             |                    |
| Chicken      | Daily        | 6<br>(16.7)  | 6<br>(17.6)   | 2.58±1.0                  | 2.5±1.10                    | 0.31 <sup>NS</sup> |
|              | Weekly       | 20<br>(55.6) | 15<br>(44.1)  |                           |                             |                    |
|              | Occasionally | 1<br>(2.8)   | 3<br>(3.9)    |                           |                             |                    |
|              | Never        | 9<br>(25.0)  | 10<br>(29.4)  |                           |                             |                    |
| Mutton       | Daily        | -            | -             | 1.97±0.69                 | 1.88±0.68                   | 2.37*              |
|              | Weekly       | 8<br>(22.2)  | 6<br>(17.6)   |                           |                             |                    |
|              | Occasionally | 19<br>(52.8) | 18<br>(53.0)  |                           |                             |                    |
|              | Never        | 9<br>(25.0)  | 10<br>(29.4)  |                           |                             |                    |
| Fish         | Daily        | 6<br>(16.7)  | 5<br>(14.7)   | 2.61±1.07                 | 2.20±1.20                   | 1.48 <sup>NS</sup> |
|              | Weekly       | 20<br>(55.6) | 13<br>(38.2)  |                           |                             |                    |
|              | Occasionally | -            | 4<br>(11.7)   |                           |                             |                    |
|              | Never        | 10<br>(29.4) | 12<br>(35.2)  |                           |                             |                    |

Figures in parentheses indicated percentage.

\* Significant at 5% level

\*\* Significant at 1% level

NS Non Significant

Table 11. Fluid consumption pattern of the subjects

N=70

| Fluid (per day)   | Range       | Day Workers (n=36) | Shift workers (n=34) | Average Consumption    |                          | t' Values          |
|-------------------|-------------|--------------------|----------------------|------------------------|--------------------------|--------------------|
|                   |             | Frequency          | Frequency            | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Plain water (L)   | < 2.1       | 15<br>(41.7)       | 11<br>(32.4)         | 2.75 ± 1.27            | 2.64 ±1.08               | 0.42 <sup>NS</sup> |
|                   | 2.1-3.2     | 11<br>(30.5)       | 17<br>(50.0)         |                        |                          |                    |
|                   | > 3.2       | 10<br>(27.8)       | 6<br>(17.6)          |                        |                          |                    |
| Tea/Coffee (cups) | Don't drink | 8<br>(22.2)        | 2<br>(5.9)           | 1.99±0.69              | 3.78±1.21                | 7.23 <sup>**</sup> |
|                   | < 2         | 22<br>(61.1)       | 5<br>(14.7)          |                        |                          |                    |
|                   | 3-4         | 6<br>(16.7)        | 6<br>(17.6)          |                        |                          |                    |
|                   | > 4         | -                  | 21<br>(61.8)         |                        |                          |                    |
| Milk (ml)         | Don't drink | 22<br>(61.1)       | 24<br>(70.6)         | 457.14±336.18          | 390 ±144.9               | 0.66 <sup>NS</sup> |
|                   | < 300       | 4<br>(11.1)        | -                    |                        |                          |                    |
|                   | 300-500     | 4<br>(11.1)        | 7<br>(20.6)          |                        |                          |                    |
|                   | > 500       | 6<br>(16.7)        | 3<br>(8.8)           |                        |                          |                    |
| Soft drinks (ml)  | Don't drink | 24<br>(66.7)       | 14<br>(41.2)         | 350.0±162.36           | 567.5±373.55             | 2.27 <sup>*</sup>  |
|                   | < 350       | 9<br>(25.0)        | 10<br>(29.4)         |                        |                          |                    |
|                   | 350-600     | -                  | -                    |                        |                          |                    |
|                   | > 600       | 3<br>(8.3)         | 10<br>(29.4)         |                        |                          |                    |
| Fruit Juice (ml)  | Don't drink | 16<br>(44.4)       | 22<br>(64.8)         | 450±202.26             | 295±135.62               | 2.35 <sup>*</sup>  |
|                   | < 250       | 7<br>(19.4)        | -                    |                        |                          |                    |
|                   | 250-400     | 10<br>(27.8)       | 6<br>(17.6)          |                        |                          |                    |
|                   | > 400       | 3<br>(8.4)         | 6<br>(17.6)          |                        |                          |                    |

Figures in parentheses indicated percentage.

\* Significant at 5% level

\*\* Significant at 1% level

NS Non Significant

The average consumption of water was found to be 2.75 litre and 2.64 litre in day and shift workers respectively. But higher difference was noticed in the average value of tea consumption among shift workers ( $3.78 \pm 1.21$  cups) compared to day workers ( $1.99 \pm 0.69$  cups), which was statistically significant. Average consumption of milk was 390 ml in shift workers and 457.14 ml in day workers. The average soft drinks consumption was more in shift workers ( $567.5 \pm 373.55$  ml) compared to day workers ( $350.0 \pm 162.36$  ml) and it was statistically significant. When average fruit juice consumption was considered it was low in shift workers ( $295 \pm 135.62$  ml) compared to day workers ( $450 \pm 202.26$  ml), values were found to be statistically significant. The average consumption of water and milk was found to be similar for the two groups.

#### 4.5.3 Food consumption habits of the Subjects

Information on meal pattern of the subjects is presented in Table 12.

Among the day workers, more than fifty per cent (58.3%) consumed 3 meals a day, but in shift workers the percentage was 38.2. Thirty six per cent (13 subjects) of day workers consumed more than 4 meals a day and only 2 day workers (5.6%) consumed 2 meals per day. Forty one per cent of shift workers consumed more than 4 meals. The per cent of shift workers consuming 2 meals per day was found to be 20.6. Majority of day workers (77.8%) and shift workers (88.2%) preferred the canteen food. Only 22.2 per cent and 11.8 per cent shift workers carried the lunch box.

Among the day workers, 38.9 per cent skipped meal, but the percentage of meal skipping was more in case of shift workers (47%). In the day workers 61.6 per cent and (53%) of shift workers never skipped any meal. Thirty three per cent day workers and 26.5 per cent of shift workers skipped breakfast, 5.6 per cent of day workers and 14.7 per cent of shift workers skipped the lunch. Approximately six per cent shift workers skipped the dinner, where as no day workers were there in this category. Regarding the frequency of meals skipped 19.4 per cent day workers and 38.2 per cent shift workers skipped meals 2-3 times a week and 8.3 per cent day workers skipped meals more than 4 times a week, but no shift worker skipped meal more than 4 times a week. Eleven per cent of day workers and 8.8 per cent shift workers reported to skip meals daily.

Majority of day workers (88.9%) and 100 per cent of shift workers regularly went outside for change in food. North Indian food was most preferred by 50 per cent of day workers and 55.9 per cent of shift workers, Chinese food was the second most preferred food by 33.3 per cent day workers and 23.5 per cent shift workers. South Indian food was preferred by 5.6 per cent of day workers and 20.6 per cent of shift workers.

With regard to the frequency of consumption of outside food 19.4 per cent and 44.1 per cent shift workers reported that they went for food outside every day, 44.4 per cent day workers and 26.5 per cent shift workers went outside for food once in a week followed by 25.2 per cent day workers and 29.4 per cent shift workers once in fifteen days.

#### 4.5.4 Smoking pattern of the subjects

Table 13 shows the smoking pattern of the subjects.

Among the day workers only 19.4 per cent of subjects were smokers, whereas in case of shift workers more than half the subjects (52.9%) were smokers. Seventy eight per cent of day workers and 47.1 per cent of shift workers were non smokers.

Regarding the age of starting 16.6 per cent day workers started smoking between 21 to 29 years, 2.7 per cent of the subjects before 21 years of age. Among the shift workers, equal percentage of subjects (23.5%) started smoking between the ages 21 years to 24 years and after 24 years. Only 5.8 per cent were found to smoke before the age of 21 years.

Before joining the job approximately 20 per cent subjects from both the group were having smoking habits, 11.1 per cent day workers and 8.8 per cent shift workers were smoking less than 18 cigarettes per week. Three per cent day workers and 5.8 per cent shift workers were smoking 18 to 34 cigarettes per week, followed by 5.5 per cent day workers and 5.8 per cent shift workers smoking more than 34 cigarettes. After joining the job the percentage of subjects smoking remained same (19.4 %) in day workers, but in shift workers this percentage increased to 52.9 per cent. Eight per cent day workers and 2.9 per cent shift

Table 12. Food consumption habits of the subjects

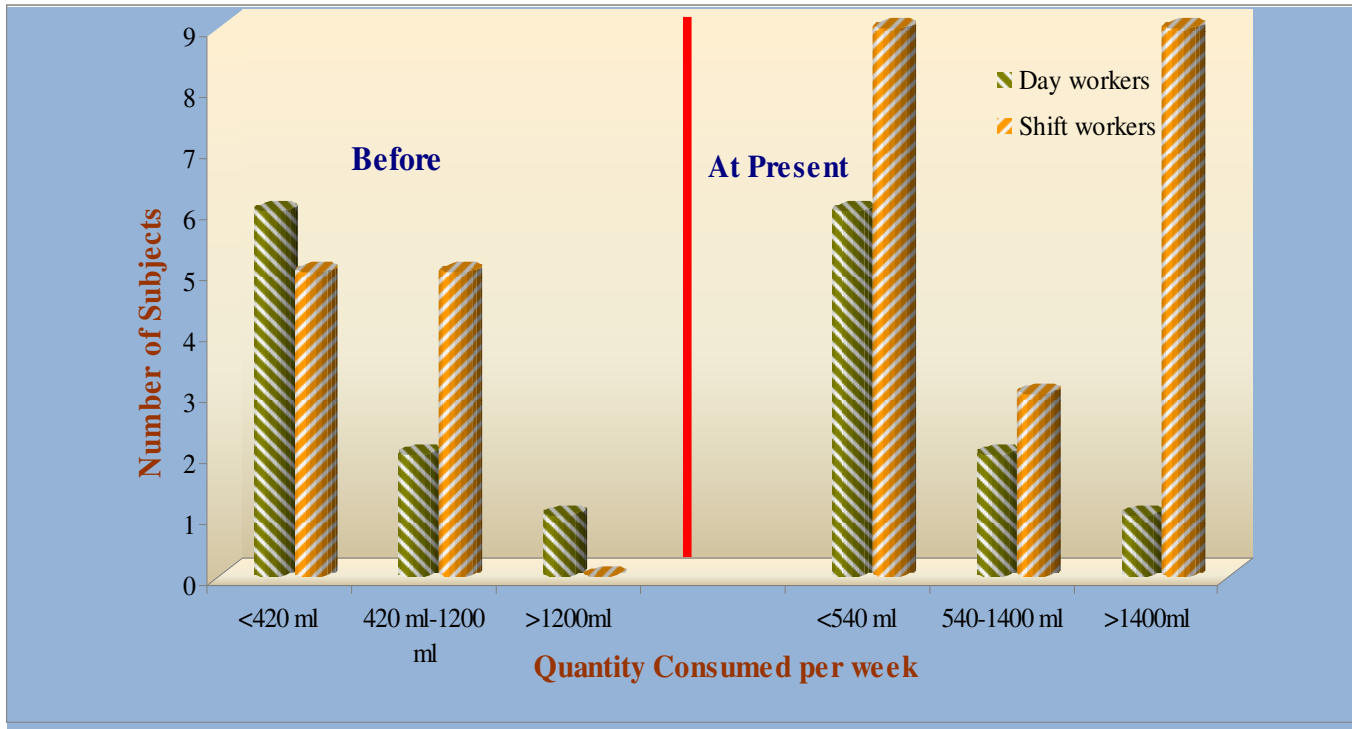
N=70

| Particulars                           | Categories          | Day Workers<br>(n=36) |            | Shift Workers<br>(n=34) |            |
|---------------------------------------|---------------------|-----------------------|------------|-------------------------|------------|
|                                       |                     | Frequency             | Percentage | Frequency               | Percentage |
| Numbers of meals/day                  | 3 meals             | 21                    | 58.3       | 13                      | 38.2       |
|                                       | 4 meals             | 13                    | 36.1       | 14                      | 41.2       |
|                                       | Other (2 meals)     | 2                     | 5.6        | 7                       | 20.6       |
| Types of meals                        | Homemade food       | 8                     | 22.2       | 4                       | 11.8       |
|                                       | Canteen food        | 28                    | 77.8       | 30                      | 88.2       |
| Meals skipping                        | Yes                 | 14                    | 38.9       | 16                      | 47         |
|                                       | No                  | 22                    | 61.1       | 18                      | 53         |
| Frequently of skipping                | Daily               | 4                     | 11.3       | 3                       | 8.8        |
|                                       | 2-3 times in a week | 7                     | 19.4       | 13                      | 38.2       |
|                                       | >4times a week      | 3                     | 8.3        | -                       | -          |
| Type of meal skipped                  | Break fast          | 12                    | 33.4       | 9                       | 26.5       |
|                                       | Lunch               | 2                     | 5.6        | 5                       | 14.6       |
|                                       | Dinner              | -                     | -          | 2                       | 5.9        |
| Eat outside                           | Yes                 | 32                    | 88.9       | 34                      | 100        |
|                                       | No                  | 4                     | 11.1       | -                       | -          |
| Outside food Preference               | Chinese             | 12                    | 33.4       | 8                       | 23.5       |
|                                       | North Indian        | 18                    | 50.0       | 19                      | 55.9       |
|                                       | South Indian        | 2                     | 5.6        | 7                       | 20.6       |
| Frequency of outside food consumption | Daily               | 7                     | 19.5       | 15                      | 44.1       |
|                                       | Once in a week      | 16                    | 44.4       | 9                       | 26.5       |
|                                       | Once in 15 days     | 7                     | 19.5       | 10                      | 29.5       |
|                                       | Once in a month     | 2                     | 5.6        | -                       | -          |

Table 13. Smoking patterns of the subjects

N=70

| Particulars                   | Category             | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|-------------------------------|----------------------|-----------------------|------------|-------------------------|------------|
|                               |                      | Frequency             | Percentage | Frequency               | Percentage |
| Smoking habit                 | Smokers              | 7                     | 19.4       | 18                      | 52.9       |
|                               | Nonsmokers           | 29                    | 77.8       | 16                      | 47.1       |
| Age of starting<br>(Years)    | < 21                 | 1                     | 2.7        | 2                       | 5.8        |
|                               | 21-24                | 6                     | 16.6       | 8                       | 23.5       |
|                               | > 24                 | -                     | -          | 8                       | 23.5       |
| Number of<br>cigarettes/week  | Before               |                       |            |                         |            |
|                               | <18                  | 4                     | 11.1       | 3                       | 8.8        |
|                               | 18-34                | 1                     | 2.7        | 2                       | 5.8        |
|                               | >34                  | 2                     | 5.5        | 2                       | 5.8        |
|                               | Total                | 7                     | 19.4       | 7                       | 20.5       |
|                               | At present           |                       |            |                         |            |
|                               | <32                  | 3                     | 8.3        | 2                       | 5.8        |
|                               | 32-47                | 2                     | 5.5        | 9                       | 26.4       |
|                               | >47                  | 2                     | 5.5        | 7                       | 20.5       |
|                               | Total                | 7                     | 19.4       | 18                      | 52.9       |
| Places smoke<br>mostly        | Office               | 5                     | 13.8       | 4                       | 11.8       |
|                               | Home                 | 2                     | 5.5        | -                       | -          |
|                               | Outside              | 3                     | 8.3        | 14                      | 41.2       |
| Company of<br>smoking         | Alone                | 4                     | 11.1       | 6                       | 17.6       |
|                               | With friends         | 5                     | 13.8       | 12                      | 35.4       |
| Motivation to<br>quit smoking | Health issue         | 6                     | 16.7       | 10                      | 29.4       |
|                               | Cost of<br>cigarette | 1                     | 2.8        | 8                       | 23.5       |



**Fig. 6. Number of subjects smoking before joining the job and at present**

Fig.6. Number of subjects smoking before joining the job and at present

worker smoked less than 32 cigarettes/week, followed by 5.5 per cent day workers and 26.9 per cent shift workers consuming 32 to 47 cigarettes. More than 47 cigarettes were consumed by 5.5 per cent day workers and 20.5 per cent shift workers. (Fig. 6)

With regard to place of smoking 8.3 per cent day workers and 41.2 per cent shift workers reported to smoke outside, 11.1 per cent day workers and 17.6 per cent shift workers were smoking alone, but 13.8 per cent day workers and 35.4 per cent shift workers smoked along with friends.

Seventeen per cent day workers and 29.4 per cent shift workers reported to quit smoking if any health problem arises. Approximately three per cent day worker and 23.5 per cent shift workers reported that they will quit smoking if the cost of cigarette is increased.

#### 4.5.5 Alcohol consumption pattern of the subjects

Table 14 presents the information on alcohol consumption habits, age of starting, quantity consumed per week (before joining the job and after joining the job), frequency of drinking, reasons behind alcohol consumption etc.

Among the day workers 25 per cent subjects consumed alcohol, whereas more than half the shift workers (61.7%) consumed alcohol regularly. Thirteen per cent day workers started consuming alcohol before 21 years, whereas in case of shift workers 5.8 per cent subjects were there in this category. But 29.4 per cent shift workers started consuming alcohol between the age of 21 to 24 years, while in day workers there were only 8.3 per cent subjects in this age range. After the age of 24 years 26.4 per cent shift workers and 2.7 per cent day worker started alcohol consumption (Fig.7).

Twenty five per cent day workers and 20.5 per cent shift workers were reported that they were taking alcohol before joining the job. The percentage of subjects consuming alcohol remained same in day workers but in shift workers it increased to 61.7 per cent after taking up the job and the quantity of alcohol intake increased in both the group. Sixteen per cent, 5.5 per cent, 2.7 per cent day workers were found to consume less than 420 ml, 420 to 1200 ml and more than 1200 ml respectively in a week. In case of shift workers 14.7 per cent and 5.8 per cent were found to consume less than 420 ml, 420 ml to 1200ml alcohol respectively and there was no shift worker in the third group (more than 1200 ml).

After joining the job, 16.6 per cent, 5.5 per cent and 2.7 per cent day workers were classified as per the quantity of alcohol consumption into less than 540 ml, 540 ml to 1400 ml and more than 1400 ml group respectively. In case of shift workers 14.7 per cent, 8.8 per cent and 38.2 per cent were reported to consume less than 540 ml, 540 ml to 1400 ml and more than 1400 ml group respectively.

In control group 5.6 per cent workers were found to drink once a week followed by 8.3 per cent drinking more than once a week and 11.1 per cent workers drinking once in fortnight. In case of shift workers 47.11 per cent, consuming once a week, followed by 8.8 per cent of subjects consuming more than once a week and 2 subjects consuming fortnightly.

#### 4.5.6 Exercise habits of subjects

Information on habits of doing exercise, hours spent on physical activity, level of satisfaction with physical activity, type of sports played, frequency of playing, membership in club or gym, mode of traveling are presented in Table 15.

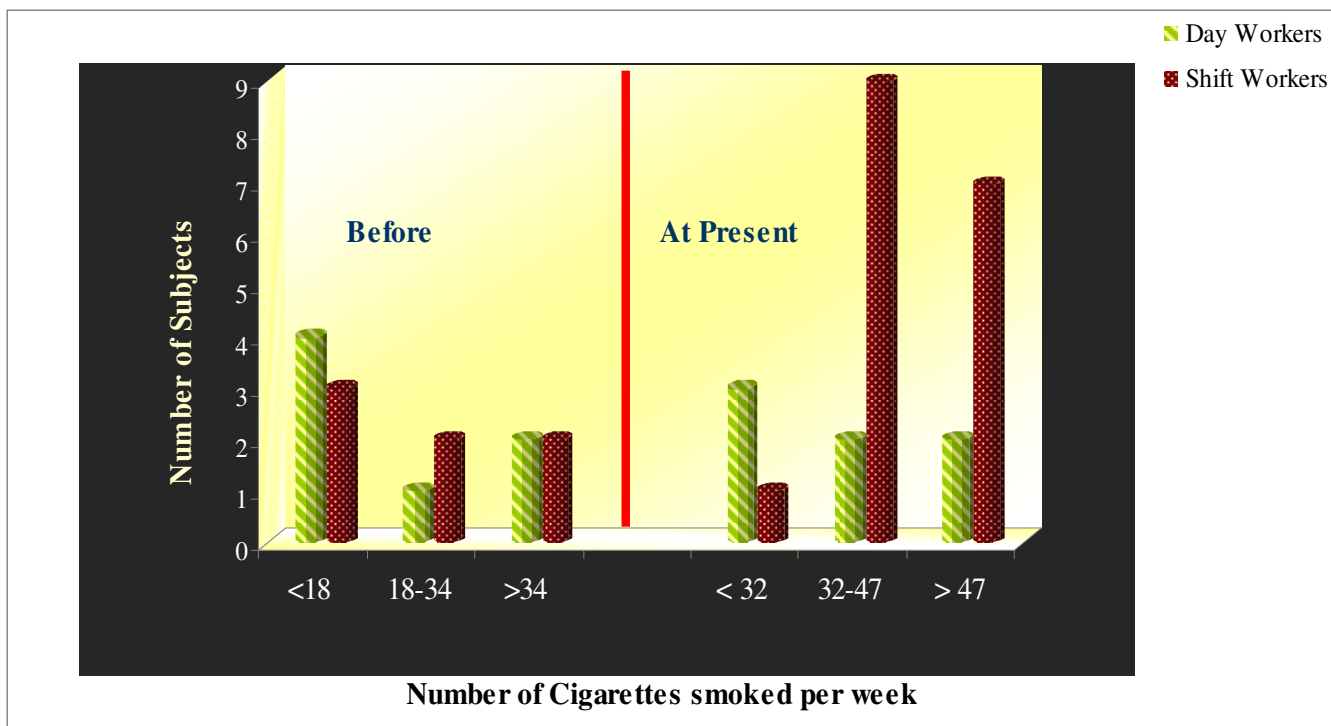
With respect to habit of doing exercise 16.7 per cent day workers and 32.3 per cent shift workers reported that they were not doing any exercise regularly, sixteen 44.4 per cent day workers and 23.5 per cent shift workers were found to have walking practice followed by 27.7 per cent day workers and 14.7 per cent shift workers doing yoga. Sixteen per cent day workers and 29.4 per cent shift workers were doing physical exercise regularly.

Higher percentage of day workers (55.5%) and shift workers (52.9%) were doing physical activity for less than one hour followed by 27.8 per cent day workers and 14.7 per cent shift workers reported that they exercise for 1 to 2 hours per day. Approximately 28 per cent subjects from both the group were not satisfied with the time spent for physical activity. Thirty three per cent day workers and 23.5 per cent shift workers were satisfied moderately, followed by 33.3 per cent day workers and 14.7 per cent shift workers satisfied fully.

Table 14. Alcohol consumption pattern of the subjects

N=70

| Particulars                 | Categories               | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|-----------------------------|--------------------------|-----------------------|------------|-------------------------|------------|
|                             |                          | Frequency             | Percentage | Frequency               | percentage |
| Alcohol habit               | Alcohol consumer         | 9                     | 25         | 21                      | 61.7       |
|                             | Non-consumer             | 27                    | 75         | 13                      | 38.2       |
| Age of starting<br>(Years)  | <21                      | 5                     | 13.8       | 2                       | 5.8        |
|                             | 21-24                    | 3                     | 8.3        | 10                      | 29.4       |
|                             | >24                      | 1                     | 2.7        | 9                       | 26.4       |
| Quantity<br>(ml/wk)         | Earlier                  |                       |            |                         |            |
|                             | < 420                    | 6                     | 16.6       | 5                       | 14.7       |
|                             | 420 -1200                | 2                     | 5.5        | 2                       | 5.8        |
|                             | >1200                    | 1                     | 2.7        | -                       | -          |
|                             | Total                    | 9                     | 25         | 7                       | 20.5       |
|                             | At present               |                       |            |                         |            |
|                             | <540                     | 6                     | 16.6       | 5                       | 14.7       |
|                             | 540- 1400                | 2                     | 5.5        | 3                       | 8.8        |
|                             | >1400                    | 1                     | 2.7        | 13                      | 38.2       |
|                             | Total                    | 9                     | 25         | 21                      | 61.7       |
| Frequency of<br>consumption | Once in a week           | 2                     | 5.6        | 16                      | 47.1       |
|                             | More than once a<br>week | 3                     | 8.3        | 3                       | 8.8        |
|                             | Fortnightly              | 4                     | 11.1       | 2                       | 5.9        |
| Reason for<br>consumption   | Enjoyment                | 9                     | 25         | 21                      | 61.8       |
|                             | Release tension          | -                     | -          | -                       | -          |
|                             | Release<br>tiredness     | -                     | -          | -                       | -          |



**Fig. 7. Number of subjects consuming alcohol before joining the job and at present**

Fig.7. Number of subjects consuming alcohol before joining the job and at present

Sixteen per cent day workers and 32.3 per cent shift workers mentioned that they do not play any kind of sports. Among day workers, 19.3 per cent and 8.8 per cent shift workers were found to play football. Majority of the day workers (58.3%) and shift workers (64.7%) were reported that they play cricket, where as rugby was played by 30.5 per cent day workers only. Badminton was played by 13.8 per cent day workers and 14.7 per cent shift workers.

Before joining the job 61.6 per cent day workers and 38.2 per cent shift workers were reported to play regularly i.e once a week. Whereas, after taking the job, the percentage of subjects playing weekly decreased to 22.2 percent and 8.8 percent in day and shift workers respectively. Approximately 67 per cent of day workers and 38.2 per cent of shift workers were found to play once in fifteen days before joining the job. But after joining the job, only 5.6 per cent day workers and 2.9 per cent shift workers continued to play once in fifteen days. Approximately twenty three per cent of shift workers were playing once a month before joining the job. After joining the job 14 per cent shift workers and 16.7 per cent day workers reported to play once in a month. Thirty eight per cent day workers and 41.4 per cent shift workers stated that there was no specific schedule for their play activity.

Among the day workers 23 (63.9%) and 14 (41.2%) shift workers were identified as members of club or gym, 58.3 per cent day workers and 29.4 per cent shift workers reported to have gym facility at work place. With respect to mode of traveling, 8.3 per cent day workers and 5.9 per cent of shift workers went to office by car, followed by 5.6 per cent day workers and 2.9 per cent shift workers preferred bus or auto. Majority of day workers (52.8%) and shift workers (85.3%) preferred to go by bike. Twenty five per cent day workers and 2.9 per cent were reported to go by walking. Approximately 8 percent day workers and 2.9 per cent shift workers preferred cab.

#### 4.5.7 Sleep pattern of subjects

The sleep pattern such as time of going to bed, time taken to fall asleep, wake up habit in the middle of night, weekend sleeping pattern etc are presented in Table 16.

All the day workers (100%) went to bed at night, while 47.1 per cent and 52.9 per cent shift workers went to bed in the morning and night respectively. With regard to time of sleep, 75 per cent day workers went to bed between 12am to 2 pm followed by 25 per cent subjects between 2 pm to 4 pm. There was no day worker reported to go to sleep between 10pm to 12 pm and after 4 am. Twenty nine per cent shift workers were found to sleep between 12 am to 2 am and higher percentages (47.1%) were found to sleep after 4 Am. Approximately 12 per cent shift workers were there in each group i.e. 10 pm to 12 am and 2 am to 4 am group respectively.

Among the day workers 36.1 per cent reported that they fall asleep within no time and the same percentages of subjects were reported to fall asleep after half an hour. Twenty seven per cent day workers took more than one hour to fall asleep. Regarding shift workers 50 per cent subjects were found to fall asleep after half an hour. Thirty eight per cent of subjects reported to sleep within no time and 11.8 per cent shift workers took more than one hour to fall asleep. Sound sleep was observed in majority of day workers (88.8%) and only in 14.7 per cent of shift workers. Less per cent of the day workers (11.1%) and majority of shift workers (85.3%) reported to have disturbed sleep at night.

Fifty two per cent day workers and 11.7 per cent shift workers were usually satisfied and felt well rested after a full night sleep, followed by 38.9 per cent day workers and 32.4 per cent shift workers satisfied sometimes, 8.3 per cent day workers and 55.9 per cent shift workers were never satisfied with their sleeping habits. More than 80 per cent of day workers and 67.7 per cent shift workers reported that they slept for more than 8 hours a day.

41.7 per cent day workers and 58.8 per cent shift workers reported not to wake up in the middle of sleep, followed by 58.3 per cent day workers and 41.1 per cent shift workers woke up once at night. Eleven per cent day workers and 55.9 per cent shift workers experienced sleepiness during working hours. Majority of day workers (77.8%) and 32.4 per cent shift workers felt sleepy sometimes, whereas 11.1 per cent day workers and 11.8 per cent shift workers never felt sleepy in office hours.

On weekends 44.4 per cent day workers and 52.4 per cent shift workers reported to sleep between 10 pm to 12 am. Approximately 45 per cent of day workers and 29.4 per cent

Table 15. Exercise habits of the subjects

N=70

| Particulars                                      | Categories           | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|--|----------------------|-----------------------|------------|-------------------------|------------|
|  |                      | Frequency             | Percentage | Frequency               | Percentage |
| Habit of doing exercise                          | No exercise          | 6                     | 16.7       | 11                      | 32.3       |
|  | Walking              | 16                    | 44.4       | 8                       | 23.5       |
|  | Yoga                 | 10                    | 27.7       | 5                       | 14.7       |
|  | Physical exercise    | 6                     | 16.6       | 10                      | 29.4       |
| Time spent for physical activity.<br>(Hours/day) | <1                   | 20                    | 55.6       | 18                      | 52.9       |
|  | 1-2                  | 10                    | 27.8       | 5                       | 14.7       |
| Level of satisfaction with physical activity     | Not satisfied        | 10                    | 27.8       | 10                      | 29.4       |
|  | Moderately satisfied | 12                    | 33.3       | 8                       | 23.5       |
|  | Satisfied            | 12                    | 33.3       | 5                       | 14.7       |
| Type of sports played                            | None                 | 6                     | 16.6       | 11                      | 32.3       |
|  | Foot ball            | 7                     | 19.3       | 3                       | 8.8        |
|  | Cricket              | 21                    | 58.3       | 22                      | 64.7       |
|  | Rugby                | 11                    | 30.5       | -                       | -          |
|  | Badminton            | 5                     | 13.8       | 5                       | 14.7       |

Table 15. Contd.....

| Particulars                  | Categories      | Day Workers<br>(N=36) |            | Shift Workers<br>(N=34) |            |
|------------------------------|-----------------|-----------------------|------------|-------------------------|------------|
|                              |                 | Frequency             | Percentage | Frequency               | Percentage |
| Frequency of playing         | Before Job      |                       |            |                         |            |
|                              | Not specific    | -                     | -          | -                       | -          |
|                              | Once in a week  | 22                    | 61.1       | 13                      | 38.2       |
|                              | Once in 15 days | 14                    | 38.9       | 13                      | 38.2       |
|                              | Once in a month | -                     | -          | 8                       | 23.5       |
|                              | At present      |                       |            |                         |            |
|                              | Not specific    | 14                    | 38.3       | 14                      | 41.4       |
|                              | Once in a week  | 8                     | 22.2       | 3                       | 8.8        |
|                              | Once in 15 days | 2                     | 5.6        | 1                       | 2.9        |
|                              | Once in a month | 6                     | 16.7       | 5                       | 14.0       |
| Membership in club or Gym    | Member          | 23                    | 63.9       | 14                      | 41.2       |
|                              | Not a member    | 13                    | 36.1       | 20                      | 58.8       |
| Gym facility at workplace    | Have            | 21                    | 58.3       | 10                      | 29.4       |
|                              | Don't have      | 15                    | 41.7       | 24                      | 70.6       |
| Mode of travelling to office | Car             | 3                     | 8.3        | 2                       | 5.9        |
|                              | Bus/Auto        | 2                     | 5.6        | 1                       | 2.9        |
|                              | Bike            | 19                    | 52.8       | 29                      | 85.3       |
|                              | Walking         | 9                     | 25.0       | 1                       | 2.9        |
|                              | Cab             | 3                     | 8.4        | 1                       | 2.9        |

Table 16. Sleep pattern of the subjects

N=70

| Particulars   | Categories                | Day Workers<br>(n=36) |            | Shift Workers<br>(n=34) |            |
|---|---------------------------|-----------------------|------------|-------------------------|------------|
|   |                           | Frequency             | Percentage | Frequency               | Percentage |
| Sleep Timing  | Day                       | -                     | -          | 16                      | 47.1       |
|   | Night                     | 36                    | 100        | 18                      | 52.9       |
| On working days<br>time of going to bed               | 10pm-<br>Midnight         | -                     | -          | 4                       | 11.8       |
|   | Midnight- 2am             | 27                    | 75         | 10                      | 29.4       |
|   | 2-4am                     | 9                     | 25         | 4                       | 11.8       |
|   | After 4am                 | -                     | -          | 16                      | 47.1       |
| Time taken to fall<br>asleep                          | Fall asleep<br>right away | 13                    | 36.1       | 13                      | 38.2       |
|   | After 1/2hr               | 13                    | 36.1       | 17                      | 50.0       |
|   | 1hr                       | 10                    | 27.8       | 4                       | 11.8       |
| Sound sleep pattern                                   | Yes                       | 32                    | 88.8       | 5                       | 14.7       |
|   | No                        | 4                     | 11.1       | 29                      | 85.3       |
| Feeling of well<br>rested after full<br>night sleep   | Usually                   | 19                    | 52.8       | 4                       | 11.7       |
|   | Sometimes                 | 14                    | 38.9       | 11                      | 32.4       |
|   | Never                     | 3                     | 8.3        | 19                      | 55.9       |
| Frequency of<br>wakening up in the<br>middle of sleep | Never                     | 15                    | 41.7       | 20                      | 58.8       |
|   | Once                      | 21                    | 58.3       | 14                      | 41.1       |

Table 16. Contd.....

| Particulars                           | Categories | Day Workers<br>(n=36) |            | Shift Workers<br>(n=34) |            |
|---------------------------------------|------------|-----------------------|------------|-------------------------|------------|
|                                       |            | Frequency             | Percentage | Frequency               | Percentage |
| Sleep for less than 8 hours           | Yes        | 4                     | 11.1       | 11                      | 32.4       |
|                                       | No         | 32                    | 88.9       | 23                      | 67.6       |
| Feeling of sleepiness in working hour | Usually    | 4                     | 11.1       | 19                      | 55.9       |
|                                       | Sometimes  | 28                    | 77.8       | 11                      | 32.4       |
|                                       | Never      | 4                     | 11.1       | 4                       | 11.7       |
| On weekend time of going to bed       | 10pm-12am  | 16                    | 44.4       | 18                      | 52.9       |
|                                       | 12-2am     | 16                    | 44.4       | 10                      | 29.4       |
|                                       | 2-4am      | 4                     | 11.1       | 6                       | 17.6       |
| On weekend time of awakening up       | 7-9am      | 9                     | 25.0       | 10                      | 29.4       |
|                                       | 9-11am     | 20                    | 55.6       | 16                      | 47.1       |
|                                       | 11-1pm     | 7                     | 19.4       | 8                       | 23.5       |

of shift workers sleeping between 12 to 2 am, followed by 11.1 per cent day workers and 17.6 per cent shift workers were sleeping between 2 am to 4 am. Twenty five per cent day workers and to 29.4 per cent shift workers were found to woke up between 7am to 9 am on weekends, followed by 55.6 per cent day workers and 47.1 per cent shift workers between 9 am to 11 am. Nineteen per cent day workers and 23.5 per cent shift workers got up between 11 am to 1 pm.

#### 4.5.8 Social and family life of the subjects

Totally, there were 14 statements under this category related to the social and family life activities, for which the subjects mentioned their answers in terms of Yes or No. For three statements all the subjects had given the answer as no. So finally the results of the 11 statements are presented in Table 17.

With regard to the impairment of social leisure activities, personal leisure activities and ability to maintain close family relationships, majority of shift workers agreed that all these were affected due to their nature of job and the percentages of shift workers were found to be 61.8, 73.5 and 55.9 respectively. Whereas for day workers these percentages were 36.1, 52.8 and 30.6 respectively. Results depicted that 47.1 per cent shift workers became workaholic with no relaxation activities, but only 27.8 per cent of day workers were found to be workaholic. For social relationship there was not much difference found between the shift workers (26.5%) and the day workers (27.8%), 38.2 per cent and 32.4 per cent shift workers reported that they had withdrawn from social gatherings and preferred to work alone respectively, while this percentage was 22.2 and 16.7 in case of day workers. As there were only 19.4 per cent day workers and 23.5 per cent shift workers married in significant results were found for three questions related to child care. Six per cent shift workers were reported to take medicine for anxiety or depression

Table 17. Social and Family life of the subjects

N=70

| Statements  | Categories | Day Workers<br>(n=36) |            | Shift Workers<br>(n=34) |            |
|---|------------|-----------------------|------------|-------------------------|------------|
|   |            | Frequency             | Percentage | Frequency               | Percentage |
| Social relationship is impaired.  | Yes        | 10                    | 27.8       | 9                       | 26.5       |
|   | No         | 26                    | 72.2       | 25                      | 73.5       |
| Social leisure activities (parties, clubs, outings, home entertainment) are impaired. | Yes        | 13                    | 36.1       | 21                      | 61.8       |
|   | No         | 23                    | 63.9       | 13                      | 38.2       |
| Personal leisure activities (like reading, walking, gardening) are impaired.          | Yes        | 19                    | 52.8       | 25                      | 73.5       |
|   | No         | 17                    | 47.2       | 9                       | 26.5       |
| Ability to form and maintain close relationship with family members is impaired.      | Yes        | 11                    | 30.6       | 19                      | 55.9       |
|   | No         | 25                    | 69.4       | 15                      | 44.1       |
| Withdraw from social gathering.   | Yes        | 8                     | 22.2       | 13                      | 38.2       |
|   | No         | 28                    | 77.8       | 21                      | 61.8       |
| Becoming a workaholic with no relaxation or pleasurable activity.                     | Yes        | 10                    | 27.8       | 16                      | 47.1       |
|   | No         | 26                    | 72.2       | 18                      | 52.9       |
| Work pattern affects the child upbringing   | Yes        | 2                     | 5.6        | 5                       | 14.7       |
|   | No         | 4                     | 11.1       | 2                       | 5.9        |
| Maintained balance between work and child care.                                       | Yes        | 4                     | 11.1       | 4                       | 11.8       |
|   | No         | 2                     | 5.6        | 1                       | 2.9        |
| Hard to supervise and help your child / children with their homework work.            | Yes        | 2                     | 5.6        | 2                       | 5.9        |
|   | No         | 4                     | 11.1       | 3                       | 8.8        |
| Prefer working alone to working with others.  | Yes        | 6                     | 16.7       | 11                      | 32.4       |
|   | No         | 30                    | 83.3       | 22                      | 64.7       |
| Habit of taking medicine for anxiety or depression                                    | Yes        | -                     |            | 2                       | 5.9        |
|   | No         | 36                    | 100        | 32                      | 94.1       |

## 4.6. HEALTH PROBLEM EXPERIENCED BY THE SUBJECTS

Information on frequency of experiencing health problems in last three months were collected based on 24 symptoms and the subjects were expected to answer in terms of never, rarely, occasionally and always. As the frequency of rarely was found to be negligible, these values were clubbed with the answers of occasionally and are presented in table 18.

Among the shift workers, 35.3 percent, followed by 25.4 per cent and 35.3 experienced loss of appetite always, occasionally and never respectively. But in day workers equal numbers of subjects (33.3%) were there in all the three categories. The mean score for loss of appetite was found to be high in day workers ( $2\pm 0.82$ ) compared to shift workers ( $1.94\pm 0.80$ ). Equal percentage of subjects from both the group (approximately 50%) always experienced gain in weight, followed by 35.3 per cent shift workers and 33.3 per cent day workers experiencing gain in weight occasionally. Twelve per cent shift workers and 16.7 per cent day workers reported that they did not observe any increase in weight. With regard to gain in weight day workers were having better score ( $1.82\pm 0.93$ ) compared to shift workers ( $1.66\pm 0.75$ ).

Majority of day workers (72.2%) and 61.8 per cent shift workers reported that they always experience fatigue, followed by 23.5 per cent shift workers and 13.9 per cent day workers experiencing tiredness occasionally. Less than one fourth percentage of subjects (13.9 % day workers and 14.7 % shift workers) from both the group never felt tired, no significant difference in health score was observed between day ( $1.41\pm 0.73$ ) and shift workers ( $1.44\pm 0.74$ ). Abdominal pain was always experienced by 13.9 percent day workers and 29.4 per cent shift workers, equal percentage of subjects from both the group (approximately 35%) had abdominal pain occasionally, followed by 50 per cent day workers and 35.3 per cent shift workers never experiencing stomachache, no significant difference was observed in the mean score between day ( $2.36\pm 0.72$ ) and shift workers ( $2.05\pm 0.81$ ).

Forty seven per cent of subjects from both the group reported to have headache regularly, followed by 27.8 per cent of day workers and 35.3 per cent of shift workers experiencing it occasionally. Headache was never felt by 17.5 per cent shift workers and 25 per cent of day workers, no significant difference was observed in the health score between day ( $1.66\pm 0.86$ ) and shift workers ( $1.70\pm 0.75$ ). Common cold was observed in 44.1 per cent of shift workers and 22.2 per cent day workers more frequently, followed by 25 per cent day workers and 29.4 per cent shift workers reported to have it occasionally. Fifty two per cent of day workers and 26.5 per cent of shift workers never felt this symptom. Statistically significant difference was observed between day ( $2.30\pm 0.82$ ) and shift workers ( $1.82\pm 0.83$ ), shift workers were reported to have poor health condition.

Majority of day workers (66.7%) and shift workers (41.2%) never had the symptom of frequent urination, followed by 19.4 per cent of day workers and 38.2 per cent shift workers experiencing it occasionally. Symptom of frequent urination was always felt by 13.9 per cent of day workers and 20.6 per cent of shift workers, statistically significant difference was observed in health score between day ( $2.58\pm 0.69$ ) and shift workers ( $2.20\pm 0.76$ ). More than 30 per cent of subjects from both the group always had a tendency of craving for sweet or fatty foods, followed by 22.2 per cent day workers and 32.4 per cent shift workers occasionally had such craving for sweets. Forty four per cent day workers and 29.4 per cent of shift workers never had any such tendency, no significant difference was observed in the mean score between the day ( $2.11\pm 0.88$ ) and shift workers ( $1.91\pm 0.83$ ). Muscle pain was always experienced by 16.7 per cent day workers and 35.3 per cent shift workers, followed by 38.9 per cent day workers and 26.5 per cent shift workers felt it occasionally. Forty four per cent of day workers and 38.2 per cent shift workers never reported to have muscle pain, no significant difference was observed in the average health score between day ( $2.27\pm 0.74$ ) and shift workers ( $2.02\pm 0.86$ ).

Majority of day workers (69.4%) and shift workers (41.2%) never experienced ringing in ear, followed by 22.2 per cent day workers and 29.4 per cent shift workers experiencing it occasionally. Eight per cent day workers and 29.4 per cent of shift workers always felt their ear ringing, statistically significant difference was observed in the mean score between day ( $2.61\pm 0.64$ ) and shift workers ( $2.11\pm 0.84$ ). Thirty six per cent day workers and 23.5 per cent shift workers never reported to have difficulty in the remembering things, followed by 41.7 per cent of day workers and 38.2 per cent shift workers experiencing it occasionally. Twenty two

per cent day workers and 38.2 per cent shift workers expressed difficulty in remembering things more frequently, no significant difference was observed between day ( $2.13\pm 0.76$ ) and shift workers ( $1.85\pm 0.78$ ) in the mean score.

Dizziness was never felt by 55.6 per cent day workers and 35.3 per cent shift workers, followed by 19.4 per cent day workers and 38.2 per cent shift workers experiencing giddiness occasionally. Twenty five per cent day workers and 26.5 per cent shift workers experienced it always, no significant difference was observed with respect to the mean value between day ( $2.30\pm 0.85$ ) and shift workers ( $2.11\pm 0.76$ ). Majority of day workers (75%) and shift workers (67.6%) never experienced chest pain. Average score between the groups were found to be non significant. Numbness or tingling in the extremities was experienced by 32.3 per cent shift workers and 11.1 per cent day workers regularly. Majority of day workers (55.6%) and 26.5 per cent shift workers reported that they had never experienced this symptom, whereas, where as 33.3 per cent day workers and 41.2 per cent shift workers reported to experience it occasionally, average score between the groups were found to be significant ( $2.5\pm 0.65$ , day workers and  $1.94\pm 0.77$  for shift workers). Sixteen per cent day workers and 26.5 per cent shift workers reported to experience joint pain mostly, followed by 38.9 per cent day workers and 26.5 per cent shift workers occasionally. More than forty per cent subjects (44.4 per cent day workers & 47.1 per cent shift workers) never felt joint pain, average health score between the groups were found to be non significant ( $2.27\pm 0.74$ , day workers and  $2.20\pm 0.84$  for shift workers).

Backache was experienced by 30.6 per cent day workers and 38.2 per cent shift workers regularly. Twenty two per cent of day workers and 23.5 per cent of shift workers never experienced backache, followed by 47.2 per cent day workers and 38.2 per cent shift workers experiencing it occasionally, average score between the groups were found to be non significant ( $1.91\pm 0.73$ , day workers and  $1.85\pm 0.78$  for shift workers). Approximately 60 per cent subjects in both the group reported irritability. No significant difference was observed in the mean score between day ( $1.66\pm 0.86$ ) and shift workers ( $1.58\pm 0.78$ ).

Acidity was more frequent in 41.7 per cent day workers and 67.6 per cent shift workers, significant difference was observed in the health score between day ( $1.83\pm 0.81$ ) and shift workers ( $1.44\pm 0.70$ ). Abdominal bloating or gas was always experienced by 38.9 per cent day workers and 47.1 per cent shift workers. Occasionally it was experienced by 38.9 per cent day workers and 35.3 per cent shift workers. Twenty two per cent day workers and 17.6 per cent shift workers never had abdominal bloating problems; mean score showed no significant difference between the day ( $1.83\pm 0.77$ ) and shift workers ( $1.70\pm 0.75$ ).

Majority of shift workers (47%) and 27.8 per cent day workers always had eye pain, followed by 19.4 per cent day workers and 32.4 per cent shift workers felt it occasionally. More than half (52.8 %) of day workers and 20.6 per cent of shift workers never had any such eye problem, significant difference in the health score was observed between day ( $2.25\pm 0.87$ ) and shift workers ( $1.73\pm 0.79$ ).

More than half (58.3 % day workers and 52.9% shift workers) reported never to experience constipation, no significant difference in the score was observed between day ( $2.36\pm 0.83$ ) and shift workers ( $2.29\pm 0.83$ ). Higher number of day workers (77.6%) and shift workers (76.5%) never had diarrhea in last few months. Approximately 17 per cent subjects from both the group experienced it occasionally, followed by negligible percentage of subjects (6% from both the group) felt this problem always. No significant difference in the mean score for diarrhoea was observed between day ( $2.72\pm 0.56$ ) and shift workers ( $2.70\pm 0.57$ ).

Higher percentage of day workers (75%) and shift workers (52.9%) never reported intolerance to caffeine, followed by approximately 25 per cent subjects from both the group experiencing it occasionally. Caffeine intolerance was always experienced by 20.6 per cent shift workers, significant difference in the mean score was observed between day ( $2.72\pm 0.45$ ) and shift workers ( $2.32\pm 0.80$ ). Majority of day workers (52.8%) and shift workers (41.2%) reported that they never had any urinary problem, followed by 33.3 per cent day workers and 38.2 per cent shift workers experiencing it occasionally. Fourteen per cent day workers and 20.6 per cent shift workers always experienced this problem. No significant difference was observed in the mean score between day ( $2.38\pm 0.72$ ) and shift workers ( $2.20\pm 0.76$ ).

Table 18. Health Problem Experienced By the Subjects

N=70

| Symptoms          | Categories   | Day Workers  | Shift Workers | Average Score          |                          | t' test            |
|-------------------|--------------|--------------|---------------|------------------------|--------------------------|--------------------|
|                   |              | Frequency    | Frequency     | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Loss of appetite  | Never        | 12<br>(33.3) | 12<br>(35.3)  | 2±0.82                 | 1.94±0.80                | 0.28 <sup>NS</sup> |
|                   | Occasionally | 12<br>(33.3) | 10<br>(25.4)  |                        |                          |                    |
|                   | Always       | 12<br>(33.4) | 12<br>(35.3)  |                        |                          |                    |
| Gain in weight    | Never        | 6<br>(16.7)  | 12<br>(35.3)  | 1.66±0.75              | 1.82±0.93                | 0.76 <sup>NS</sup> |
|                   | Occasionally | 12<br>(33.3) | 4<br>(11.8)   |                        |                          |                    |
|                   | Always       | 18<br>(50.0) | 18<br>(52.9)  |                        |                          |                    |
| Fatigue/<br>Tired | Never        | 5<br>(13.9)  | 5<br>(14.7)   | 1.41±0.73              | 1.44±0.74                | 0.13 <sup>NS</sup> |
|                   | Occasionally | 5<br>(13.9)  | 8<br>(23.5)   |                        |                          |                    |
|                   | Always       | 26<br>(72.2) | 21<br>(61.8)  |                        |                          |                    |
| Abdominal pain    | Never        | 18<br>(50.0) | 12<br>(35.3)  | 2.36±0.72              | 2.05±0.81                | 1.63 <sup>NS</sup> |
|                   | Occasionally | 13<br>(36.1) | 12<br>(35.3)  |                        |                          |                    |
|                   | Always       | 5<br>(13.9)  | 10<br>(29.4)  |                        |                          |                    |
| Headache          | Never        | 9<br>(25.0)  | 6<br>(17.5)   | 1.66±0.86              | 1.70±0.75                | 0.20 <sup>NS</sup> |
|                   | Occasionally | 10<br>(27.8) | 12<br>(35.3)  |                        |                          |                    |
|                   | Always       | 17<br>(47.2) | 16<br>(47.2)  |                        |                          |                    |
| Common cold       | Never        | 19<br>(52.8) | 9<br>(26.5)   | 2.30±0.82              | 1.82±0.83                | 2.43*              |
|                   | Occasionally | 9<br>(25.0)  | 10<br>(29.4)  |                        |                          |                    |
|                   | Always       | 8<br>(22.2)  | 15<br>(44.1)  |                        |                          |                    |

Table 18. Contd.....

| Symptoms                             | Categories   | Day Workers  | Shift Workers | Average Score             |                             | t' test            |
|--------------------------------------|--------------|--------------|---------------|---------------------------|-----------------------------|--------------------|
|                                      |              | Frequency    | Frequency     | Day Workers<br>(Mean ±SD) | Shift Workers<br>(Mean ±SD) |                    |
| Frequent urination                   | Never        | 24<br>(66.7) | 14<br>(41.2)  | 2.58±0.69                 | 2.20±0.76                   | 2.15*              |
|                                      | Occasionally | 7<br>(19.4)  | 13<br>(38.2)  |                           |                             |                    |
|                                      | Always       | 5<br>(13.9)  | 7<br>(20.6)   |                           |                             |                    |
| Craving for sweets /fatty foods      | Never        | 16<br>(44.4) | 10<br>(29.4)  | 2.11±0.88                 | 1.91±0.83                   | 0.97 <sup>NS</sup> |
|                                      | Occasionally | 8<br>(22.2)  | 11<br>(32.4)  |                           |                             |                    |
|                                      | Always       | 12<br>(33.4) | 13<br>(38.2)  |                           |                             |                    |
| Muscle pain                          | Never        | 16<br>(44.4) | 13<br>(38.2)  | 2.27±0.74                 | 2.02±0.86                   | 1.28 <sup>NS</sup> |
|                                      | Occasionally | 14<br>(38.9) | 9<br>(26.5)   |                           |                             |                    |
|                                      | Always       | 6<br>(16.7)  | 12<br>(35.3)  |                           |                             |                    |
| Ringing in ears                      | Never        | 25<br>(69.4) | 14<br>(41.2)  | 2.61±0.64                 | 2.11±0.84                   | 2.73*              |
|                                      | Occasionally | 8<br>(22.2)  | 10<br>(29.4)  |                           |                             |                    |
|                                      | Always       | 3<br>(8.3)   | 10<br>(29.4)  |                           |                             |                    |
| Difficulty in remembering the things | Never        | 13<br>(36.1) | 8<br>(23.5)   | 2.13±0.76                 | 1.85±0.78                   | 1.54 <sup>NS</sup> |
|                                      | Occasionally | 15<br>(41.7) | 13<br>(38.2)  |                           |                             |                    |
|                                      | Always       | 8<br>(22.2)  | 13<br>(38.2)  |                           |                             |                    |
| Dizziness                            | Never        | 20<br>(55.6) | 12<br>(35.3)  | 2.30±0.85                 | 2.11±0.76                   | 0.96 <sup>NS</sup> |
|                                      | Occasionally | 7<br>(19.4)  | 13<br>(38.2)  |                           |                             |                    |
|                                      | Always       | 9<br>(25.0)  | 9<br>(26.5)   |                           |                             |                    |

Table 18. Contd.....

| Symptoms                                | Categories   | Day Workers  | Shift Workers    | Average Score          |                          | 't' test           |
|---|--------------|--------------|------------------|------------------------|--------------------------|--------------------|
|   |              | Frequency    | Frequency        | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Chest pain                              | Never        | 27<br>(75.0) | 23<br>(67.6)     | 2.66±0.63              | 2.50±0.78                | 0.97 <sup>NS</sup> |
|   | Occasionally | 6<br>(16.7)  | 5<br>(14.7)      |                        |                          |                    |
|   | Always       | 3<br>(8.3)   | 6<br>(7.6)       |                        |                          |                    |
| Numbness or tingling in the extremities | Never        | 20<br>(55.6) | 9<br>(26.5)      | 2.5±0.65               | 1.94±0.77                | 3.24 <sup>**</sup> |
|   | Occasionally | 12<br>(33.3) | 14<br>(41.2)     |                        |                          |                    |
|   | Always       | 4<br>(11.1)  | 110.37<br>(32.3) |                        |                          |                    |
| Joint pain                              | Never        | 16<br>(44.4) | 16<br>(47.1)     | 2.27±0.74              | 2.20±0.84                | 0.37 <sup>NS</sup> |
|   | Occasionally | 14<br>(38.9) | 9<br>(26.5)      |                        |                          |                    |
|   | Always       | 6<br>(16.7)  | 9<br>(26.5)      |                        |                          |                    |
| Backache                                | Never        | 8<br>(22.2)  | 8<br>(23.5)      | 1.91±0.73              | 1.85±0.78                | 0.35 <sup>NS</sup> |
|   | Occasionally | 17<br>(47.2) | 13<br>(38.2)     |                        |                          |                    |
|   | Always       | 11<br>(30.6) | 13<br>(38.2)     |                        |                          |                    |
| Irritability                            | Never        | 9<br>(25.0)  | 6<br>(17.6)      | 1.66±0.86              | 1.58±0.78                | 0.39 <sup>NS</sup> |
|   | Occasionally | 6<br>(16.7)  | 8<br>(23.5)      |                        |                          |                    |
|   | Always       | 21<br>(58.3) | 20<br>(58.9)     |                        |                          |                    |
| Acidity/ Indigestion                    | Never        | 9<br>(25.0)  | 4<br>(11.8)      | 1.83±0.81              | 1.44±0.70                | 2.16 <sup>†</sup>  |
|   | Occasionally | 12<br>(33.3) | 7<br>(20.6)      |                        |                          |                    |
|   | Always       | 15<br>(41.7) | 23<br>(67.6)     |                        |                          |                    |

Table 18. Contd....

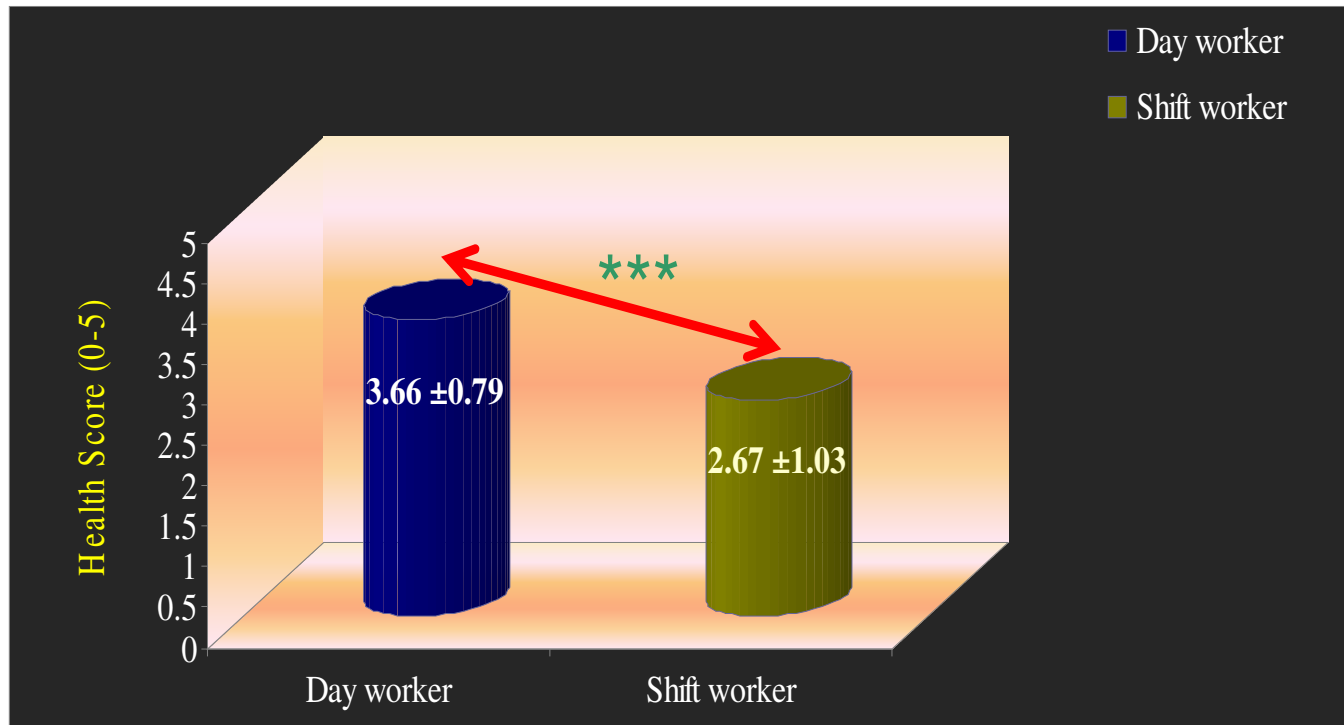
| Symptoms                  | Categories   | Day workers  | Shift workers | Average Score          |                          | 't' test           |
|---------------------------|--------------|--------------|---------------|------------------------|--------------------------|--------------------|
|                           |              | Frequency    | Frequency     | Day Workers (Mean ±SD) | Shift Workers (Mean ±SD) |                    |
| Abdominal bloating or gas | Never        | 8<br>(22.2)  | 6<br>(17.6)   | 1.83±0.77              | 1.70±0.75                | 0.69 <sup>NS</sup> |
|                           | Occasionally | 14<br>(38.9) | 12<br>(35.3)  |                        |                          |                    |
|                           | Always       | 14<br>(38.9) | 16<br>(47.1)  |                        |                          |                    |
| Eye pain                  | Never        | 19<br>(52.8) | 7<br>(20.6)   | 2.25±0.87              | 1.73±0.79                | 2.58*              |
|                           | Occasionally | 7<br>(19.4)  | 11<br>(32.4)  |                        |                          |                    |
|                           | Always       | 10<br>(27.8) | 16<br>(47.0)  |                        |                          |                    |
| Constipation              | Never        | 21<br>(58.3) | 18<br>(52.9)  | 2.36±0.83              | 2.29±0.83                | 0.33 <sup>NS</sup> |
|                           | Occasionally | 7<br>(19.4)  | 8<br>(23.5)   |                        |                          |                    |
|                           | Always       | 8<br>(22.3)  | 8<br>(23.5)   |                        |                          |                    |
| Diarrohea                 | Never        | 28<br>(77.6) | 26<br>(76.5)  | 2.72±0.56              | 2.70±0.57                | 0.11 <sup>NS</sup> |
|                           | Occasionally | 6<br>(16.7)  | 6<br>(17.6)   |                        |                          |                    |
|                           | Always       | 2<br>(5.6)   | 2<br>(5.9)    |                        |                          |                    |
| Intolerance to caffeine   | Never        | 27<br>(75.0) | 18<br>(52.9)  | 2.72±0.45              | 2.32±0.80                | 2.52*              |
|                           | Occasionally | 9<br>(25.0)  | 9<br>(26.5)   |                        |                          |                    |
|                           | Always       | -            | 7<br>(20.6)   |                        |                          |                    |
| Very dark yellow urine    | Never        | 19<br>(52.8) | 14<br>(41.2)  | 2.38±0.72              | 2.20±0.76                | 1.02 <sup>NS</sup> |
|                           | Occasionally | 12<br>(33.3) | 13<br>(38.2)  |                        |                          |                    |
|                           | Always       | 5<br>(13.9)  | 7<br>(20.6)   |                        |                          |                    |

Figures in parentheses indicated percentage.

\* Significant at 5% level

\*\* Significant at 1% level

NS Non Significant



\*\*\* Significant at <1% level

**Fig. 8. Health score of the subjects based on the life style indicators**

Fig.8. Health score of the subjects based on the life style indicators

The health score based on the “lifestyle indicators” of both the groups is shown in Fig.8. Among the two groups the health score for the shift work group was remarkable lower than the day work group, it was found to be statistically significant.

#### **4.7 ASSOCIATIONS BETWEEN SHIFT WORK AND FOOD HABIT**

The association of shift work with number of meals consumed and quantity of tea or coffee consumption was not statistically significant. (Table 19 a). Though the association was not significant, majority of the shift workers were found to consume 4 meals and more than 4 cups of tea/ coffee per day. With respect to tea or coffee consumption higher numbers of night shift workers were consuming more than 4 cups of tea or coffee per day. The meal skipping habits, outside food consumption was significantly associated with shift work at 5% level. (Table 19 b). The frequency distribution table clearly indicated that more numbers of shift workers were found to skip meals 2-3 times per week, among them majority were in night shift. With regard to outside food consumption, higher numbers of shift workers were found to go daily.

#### **4.8 ASSOCIATION BETWEEN SHIFT WORK WITH LIFESTYLE FACTORS**

The results depicted that there was significant association between different shift schedule with body mass index and regular exercise habits. (Table 20 a). Majority of the shift workers were in obese grade- I category and from the frequency distribution it was clear that more of night shift workers were in this group. With respect to exercise habit majority of the shift workers were found not to do exercise. But no association of shift work was found with smoking habit, alcohol consumption and feeling of sleepiness in working hours (Table 20 b).

But night shift workers were found to smoke more compared to the other two groups. Majority of the shift workers were found to feel sleepy in the working hours. From the table it was clear that higher number of night shift works usually feel sleepy during office hours. Significant association was found between shift work and number of cigarette smoked at 1 % level, but with regard to quantity of alcohol consumption no association was observed (Table 20 c). More numbers of night shift workers were found to smoke 32-47 cigarettes and consume more than 1400ml of alcohol per week.

Table 19 a. Association between shift work and food habit

| Shift work          | Meals consumed/day |            |                       |       | Tea/ Coffee consumed/day |          |         |       |
|---------------------|--------------------|------------|-----------------------|-------|--------------------------|----------|---------|-------|
|                     | Three meals        | Four meals | Others<br>(Two meals) | Total | < 2cups                  | 3-4 cups | >4 cups | Total |
| Morning             | 3                  | 4          | 1                     | 8     | 1                        | 1        | 6       | 8     |
| Evening             | 6                  | 3          | 1                     | 10    | 1                        | 2        | 5       | 8     |
| Night               | 4                  | 7          | 5                     | 16    | 3                        | 3        | 10      | 14    |
| Total               | 13                 | 14         | 7                     | 34    | 5                        | 6        | 21      | 29    |
| $\chi^2$ (Modified) | 2.00 <sup>NS</sup> |            |                       |       | 1.31 <sup>NS</sup>       |          |         |       |

NS Non Significant

Table 19 b. Association between shift work and food habit

| Shift work                | Frequency of meal skipping |               |       | Frequency of outside food consumption |                |                 |       |
|---------------------------|----------------------------|---------------|-------|---------------------------------------|----------------|-----------------|-------|
|                           | Daily                      | 2-3times/week | Total | Daily                                 | Once in a week | Once in 15 days | Total |
| Morning                   | 2                          | 1             | 3     | 6                                     | 0              | 2               | 8     |
| Evening                   | 1                          | 2             | 3     | 5                                     | 3              | 2               | 10    |
| Night                     | 0                          | 10            | 10    | 4                                     | 6              | 6               | 16    |
| Total                     | 3                          | 13            | 16    | 15                                    | 9              | 10              | 34    |
| x <sup>2</sup> (Modified) | 3.70*                      |               |       | 3.87*                                 |                |                 |       |

\* Significant at 5% level

Table 20 a. Association between shift work with Lifestyle factors (BMI and Exercise)

| Shift work                | BMI       |             |               |                |       | Exercise    |         |                   |      |       |  |
|---------------------------|-----------|-------------|---------------|----------------|-------|-------------|---------|-------------------|------|-------|--|
|                           | Ideal BMI | Over Weight | Obese Grade-I | Obese Grade-II | Total | No Exercise | Walking | Physical exercise | Yoga | Total |  |
| Morning                   | 1         | 1           | 6             | 0              | 8     | 3           | 2       | 1                 | 3    | 6     |  |
| Evening                   | 1         | 3           | 5             | 1              | 10    | 2           | 2       | 4                 | 2    | 10    |  |
| Night                     | 4         | 2           | 8             | 2              | 16    | 6           | 4       | 0                 | 6    | 7     |  |
| Total                     | 6         | 6           | 19            | 3              | 34    | 11          | 8       | 5                 | 10   | 23    |  |
| x <sup>2</sup> (Modified) | 2.61*     |             |               |                |       |             | 4.69**  |                   |      |       |  |

\* Significant at 5% level

\*\* Significant at 1% level

Table 20 b. Association between shift work with Lifestyle factors (Smoking habits, Alcohol consumption and Sleep disturbances)

| Shift work          | Smoking            |             |       | Alcohol consumption |              |       | Sleepiness         |           |         |       |
|---------------------|--------------------|-------------|-------|---------------------|--------------|-------|--------------------|-----------|---------|-------|
|                     | Smokers            | Non smokers | Total | Alcohol consumer    | Non consumer | Total | Never              | Sometimes | Usually | Total |
| Morning             | 6                  | 2           | 8     | 7                   | 1            | 8     | 1                  | 1         | 6       | 8     |
| Evening             | 1                  | 9           | 10    | 6                   | 4            | 10    | 1                  | 6         | 3       | 10    |
| Night               | 11                 | 5           | 16    | 8                   | 8            | 16    | 2                  | 4         | 10      | 16    |
| Total               | 18                 | 16          | 34    | 21                  | 13           | 34    | 4                  | 11        | 19      | 34    |
| $\chi^2$ (Modified) | 1.63 <sup>NS</sup> |             |       | 1.73 <sup>NS</sup>  |              |       | 2.65 <sup>NS</sup> |           |         |       |

NS Non Significant

Table 20 c. Association between shift work with Life style factors (Number of cigarette smoked & quantity of alcohol consumed)

| Shift work                | Number of cigarette/week |                  |                |       | Quantity of alcohol consumed/week |              |        |       |
|---------------------------|--------------------------|------------------|----------------|-------|-----------------------------------|--------------|--------|-------|
|                           | <32 cigarettes           | 32-47 cigarettes | >47 cigarettes | Total | < 540ml                           | 540ml-1.4 lt | >1.4lt | Total |
| Morning                   | 1                        | 1                | 4              | 6     | 1                                 | 1            | 2      | 4     |
| Evening                   | 1                        | 0                | 0              | 1     | 2                                 | 0            | 3      | 5     |
| Night                     | 0                        | 8                | 3              | 11    | 2                                 | 2            | 8      | 12    |
| Total                     | 2                        | 9                | 7              | 18    | 5                                 | 3            | 13     | 21    |
| x <sup>2</sup> (Modified) | 6.51**                   |                  |                |       | 2.03 <sup>NS</sup>                |              |        |       |

\*\* Significant at 1% level

NS Non Significant

## 5. DISCUSSION

Modern society is moving towards a pattern of working twenty-four hours a day. Twenty four-hours operations are an inevitable component of numerous industries. Night work, shift work is a necessary condition of employment for a significant segment of the work force. Because of the necessity of 24-hours operations, shift workers often live at variance with the conventional pattern of human activity. These deviations from the daytime (or diurnal) activity pattern place the shift worker in opposition to many human functions that oscillate within a 24 hours period. Unfortunately, shift work is the part and parcel of today's fast life in the working atmosphere be it call centre, BPOs or even software companies, which needs people to work during night to provide technical expertise for their clientele abroad.

The present investigation has detailed about the nutritional status, life style and general health of the shift workers in terms of anthropometric measurements, nutrient intake general health and other components like smoking habits, alcohol consumption, exercise habits, sleep pattern and social life *etc.* The salient results of the investigation are discussed in this chapter.

In the present investigation, majority of the subjects from both the groups belonged to 25-27 years of age group. Maximum numbers of subjects were found to be graduates. More than 70 per cent of the subjects were from nuclear families and were reported to be unmarried.

### 5.1 NUTRITIONAL STATUS OF SOFTWARE ENGINEERS

The nutritional status of the subjects was assessed in terms of anthropometric measurements, diet survey and biochemical parameters.

The difference observed in weight, BMI, WHR was statistically significant between the day and shift workers (Table 2). However, majority of the subjects doing day workers (41.7%) were having ideal BMI, whereas, 55.9 per cent shift workers were in obese grade I group (Table 3). This could be due to the irregular work hours, the daily routine is interrupted, regular eating and exercise habits are difficult to maintain. These results were in line with the results of Chee *et al.* (2004), Sudo and Ohtsuka (2001) who stressed that, shift workers have a higher prevalence of being overweight.

Analysis of diet survey (Table 8) revealed that there was no significant difference in the intake of nutrients between the day workers and shift workers except protein, iron, fiber and saturated fat. With regard to food intake also no significant difference was observed between the two groups (Table 7). This was due to the fact that, majority of the subjects were found to eat food at canteen. In night time limited varieties of menus were served at dinner due to smaller number of subjects, compared to lunch. Ultimately leading to dissatisfaction and reduced intake of food. The results were on par with the study of Morikawa *et al.* (2008) who concluded that, there were no significant differences in the intake of nutrients between fixed day workers and shift workers.

It was observed that the adequacy of energy, iron,  $\beta$ -carotene, vitamin A were less than recommended dietary allowances (RDA) for both the groups (Fig. 3). The adequacy of fat was more than 500 per cent in both the groups and similar result was observed with the adequacy of Vit-C (260%). This might be due to the higher consumption of fruit juices. This finding was on par with the findings of Sudo and Ohtsuka (2003), who suggested that mean nutrient adequacy was highest in day time workers and lowest in late shift workers.

The statistical analysis demonstrated that there was a significant difference with regard to fasting blood sugar in day (91.84 mg/dl) and shift workers (97.10 mg/dl). This could be due to the erratic eating pattern and intake of low protein and fiber rich foods and more consumption of fat and junk foods. This result was in agreement with that of Morikawa *et al.* (2005), who stressed that the relative risk of diabetes mellitus for the two-shift and three shift workers were more compared with the fixed day time workers.

In the present study, higher mean of serum total cholesterol (195.33 mg/dl), triglycerides (159.65 mg/dl), LDL-cholesterol (125.48 mg/dl) levels in shift workers compared to permanent day workers (total cholesterol 173.43mg/dl, triglycerides 150.08mg/dl, LDL-cholesterol 114.17mg/dl) were observed. The results also showed low HDL cholesterol

among shift workers (39.62 mg/dl) than day workers (44.96 mg/dl). The ratio of total cholesterol and HDL-C was found to be higher ( $5.03 \pm 1.00$ ) in shift workers compared to day workers ( $3.05 \pm 1.15$ ). Similar findings were observed by Rahman *et al.* (2007). But Knutsson (1990) in his study has shown that there was no difference in serum total cholesterol levels between shift workers and day workers. The observed higher mean serum LDL-cholesterol level in shift workers was in agreement with those reported by Lennerans *et al.* (1995). The findings of Karlsson *et al.* (2003) suggested the higher prevalence of high serum triglyceride levels and low HDL-cholesterol levels among shift workers than day workers.

The observed findings might be due to the fact that, nocturnal eating raises the blood insulin concentration and decrease in production of pancreatic polypeptide. This reduced pancreatic polypeptide affects the sensitivity of the receptor tissues available for the insulin. The higher insulin concentration has an antagonist effect on the enzyme lipase required for the hydrolysis of fat. Ultimately affecting the lipid metabolism. The ratio was found to be high in shift workers, might be due to the lower value of serum HDL-C and higher cholesterol value observed in shift workers.

So the study pointed out that majority of the software engineers were in obese category with higher biochemical parameters.

## 5.2 LIFESTYLE OF THE SOFTWARE ENGINEERS

With reference to the findings of the smoking pattern the numbers of smokers (18 subjects) in shift workers were more than the day workers (19.4%). Out of 52.9 per cent smokers in shift workers 23.5 per cent of subjects had started smoking after the age of 24 years that was after joining the job. There was difference observed in the number of cigarettes consumed before joining the job and at present. The findings were in conformity with the results of Amelsvoort *et al.* (2004), who concluded that shift workers are more often smokers and have significantly higher risk to take up smoking as compared to day workers. Lin *et al.* (2005) also explored that shift work was an important factor in determining cigarette smoking habits in participants. The possible mechanism might be the use of nicotine as a way to cope with feelings of sleepiness or to maintain vigilance, which was required in night workers and to reduce job stress.

With the alcohol consumption pattern more number of shift workers (61.7%) were consuming alcohol than permanent day workers (25%). Out of 61.7 per cent shift workers, 26.4 per cent had started consuming alcohol after joining the job and also the quantity of consumption of alcohol increased in both the groups. Majority of shift workers (47.1%) and only 5.6 percent day workers reported to consume alcohol weekly. This result was on par with the study conducted by Smart *et al.* (1979) who also pointed out that alcohol drinking was more prevalent in shift workers than day worker. Regarding the type of alcohol mostly consumed were beer, whisky, rum, wine, Russian vodka, scotch and gin *etc.* The particular brands which were preferred by the software engineers were Bacardi, Absolute for rum, Jack Daniel and Signature for whisky, Absolute and Bacardi for Russian vodka, Kingfisher and Foster for beer *etc.* Along with alcohol the commonly preferred snacks were kurkure, chips, fried cashew nut, peanut, salad and non-vegetarian items like chicken pakoda, boiled egg and tandoori chicken.

The study also pointed out that among the three shift workers number of alcohol consumers and the quantity of consumption was low in morning and evening shift workers. It might be due to the reason that, going to restaurant or pubs tends to occur in the evenings. However these two shift workers often reluctant to attain such activities due to their work schedules, where they have to work early in the morning, any high alcohol intake in the previous night will affect their work efficiency.

With reference to the exercise habits, the results depicts that 32.3 per cent shift workers did not have any regular exercise habits, but only 16.7 per cent day workers did not do exercise. More than half of the shift workers (52.9%) exercised for less than an hour a day. The frequency of playing was affected in both the groups, due to their nature of job. Before joining the job equal percentage of shift workers (38.6%) and more than 60 per cent of day workers used to play once in a week and once in 15 days respectively. But after joining the job majority of day workers (38.3%) and shift workers (41.4%) did not have any specific time for play activities. In context to the membership in club or gym, 41.2 per cent of shift workers

and 63.9 per cent of day workers were members, whereas, 41.7 per cent of day workers and 70.6 per cent shift workers didn't have gym facility at their office.

The findings showed that among the three shift workers 67.6 per cent of shift workers were having exercise habits and 82.4 per cent were in obese category. This might be due to the irregular work schedule, their exercise habit, playing habit was affected as they have to sleep in day hours to regain energy. It could be also due to the fact that the obese individuals were less likely to engage in physical activity than the ideal weight subjects. The results were in agreement with that of Lasfargues *et al.* (1996) who pointed out few subjects were doing physical activity in shift workers (50.7%) in comparison with day workers (59.9%).

Majority of shift workers (50%) and 36.1 per cent day workers reported to sleep after half an hour of going to bed (Table 16). Thirty two per cent shift workers and 11.1 per cent day workers were found to sleep for less than five hours a day. Forty seven per cent shift workers mentioned that, they feel sleepy in working hours. This feeling of sleepiness might be due to the fact that day time sleep of shift workers were shorter than the night time sleep of permanent day workers. Poor day-time sleep of the night shift workers might be due to unfavorable sleeping environment during day time, such as noisy surroundings, high temperature in day time, overcrowded rooms in which a number of heterogeneous shift workers were living together. This result was in conformity with the results of Folkard *et al.* (1990) and Knauth (1993) who revealed that sleep disturbance is a major problem of shift workers.

Impairment in the social life, personal life and family relationship were the most common complaints reported by the shift workers compared to day workers. (Table 17). The findings clearly indicated that, shift work affecting negatively the personal and social relationship of the soft ware engineers. It might be due to the lack of ability of shift workers to maintain the balance between the working and non working hours. When individual works in shift there normal work schedule is disturbed, they work in night hours and sleep in the day. But due to day time light, heat, noise, the sleep is disturbed, leading to tiredness and negative mood. Ultimately resulting in dysfunction in family and marital relationship. The results are in agreement with the results of Khaleque (1998) who also suggested that shift system disrupt workers family and social lives.

### 5.3 IMPACT OF SHIFTWORK AND ASSOCIATED FACTORS ON THE HEALTH OF THE SOFTWARE ENGINEERS

Health is a state of complete physical, mental and social well being and not merely an absence of disease. It provides the ability to lead a socially and economically productive life. So a healthy individual is free from disease; in a state of normal functioning. As shift work is a phenomenon of 24 hours continuous operations, the effect of shift work on health was assessed in terms of nutritional anthropometry and life style indicators.

The results of the anthropometric measurements revealed that, majority of the shift workers were found to be obese, with higher BMI (table 2). The biochemical parameters were also found to be significantly higher compared to day workers (Table 3). The mean changes in weight of the subjects were found to be significant statistically, showing the relationship between shift work and changes in the weight at the joining time and at present. The per cent change in weight in shift workers were found to be 23 per cent compared to 15.87 per cent that of day workers (Table 5). But the dietary intake did not differed significantly between the groups (Table 8). The findings of dietary intake was in line with the findings of Lennermas *et al.* (1995), who suggested that the frequency of meals and type of snacks across the three different shift schedules showed no significant variation.

Canteen food was preferred by 77 per cent day workers and 88 per cent of shift workers respectively. More percentage of shift workers (47%) were found to skip meals regularly, out of which 26.5 per cent shift workers skipped breakfast. Majority of day workers (88.9%) and 100 per cent of shift workers regularly went outside for change in food, 44.1 per cent shift workers went outside for food once in a week and north Indian dishes were the most preferred by the soft ware engineers. With reference to meal skipping habits it was found to be statistically significant. It showed out of 34 subjects, 17 shift workers skipped meals more than 4 times a week and it was more frequent in night shift workers. Similarly significant association was found with shift work and outside food consumption habits. Out of 34

subjects, 15 subjects went outside for food once in a week and frequency was more in morning shift, followed by evening night shift. (Table 20).

Eating food at canteen might be due to the fact that majority of the software engineers were living in rented rooms or with friends and were found to be unmarried. So there was a little chance for them to have home-made foods. Regarding the meal skipping habits, more night shift workers were found to skip breakfast four times a week. Breakfast was most affected, it might be due to the feeling of sleepiness after a full night shift. So they go to bed without any food. The findings were in line with the finding of Lasfargues *et al.* (1996) who explored higher prevalence of missing breakfast in night shift workers, compared to control. The study also pointed out that among the three shift workers number of subjects going outside for food was more in morning and evening shift workers. It might be due to the reason that going to the restaurant is common in the evening or afternoon. So these two shift workers had sufficient time to enjoy food outside. But the night shift workers were often unable to enjoy such family parties due to the nature of their work schedules.

While analyzing the relationship between shift work, diet and health, it was found that not only the total intake of energy and nutrient, but also meal patterns (including frequency and time of consumption) are of major concern. Though the dietary intake of the major foods and nutrients were found to be low, the observed increase in weight and body mass index was clearly explained by the food frequency table (Table 10), which showed that irrespective of the type of food like sweets, bakery and confectionary, fried products, fast foods, desserts, fruits, fleshy foods, the frequency of consumption was more in shift workers compared to day workers. Again the increase in weight was also due to the erratic eating habits of the shift workers, in terms of regular meal skipping habit, their major meals were replaced by snacks like sandwiches and soft drinks. The most preferred restaurant food was reported to be north Indian foods, which was high in fat.

In addition, majority of the subjects were reported to work for 10 to 12 hour a day, in comparison of routine 8 hour schedule. So the workers who did a great deal of overtime possibly had higher dietary intakes of sweets and fatty foods due to stress induced behaviors including overeating. Another possible mechanism of weight gain for those who were working in night shift might be due to the inter-correlation between shift hours and dinner time i.e. in night shift workers were habituated to take dinner late. This study was in agreement with the study conducted by Geliebter *et al.* (2000), who reported that late shift groups were found to gain more weight than the day shift group. Lorenzo *et al.* (2003) also stressed that obesity was more prevalent in shift workers than in day workers.

The scientific reason behind the increase in weight might also be due to the fact that, nocturnal eating affects lipid metabolism. This night time eating leads to the insulin resistance, due to the lack of sensitivity of the peripheral tissues. So the higher post prandial insulin levels affects the lipase enzyme needed for the hydrolysis of fat, leading to fat deposition and disturbance in the lipid profile level, which may put them at increased risk of coronary artery disease. The higher level of blood sugar was due to their frequent consumption of the energy dense foods like rasgulla (26.5%), cakes and pastries (20.6%), biscuits and cookies (50%), sandwiches (32.8%), chocolate (53%) etc (Table 10 & Appendix- II) and higher consumption of tea, coffee and soft drinks. So the increase in the weight due to the shift work was found to affect the physiological health adversely.

Sixty per cent of day workers consumed less than two cups of tea per day, same percentage of shift workers were found to consume more than four cups of tea or coffee per day. Majority of the software engineers did not consume fruit juices.

The increased consumption of tea or coffee in night shift workers might be, to keep themselves alert, as it is a well known fact that sleepiness is associated with night work. The lower consumption of fruit juices was due to the lack of availability of juices at night. These results were in conformity with the results of (Knutsson, 1989; and Tepas, 1990) who stated that the consumption of coffee and sucrose is more in night shift. Though the association between shift work and tea or coffee consumption was found to be non significant, higher number of shift workers were reported to consume 3-4 cups of tea or coffee daily, that too from night shift group.

The association between the income and body mass index was found to be significant (Table 6). Results also suggested that in all income, group of the software

engineers there was a greater shift from major meals to other snacks and fatty foods. It also reported higher intake of saturated fat and carbohydrate (Table 8).

This might be due to the fact that, all the software engineers work for more than 10-12 hours a day and in different time schedules. Majority were found to live in rented rooms along with the heterogeneous shift workers. Due to their nature of job, lack of time for preparation of healthy nutritious foods and because of better economic conditions they went for processed food or foods outside home more often. It indirectly showed an association of income with the consumption of processed foods or fast food. The study also pointed out that the changes in life style among the shift workers in terms of increased smoking and alcohol consumption. The ultimate findings suggested that, higher payment of shift workers lead to changes in daily health habits (as measured by diet, BMI, smoking and alcohol consumption) and the ultimately ending in overweight. The study was on par with the study conducted by Popkin *et al.* (2001), who showed an effect of economic transition on diet, nutritional status and diet related non-communicable diseases in China and India.

With regard to the life style factors, smoking habit was more frequent in shift workers compared to day workers. Night shift workers were reported to consume more number of cigarettes compared to the other two groups and it was statistically significant also. The alcohol consumption was also found to be high in case of shift workers than the day workers, but association was found to be non significant. Similar result was also reported by Kivimaki *et al.* (2001) who concluded that shift workers were found to smoke more and to gain more weight compared to day workers. However, shift work was not associated with alcohol intake or sedentary lifestyle.

In the present study, the subjects were reported to do computer related work, which includes long sitting hours. So there was a positive (excessive) energy balance, caused by excessive energy intake than energy expenditure for physical activity and metabolic processes. These factors, again leading to obesity. Obesity and exercise was found to be inter related, that is lack of exercise will lead to obesity and obese individuals were less interested to do any physical activity. Disturbed sleep was reported by majority of the shift workers. It was due to the fact that shift workers work against the nature. They work at night and sleep during the day time. But due to the environmental factors like more heat, noise the sleep was found to be disturbed. Majority of the subjects were found to live in rented room with heterogeneous group of people having different work schedule, which in turn affects the sleep. Studies also reported that consumption of tea, coffee and cigarettes before 3 to 4 hours of going to bed affect the sleep. It's a known fact that body needs rest to recover from mental and physical exertion, but due to the shift work, sleep was affected leading to negative mood and irritability, ultimately affecting social and family life.

So it can be concluded that, these shifts can have an effect on health. Night work causes a mismatch between the circadian timing system and environmental synchronizers. Many psychophysiological, functions such as the sleep-wake rhythm are also disrupted due to shift work.

The major health problems experienced more by shift workers were found to be loss of appetite (36.3%), gain in weight (52.9%), fatigue or tiredness (61.8%), abdominal pain (29.4%), headache (47.2%), common cold (44%), muscle pain (35.3%), difficulty in remembering things (38.2%), backache (38.2%), irritability (85.9%), acidity (27.6%), abdominal gas (47.1%), eye pain (47%) than their counter parts i.e day workers except fatigue (72.2%) which was highest in day workers (Table 19). From the health score it was also clear that shift workers were having poorer health status compared to day workers.

These findings suggested that, shift work in particular night work, can have a negative impact on health and well being of workers as it could cause, disturbances of normal circadian rhythms beginning with the sleep/wake cycle. These symptoms were more frequently observed in shift workers as human body is meant to be active during day time hours, while during night time hours it is meant to sleep, which allows of to reserve and replace energy. Working at night and sleeping during the day is opposite to the body's biological clock and what the body naturally wants to do. This may make sleeping difficult, it may also mean that the body can't recover as quickly from physical and mental exertions/demands.

Among the most common health problems are gastrointestinal complaints, including loss of appetite, indigestion, abdominal bloating etc and these ailments are two or three times more frequent in shift workers. The causes might be poor eating or dietary habits. They were also reported to consume too much fast food because of constant tiredness and lack of time to prepare healthy foods. People also have difficulty in digesting foods during the overnight hours. Other factors might be disturbed sleep, overeating, excessive tea or coffee drinking, smoking and job related psychological stress. The study is in line with the study conducted by Segawa *et al.* (1987) who suggested prevalence of duodenal ulcer was more in shift workers compared to day workers.

The biochemical analysis also suggested that heart disease is an added risk. The anthropometric findings clearly demonstrated that the shift workers were centrally obese, consumed high fat foods, which ultimately affecting lipid metabolism, by increasing cholesterol levels in the blood stream. Higher levels of smoking among shift workers exacerbate the danger.

Finally the subjects of this study were in the same age group and had work experience from 6 months to 2 years, majority were unmarried. The results also showed higher consumption of sweet drinks, sweets, baked products, fried items, fast foods and higher frequency of missing meals. Tobacco consumption and alcohol consumption was also significantly higher in shift workers. Higher percentages of shift workers were found to be obese. There was also increased trend in biochemical parameters which is an alarming factor at this young age. The synergistic effect of the erratic eating habits, adverse life style along with shift work will have health impact in long run. So, if this segment is neglected, then very soon the young, healthy population will be reduced affecting the development of the Company, Institution or Nation.

In conclusion, despite a similar overall health status, shift workers were characterized by poor dietary habits associated with a higher prevalence of cardiovascular risk in shift workers in addition to changes in the circadian rhythm.

#### Suggestions and implications

To protect the health of the potential young generation nutrition education is required regarding the role of nutrition; importance of balanced diet etc. There is a need to make aware of these facts to the policy makers/ managements of the corporate. The policy makers should provide workers the support policies i.e. shortening of working hours (reduce overtime) by ample staff appointment. There is also a need to provide scope for yoga, relaxation, entertainment to improve the efficiency of the workers.

#### Future line of work

1. Comparative study on the nutritional status of male and female software engineers
2. Health and life style of female shift workers
3. Coping mechanism of the shift workers

## 6. SUMMARY AND CONCLUSIONS

A study entitled “The impact of shift work on nutritional status, lifestyle and health status of shift workers” was carried out during 2009-2010 at various software industries in Bhubaneswar, Orissa. The purpose of the present investigation was to assess the nutritional status of shift workers in comparison to permanent day workers and also to assess the lifestyle of the shift workers.

A total of 70 software engineers, in the age group of 22-33 years were selected for the study, with 36 members in control group (permanent day workers) and 34 members in study group (shift workers). The study was conducted in five software industries in Bhubaneswar, Orissa. All the subjects were male workers as there were no female workers working in shifts due to safety reasons.

All the shift workers followed an 8 hour irregular rotating work schedule namely morning, evening and night shift. Permanent day workers were the workers of typical day schedule who work for 8 hours.

General information such as age, education, occupation, duration of work, timing of work, residence, family type, family size, marital status, living status, nativity, since how long the person has been in the shift were collected by a structured pretested questionnaire. Information on food habit *viz.*, type of food habit, consumption of various foods and its relative frequencies, fluid intake, meal skipping habits, habit of eating outside and its frequency were collected.

Further, information on lifestyle habits were collected in terms of smoking, alcohol consumption, exercise, sleep pattern, social and family activities. Information on frequency of experiencing general health problems was also assessed. Anthropometric measurements were recorded and the biochemical parameters *viz.*, fasting blood glucose and lipid profiles were also estimated by taking subsamples. The dietary information was assessed by 24 hour recall method using a set of pre standardized vessels. The salient findings of the study are summarized below.

- Majority of the day workers (41.7%) were in the age group of 25 to 27 years. Among 37 shift workers equal percentage (35.5%) were found to be in the age group of less than 25 years and 25 to 27 years respectively. Majority of the software engineers were graduates. The income levels of day workers were different than the income levels of shift workers. Among the shift workers 47.1 per cent were in night shift, followed by 29.4 per cent in the evening shift and 23.5 per cent were in morning shift. Higher percentage of software engineers belonged to nuclear family. Majority of the subjects were found to be unmarried. Highest percentage of day workers (63.9%) and shift workers (61.8%) lived in rented rooms. Among the shift workers 58.5 per cent were having 6 month to one year of shift work experience.
- Majority of day workers (75%) and shift workers (70.6%) were found to be non-vegetarian.
- Non-significant difference in height was found among the day and the shift workers, but with respect to weight statistically significant difference was found between the groups. Shift workers were reported to have higher weight compared to day workers.
- The BMI was also found to be significant statistically, with respect to waist and hip circumference the difference was non-significant. But waist-to-hip ratio (WHR) was found to be significant statistically between the day and shift workers. The shift workers were found to have higher BMI and WHR.
- As per the BMI classification majority of the (41.7%) day workers belonged to ideal BMI category, whereas 55.9 per cent shift workers belonged to obese grade- I category.
- With regard to WHR classification, more than 90 per cent software engineers were reported to be normal.
- Significant difference was observed in mean changes in weight of the software engineers at the time of joining and at the time of the research work.

- The income of the software engineers was found to be significantly associated with BMI.
- The mean food intake was also found to be non significant between the two groups.
- Mean nutrient intake of the subjects showed non-significant difference in energy, carbohydrate, vitamin A, vitamin C, where significant difference was found in protein, iron and fiber intake between the two groups.
- Mean fat intake of the subjects were found to be non-significant except for the saturated fat. The consumption of saturated fat was high in shift workers compared to day workers.
- Percent nutrient adequacy for fat intake was found to be 500 per cent, followed by vitamin C which was more than 200 per cent in both the groups.
- The biochemical analysis showed significant difference in the fasting blood glucose of the subjects. With respect to lipid profile significant difference was found for HDL-C and the ratio of total cholesterol to HDL-C. Non significant difference was observed in the mean values of total cholesterol, triglycerides and LDL-cholesterol. The values were higher in shift workers compared to day workers, except for HDL-C which was higher in day workers.
- There was no difference in the relative quality of the diet this indicates consumption of same type of food items regardless of shift. However, there was difference in the frequency of consumption and the eating habits.
- With regard to the consumption of high energy foods, rasgulla, cakes and pastries, burger, sandwiches, vada, and chats were more frequently consumed by shift workers compared to day workers. The average consumption of these items was statistically significant.
- Shift workers were reported to consume more tea, coffee and soft drinks than day workers, these differences were statistically significant.
- Majority of the subjects were reported to eat food at canteen. With respect to meal skipping, majority of shift workers (47%) skipped meal and 38.2 per cent shift workers skipped meal 2-3 times per week.
- Generally all shift workers used to go for restaurant foods. Majority of the software engineers preferred north Indian food, followed by, Chinese foods. While selecting foods, majority of subjects were reported to prefer both high and low fat foods.
- More number of smokers were there in shift work group than the day work group and the number of smokers increased in shift workers after joining the job, where as in day workers the number remained the same. Usually the subjects preferred to smoke along the company of the friends.
- More shift workers were found to consume alcohol, number of alcohol consumers and frequency of consumption increased after joining the job. Majority of shift workers were found to drink once in a week.
- More shift workers reported that they were not doing exercise regularly than day workers. Higher percentage of day workers and shift workers were doing physical activity for more than one hour. Majority of the subjects reported to play cricket. The frequency of playing was also affected after joining the job. Maximum of day workers were found to be the members of gym or any health club. Majority of the subjects went to office by bike.
- 47.1 per cent and 52.9 per cent shift workers went to bed in morning and night respectively. Half of the shift workers took more than half an hour to fall asleep at night.
- Majority of shift workers reported impairment in social leisure activities, personal leisure, activities and ability to form and maintain close relationship with family members compared to day workers. Majority of shift workers were reported to become workaholic.
- The major health problem experienced by the subjects were loss of appetite, gain of weight, fatigue/tiredness, headache, common cold, backache, irritability, acidity, abdominal bloating or gas *etc.* more frequently observed in shift workers compared to day workers.

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# APPENDIX-I

## NUTRITIONAL PROFILE FOR SHIFT WORKERS

University of Agricultural Science, Dharwad

### 1. GENERAL INFORMATION

Please put  $\surd$  mark at the required places

SAMPLE NO-

- a) Name:
- b) Age (yrs):
- c) Gender:
- d) Education:
- e) Occupation:
- f) Designation:
- g) Duration of work: a)8 hr.....b)10 hr.....c)more than 10 hrs.....
- h) Timing: a) Morning .....to.....b) Evening.....to....c) Night...to.....
- i) Income/Month:
- j) Address:
  
- k) Contact No(Mob):
- l) Email ID:
- m) Residence: a)House..... b)Apartment..... c)Room rented..... d)Own.....
- n) Family type: a)Nuclear.....b)Joint..... c)PG.....
- o) Family size:
- p) Marital status: a) Married.....b) Unmarried .....
- q) Living with whom: a) Parents.....b) Spouse..... c) Friends.....d) Alone.....
- r) Nativity: Orissa / Other state(Specify)
- q) Working in shift since: a) < 6mth..... b) 6 mth-1½ yrs.....c) 1½- 2yrs.....  
d) 2-3 yrs.....e) 3-4 yrs.....

## 2. ANTHROPOMETRIC MEASUREMENTS

- 5. a) Height:
- 5. b) Weight(Kgs) at present:
- 5. c) Weight (Kgs) before joining the job:
- 5. d) BMI (Wt in Kg/ Ht in m<sup>2</sup>):
- 5. e) Waist circumference (Cms):
- 5. f) Hip circumference (Cms):
- 5. g) WHR:

### DIET SURVEY (24 Hr recall method)

| Items     | Menu | Ingredients | Subject intake | Cup no. |
|-----------|------|-------------|----------------|---------|
| B fast    |      |             |                |         |
| Lunch     |      |             |                |         |
| Snacks    |      |             |                |         |
| Dinner    |      |             |                |         |
| Any other |      |             |                |         |

### 3. FOOD HABIT SURVEY

Please put  $\checkmark$  mark at the required places

a) Type of food: a) Vegetarian.....b) Non vegetarian..... c) Eggerian.....

b) What type of snacks do you eat, how frequently?

| Name of the product        | Product description  | Daily | Weekly | Occasionally |
|----------------------------|--|-------|--------|--------------|
| 1-Sweets                   | Rasgula<br>Kaju burfi<br>Gulab jamun<br>Rasmalai<br>Any other                    |       |        |              |
| 2-Bakery and Confectionary | Cakes/Pastries<br>Biscuits/cookies<br>Pizza<br>Burger<br>Sandwiches<br>Chocolate |       |        |              |
| 3-Fried products           | Chips<br>Pakodas<br>Vada etc   |       |        |              |
| 4-Fast foods               | Noodles<br>Rolls<br>Gobimanchurian<br>Panipuri<br>Chats<br>others                |       |        |              |
| 5-Desserts                 | Ice cream<br>Fruit salad   |       |        |              |
| 6- Fresh Fruits            | Banana<br>Guava<br>Apple<br>Oranges<br>Any other                                 |       |        |              |
| 7-Fleshy foods             | Chicken/ Mutton<br>Fish  |       |        |              |
| 8-Any other                |  |       |        |              |

c) How much fluids do you consume per day in following forms

a)cups..... b)ml.....

- ❖ Plain water
- ❖ Coffee /Tea
- ❖ Milk
- ❖ Soft drinks
- ❖ Fruit juice

d) How many meals you consume/day?

a) Thrice ..... b) 4 times..... c) 5 times ..... d) any other.....

e) Do you carry lunch box.....or eat at Canteen.....

f) Generally do you skip off any meals? Yes..... No.....

g) If yes, a) Breakfast ..... b)Lunch ..... c)Dinner.....

h) How often you skip off meals?

a)Every day ..... b)2-3 times a week..... c)More than 3 times a week.....

i) Do you eat out side? Yes..... No.....

j) If yes, What foods you take usually?

a)Chinese items..... b)North Indian foods.....c) South Indian foods.....

k) How often:

a)Every day.....b)Once in a week.....c)Once in 15 days.....d)Once in a month.....

l) While choosing foods for your meal ,do you usually select high fat / low fat foods?

- a) High fat foods all the times.
- b) High fat foods most of the times.
- c) Both high and low fat foods equally as often.
- d) Low fat foods most of the time.
- e) Low fat food all the time.

m) If yes, a) Increased..... b) Decreased.....

n) Have you fallen ill in last 3 months? Yes.....No.....

o) To whom you have consulted

a)Doctor.....b)Dietitian..... c) Home remedies.....d)Nutritionist.....

#### 4. LIFE STYLE

##### EXERCISE

Please put  $\sqrt{\quad}$  mark at the required places

- a) Do you have the habit of doing exercise? Yes.....No.....
- b) If yes, type a) Walking.....b) Yoga..... c) Physical Exercise.....d) Aerobics.....
- c) How many hours of physical activity do you do every day?  
a) 2-3 hrs.....b) 1-2 hrs.....c) less than 1 hr.....
- d) Are you satisfied with your physical activity?  
a) Not satisfied..... b) moderately satisfied.....c) Satisfied.....
- e) How do you go to office?  
a) Car..... b) Bus..... c) Bike ..... d) Walking.....

f) Which sports do you play?

|          |  |          |  |                     |  |          |  |
|----------|--|----------|--|---------------------|--|----------|--|
| Football |  | Net ball |  | Cricket             |  | Athletic |  |
| Rugby    |  | Swimming |  | Others<br>(Specify) |  | None     |  |

g) How frequently you play?

|                         | Once in a week | Once in 15 days | Once in a month | Not specific |
|-------------------------|----------------|-----------------|-----------------|--------------|
| Earlier<br>(Before job) |                |                 |                 |              |
| At present              |                |                 |                 |              |

- h) Are you a member of a) Club..... b) Gym.....
- i) Do you have any club or gym at work place? Yes.....No.....
- j) What type of activity you usually do there?

SMOKING

Please put √ mark at the required places

a) Do you smoke cigarettes? Yes.....No.....

b) At what age did you begin smoking? .....Yrs

| c)No of cigarette   | Per day | Per week |
|---------------------|---------|----------|
| Earlier(Before job) |         |          |
| At present          |         |          |

d) Name the 3 places you smoke most often

a)Office..... b)Home..... c) Out side.....

e) Do you have other smoking habits?

a) Cigars..... b) Pipes ..... c) Any other tobacco products.....(specify)

f) What could motivate you to quit smoking?

a) Health issues..... b)Cost of the cigarettes..... c) Family Pressure.....

g)Usually you smoke a) Alone..... b)With friends.....

ALCOHOL CONSUMPTION

Please put √ mark at the required places

a) Do you take alcohol ? Yes..... No.....

b)If yes, when

a)Daily.....b)Once in a week..... c)More than once a week....

d)Fortnightly..... e)Occasionally.....

c) At what age did you start alcohol? .....Years

d) Why you started drinking alcohol?

a)To release tension..... b)Release tiredness... c) Enjoyment.....d)Any other.....

| e) Quantity,        | pegs/ day(1 peg=60 ml)<br>(1 ounce=30ml) | pegs/week |
|---------------------|--|-----------|
| Earlier(Before job) |  |           |
| At present          |  |           |

f)Which type of alcohol you consume usually?

-  
-  
-

g) Along with alcohol what foods you take?

Specify

h ) Have you suffered any health problem as a result of alcohol use? Yes.....No.....

If yes ,please provide details-

i) Have you ever been advised to reduce your alcohol consumption ? Yes.....No.....

If yes ,please provide details

### SLEEP PATTERN

Please put √ mark at the required places

a)When do you go to bed? Morning..... Night.....

b) How long does it take you to fall asleep at night?

a)Fall asleep right away.... b)after ½ hr.....c)1 hr.....d)2 hrs.....e)3 or more hrs.....

c) Do you have sound sleep? a))Yes..... b)No.....

d) How often do you wake up in the middle of the night?

a)Never.....b)1 time.....c)2 times..... d)3 or more times.....

e) How long does it take you to fall back asleep when you wake up in the middle of the night?

a)Never wake up in the middle of the night....b) ½ hr..... c)1 hr.....d)2/more hrs...

f) After a full night of sleep, do you feel well rested?

a)Usually.....b)Sometimes.....c)Never.....

g) Do you often feel sleepy in the daytime?

a)Always..... b)Sometimes..... c)Never.....

h) Do you sleep for less than 5 hours a day? Yes.....No.....

i) On the weekends, what time do you go to bed?

a)8 -10 pm.....b)10 pm.- 12am.....c)12 am - 2 am.....d)2 - 4 am..... e)After 4 am...

j) On the weekends, what time do you get up in the morning?

a)7 - 9 am..... b)9- 11 am.....c) 11 am.-1 pm.....d)1- 3 p.m.....e)Later than 3 pm.....

### SOCIAL AND FAMILY ACTIVITIES

Please put √ mark at the required places

| Sl.No. | Social and Family activities  | Yes | No |
|--------|---|-----|----|
| 1      | Social relationship is impaired   |     |    |
| 2      | Social leisure activities (parties, clubs ,outings ,home entertainment) are impaired        |     |    |
| 3      | Personal leisure activities (like reading, walking ,gardening) are impaired                 |     |    |
| 4      | Ability to form and maintain close relationship with family members and others is impaired. |     |    |
| 5      | Withdraw from social gathering  |     |    |
| 6      | Becoming a workaholic with no relaxation or pleasurable activity                            |     |    |
| 7      | Work pattern affects the child upbringing   |     |    |
| 8      | Leave your child in day care center.  |     |    |
| 9      | Maintained balance between work and child care  |     |    |
| 10     | Hard to supervise and help your child / children with their homework work                   |     |    |
| 11     | Avoid social gatherings, even if invited or expected to attend                              |     |    |
| 12     | Friendships and/or family relationships suffer from your type of duty                       |     |    |
| 13     | Prefer working alone to working with others.  |     |    |
| 14     | Habit of taking medicine for anxiety or depression  |     |    |

b) If answer is negative for most of the questions please give reason-

### 5. HEALTH ASPECTS

a) Are you suffering from any diseases? Yes.....No.....

b) If yes ,Specify

| Disease           | When it started | Taking medicine/not | Name of medicine |
|-------------------|-----------------|---------------------|------------------|
| Diabetes Mellitus |                 |                     |                  |
| Blood pressure    |                 |                     |                  |
| Digestive problem |                 |                     |                  |
| Heart disease     |                 |                     |                  |
| Any other         |                 |                     |                  |

c) If at all you are on insulin therapy how you manage during office hrs

d) Symptom (indicate how often you experienced each symptom in past 3 months)

Please put  $\surd$  mark at the required places

| Sl. No. | Symptom                                 | Never | Rarely | Occasionally | Always |
|---------|---|-------|--------|--------------|--------|
| 1       | Loss of appetite                        |       |        |              |        |
| 2       | Loss/ gain of weight                    |       |        |              |        |
| 3       | Fatigue/Tired                           |       |        |              |        |
| 4       | Abdominal pain                          |       |        |              |        |
| 5       | Headaches                               |       |        |              |        |
| 6       | Common cold                             |       |        |              |        |
| 7       | Frequent urination                      |       |        |              |        |
| 8       | Craving for sweets /fatty foods         |       |        |              |        |
| 9       | Muscle pain                             |       |        |              |        |
| 10      | Ringling in ears                        |       |        |              |        |
| 11      | Difficulty remembering things           |       |        |              |        |
| 12      | Dizziness                               |       |        |              |        |
| 13      | Chest pain                              |       |        |              |        |
| 14      | Numbness or tingling in the extremities |       |        |              |        |
| 15      | Joint pain                              |       |        |              |        |
| 16      | Backache                                |       |        |              |        |
| 17      | Irritability                            |       |        |              |        |
| 18      | Acidity/Indigestion                     |       |        |              |        |
| 19      | Abdominal bloating or gas               |       |        |              |        |
| 20      | Eye pain                                |       |        |              |        |
| 21      | Constipation                            |       |        |              |        |
| 22      | Diarrhea                                |       |        |              |        |
| 23      | Intolerance of caffeine                 |       |        |              |        |
| 24      | Very dark yellow urine                  |       |        |              |        |
| 25      | Crusts or fissures at corners of mouth  |       |        |              |        |

## APPENDIX II

### Nutritive value of some of the energy dense foods

| Food items  | Energy (kcal) | Protein (g) | Carbohydrate (g) | Fat(g) |
|-------------|---------------|-------------|------------------|--------|
| Rasgulla    | 242           | 6           | 50               | 2      |
| Gulab jamun | 420           | 16          | 62               | 12     |
| Ice cream   | 194           | 3.5         | 22.5             | 10     |
| Chocolate   | 515           | 9.3         | 60               | 27     |
| Cookies     | 481           | 5.7         | 73               | 18.5   |
| Potato chip | 372           | 2.4         | 33.9             | 25.15  |
| Noodles     | 402           | 9.2         | 58.9             | 14.4   |

Nutritional fact per 100g

# **IMPACT OF SHIFT WORK ON NUTRITIONAL STATUS, LIFESTYLE AND HEALTH STATUS OF SHIFT WORKERS**

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2010

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## **ABSTRACT**

A study entitled "The Impact of Shift Work on Nutritional Status, Lifestyle and Health Status of Shift workers" was carried out during 2009-2010 at various software industries in Bhubaneswar, Orissa. The objectives of the study were to assess the nutritional status and life style in shift workers to document their health problems. A total of 70 subjects in the age group of 22-33years, belonging to software profession were considered for the study, with 34 shift workers and 36 permanent day workers. Information on nutritional status, food habits, lifestyle, health status were collected by a structured and pre-tested questionnaire.

Results showed that, majority of the day workers (41.7%) were having ideal BMI, whereas, 55.9 per cent shift workers were in obese grade I group. Analysis of diet survey revealed no significant difference in the intake of food as well as nutrients between the day and shift workers. Tobacco consumption and alcohol consumption was significantly higher in shift workers. Higher consumption of sweet drinks, sweets, baked products, fried items, fast foods and higher frequency of missing meals were found in shift workers than day workers. Gastrointestinal complaints including loss of appetite, indigestion, abdominal bloating was two to three times more frequent in shift workers than day workers. A significant difference was observed with regard to fasting blood sugar in day (91.84 mg/dl) and shift workers (97.10 mg/dl). Higher levels of serum total cholesterol (195.33 mg/dl), triglycerides (159.65 mg/dl), LDL-cholesterol (125.48 mg/dl) were observed in shift workers than day workers (total cholesterol 173.43 mg/dl, triglycerides 150.08 mg/dl and LDL-cholesterol 114.17 mg/dl). Low HDL cholesterol was observed among shift workers (39.62 mg/dl) than day workers (44.96 mg/dl).