# RESULTS AND DISCUSSION

The present study was conducted with a broad objective of designing and implementing a comprehensive workplace nutrition health promotion program and evaluating its impact on the employees. The study was carried out in 5 phases. The results are presented accordingly.

## PHASE 1

## SITUATIONAL ANALYSIS OF THE WORKPLACE

In the first phase of the study, an industry located in urban Vadodara was selected as the study setting after obtaining permission from the Head of Human Resources (HR) as well as Admin. & Personnel Head of the industry. The Worksite Wellness Index Questionnaire (WWI) developed by Cardiovascular Health and Wellness Programme – Texas Department of State Health Services in 2004 was pretested, standardized and adapted before using on the local industry. Being knowledgeable about all company policies and programmes, the Admin. & Personnel Head was identified as the appropriate resource person (key informant) for filling the WWI questionnaire. The questionnaire was administered to the Admin. & Personnel Head and thereby, information regarding the industry's existing nutrition and health policies as well as canteen and recreational facilities was obtained. The answers so obtained were analyzed and the industry was evaluated regarding its strengths and weaknesses with respect to nutrition and health policies as per the WWI questionnaire format.

The worksite under survey is an Engineering consultancy. At the time when the study was conducted (April 2010 – December 2011), it employed more than 500 employees, 150 of them belonged to the management category.

## WORKSITE POLICIES AND ENVIRONMENT

At the time of the situational analysis of the workplace policies & programmes (April 2010), the industry had no policy outlining the requirements and functions of a comprehensive worksite wellness program and there were no future plans, till the time of this survey to form one (December 2011). There was no representative committee overseeing regular organisation worksite wellness programmes and plans for the employees, such as physical activity and nutrition programmes.

***Breaks***

Within the total working hours (8 hrs/day), employees were allowed 3 breaks; 1 lunch break and 2 tea/coffee breaks.

***Physical Activity***

The worksite also did not have any written policies on physical activity for the employees which encouraged them to indulge in physical activity during work hours. There was no practice of encouraging the employees to be physically active during the breaks. However, the worksite had on-site facility for playing table tennis as well as volleyball for the employees, which they could avail after regular work hours. In case of over time when the employees stayed back after regular office hours, they were allowed to use the volleyball court as well as table tennis facility.

In addition to this, the industry held interdepartmental table tennis, and volleyball competitions regularly – about 4 times a year. The employees were encouraged to participate in the same and were motivated for the same by inculcating a competitive spirit. This provided a chance to the employees to indulge in physical activity in an enjoyable way. It also served to create a harmonious atmosphere and helped in developing a healthy work environment. As part of the practice for these competitions, the employees utilized the physical activity facilities provided on the premises. However, apart from this, no other regular physical activity facilities with time allocated for it out of total working hours were present on premises. Also, there was no provision for free or discounted gym/fitness membership for the industry employees which would motivate them to take up the same.

***Nutrition policies***

An attempt was made to see how dependent the employees were on food available in and around the industry during working hours. About 71% of the subjects said that they brought lunch from home while the remaining 29% depended on outside food for their daily lunch. Out of

this 29%, almost 36% availed the tiffin service supplied at workplace by two different food service providers while 56.5% used the food service provided by caterer (served in the industry canteen) and 7.6% visited the nearby restaurant for lunch. However, the frequency with which the employees used these food services varied. Details are given in Table 4.6. There was a canteen space in the premises which though did not offer food to the employees, provided a place for them to eat their lunch. There were no written policies on nutrition that committed to an on-campus cafeteria following healthy food preparation guidelines and practices. Vending machines provided tea and coffee to the employees during their break time. Information and educational material on yoga, ergonomics and several other topics was also circulated to the employees via the company's intranet to each individual at his desk.

***Tobacco Use***

The worksite had written policies banning smoking on premises and participated in smoking cessation activities such as circulation of brochures/e-mails spreading awareness regarding the harmful effects of smoking. The industry was strict in the implementation of its 'no smoking' policy for the employees during duty hours. "No smoking" signs were placed at strategic points thus providing prompts to discourage smoking. The staff was routinely oriented to and given copies of the policies regarding the same by the management (Administrative & Personnel Head of the industry). However, no measures were taken to discourage oral or other forms of tobacco use among the employees.

***Emergency Response Training***

The worksite had a written plan for emergency response to cardiac events at their premises. Also, important phone numbers such as ambulance, hospital, doctor's contact number were placed at strategic points in the premises for use in case of any event. Also, some of the staff, executives as well as administrative staff was trained in CPR (Cardio Pulmonary Resuscitation) and First Aid in case of an event during work hours. However, the DGM expressed a need to train more number of employees for the same to better equip themselves for any cardiac emergency situation. However, the management did not think it was important to prevent cardiac events by promoting healthy diet and lifestyle among its employees.

***Score***

The industry earned 18 points out of 36 i.e. 50% in the area of worksite policies and environment as per the Worksite Wellness Index. The only recommendation that was made by the management (key informant) was regarding the training of more number of employees for action during emergency situations including medical emergencies or natural disasters like

floods or earthquakes. There was a complete ignorance about the NCD burden and its adverse consequences and prevention strategies that could be put into place to prevent adverse outcomes and emergencies at the workplace. Detailed scorecard is presented in Table 4.1. For each question, scores were assigned between 0 and 3. As per the strength of the policy regarding that particular issue, each question ranked the worksite. Zero implied no provision was there for that particular issue. E.g. In Question.1, regarding Worksite Nutrition Policy, as there were no written policies, the workplace scored "0" for that question and so on. At the end of the questionnaire, total was made from the individual scores and a score was arrived at, out of 36. Percentage was also then calculated. The workplace under study scored 18 out of 36 i.e. 50% on this scale.

**HEALTH PROMOTION FOR EMPLOYEES**

The industry management provided adequate health care coverage to the managerial staff of the worksite. The company policy had provision for free health checkups and health counseling for managers. In addition to this, the company appointed doctor visited the industry on a weekly basis and tended to any medical complaints the employees may have had. The company provided reimbursement for the medical expenses incurred by any of the managerial employees in case of a health problem with or without hospitalization.

There was however, no worksite budget allocated for employee health promotion. However, the industry periodically arranged for informative talks and medical camp (dental/eye checkups) by medical professionals from different specialties such as Eye specialist, Dentist etc. However, programmes on health issues perceived as important by the industry doctor or employee interest were regularly held in the industry through the initiative taken by the Administrative head and the company-appointed doctor who organized these events for the benefit of the employees. The employees were encouraged to be a part of these activities and were intimated as well as reminded about the same so as to encourage all those interested to attend the sessions, though this was purely voluntary.

***Score***

As per the criteria of the Worksite Wellness Index (Table 4.2), the industry earned 17 points out of 21 i.e. scored 80.95% in the area of 'Health Promotion for Employees'. No concrete recommendations were made regarding this aspect by either the Head of Human Resources or the Admin. & Personnel Head. Detailed scorecard is given in Table 4.2. The same scoring method also was used for evaluating the "Health Promotion for Employees" section scores.

| Table 4.1 Score card for "Worksite Policies and Environment" in the Selected Workplace | | |
|---|---|---|
| **Sr. no.** | **Question** | **Score (out of 36)** |
| 1 | Worksite Wellness Program Policy | 0 |
| 2 | Representative Committee overseeing the Worksite Wellness Programs | 0 |
| 3 | Worksite Wellness Plan | 0 |
| 4 | Written Policies on Physical Activity | 0 |
| 5 | Breaks | 2 |
| 6 | Physical Activity Facilities | 2 |
| 7 | Employee Access to Physical Activity Facilities Outside of Work Hours | 3 |
| 8 | Written policies on Nutrition | 1 |
| 9 | Written Policies on Tobacco Use | 3 |
| 10 | Staff Oriented to Policies | 2 |
| 11 | Plan to Respond to Cardiac Events | 3 |
| 12 | Emergency Response Training | 2 |
| | *Total* | *18* |
| | **Percentage** | **50%** |

*Source: Worksite Wellness Index for Cardiovascular Health - developed by Cardiovascular Health and Wellness Program. Revised September 2004. Texas Department of State Health Services.*

| Table 4.2 Score card for "Health Promotion for Employees" in the Selected Workplace | | |
|---|---|---|
| **Sr. no.** | **Question** | **Score (out of 21)** |
| 1 | Healthcare Coverage for Staff | 2 |
| 2 | Health Screening for Staff | 3 |
| 3 | Physical Activity/Fitness Programs for Employees | 3 |
| 4 | Nutrition Education/Weight Management Programs for Employees | 3 |
| 5 | Promote and Encourage Employee Participation | 3 |
| 6 | Awareness and Education Messages | 3 |
| 7 | Budget for Employee Health Promotion | 0 |
| | *Total* | *17* |
| | **Percentage** | **80.9%** |

*Source: Worksite Wellness Index for Cardiovascular Health - developed by Cardiovascular Health and Wellness Program. Revised September 2004. Texas Department of State Health Services.*

**SUMMARY**

In the selected workplace setting, the highlights of workplace wellness index show:

- "No Smoking" policy in place, banning smoking in industry premises. However, oral or other forms of tobacco use was not discouraged.
- Documented policies for emergency response to cardiac events was present. Some staff members were trained in CPR (Cardio Pulmonary Resuscitation).
- Free health check-ups on yearly basis for managerial level of employees as part of the health policy of the industry. However, no such policy existed for lower level of employees.
- Weekly visit by company-appointed doctor to look after the perceived health issues of the employees.
- Provision for medical reimbursement for manager level employees with or without hospitalization.
- Food service provided by contractual caterers and tiffin-service providers in the absence of a regular in-house canteen or food facility.
- Absence of guidelines in place to ensure availability of healthy, nutritious meals for employees and prevent ready availability of junk foods.
- Absence of any written policies for ensuring physical activity of employees at workplace. Though infrastructure was provided on industry premises for games such as Table Tennis and Volleyball, no time allocation was made for the same during working hours. No provision of free/discounted gym membership for employees.
- No comprehensive workplace nutrition health promotion programme or policies.
- Absence of enabling environment to practice healthy diet and lifestyle habits in the worksite premises as there were no policies for serving of healthy food or physical activity in the workplace.
- No budget allocation for a Nutrition Health Promotion Programme, identifying risk factors of diseases, especially cardiovascular diseases, diabetes, cancer or any other means to ensure preventive health management or nutrition health promotion.
- As per the criteria of the Worksite Wellness Index, the industry earned 18 points out of 36 i.e. 50% in the area of worksite wellness policies & environment and scored 17 points out of 21 i.e. 80.9% in the area of 'Health Promotion for Employees'.

**DISCUSSION**

It can be seen from the data presented in the results section that, apart from well documented and strictly implemented "No Smoking on Premises" policy, no other preventive health measure was practiced by the management in the selected industry. However, tobacco use in other forms such as oral (chewing tobacco), snuff, betel etc. was not discouraged. Tobacco use is one of the leading preventable causes of death. The global tobacco epidemic kills nearly 6 million people each year, of which more than 600,000 are people exposed to second-hand smoke. Unless we act, it will kill up to 8 million people by 2030, of which more than 80% will live in low- and middle-income countries (WHO Factsheet on Tobacco 2013). Considering the fact that a large proportion of the population of India in general and Gujarat in particular use smokeless forms of tobacco, this policy is definitely inadequate to curb tobacco consumption among the population. Data from Global Adult Tobacco Survey, India 2009-2010 revealed that in India, 35% adults (48% males and 25% females) used tobacco in some or the other form and considerable percentage (33% males and 18% females) of the population used smokeless (oral) tobacco. With respect to Gujarat, a study conducted by Patel and Patel in 2011 in a town in Gujarat on 3030 free living subjects reported the prevalence of smokeless tobacco to be as high as 53%. Thus, a 'no smoking policy' is insufficient and should be replaced by a 'no tobacco usage policy' in order to curb the tobacco consumption of employees, especially in Gujarat.

The World Health Organization also includes all forms of tobacco in their policies and frameworks, recognizing the inadequacy of a 'no smoking' policy. In 2003, the WHO Framework Convention on Tobacco Control (WHO FCTC) was adopted by the World Health Assembly in response to the globalization of the tobacco epidemic. In May 2013, the World Health Assembly adopted the WHO global action plan for the prevention and control of non communicable diseases from 2013–2020, in which reducing tobacco use is identified as one of the critical elements of effective NCD control. The global action plan comprises a set of actions which – when performed collectively by Member States, WHO and international partners – will set the world on a new course to achieve nine globally agreed targets for NCDs; these include a reduction in premature mortality from NCDs by 25% in 2025 and a 30% relative reduction in prevalence of current tobacco use in persons aged 15 years and older (WHO Global Report on Tobacco Epidemic 2013).

With respect to policies regarding medical care of the employees, while the industry had budget allocations for payment of medical bills for employees who fall ill, there was no provision for ensuring that employees do not develop health diseases in the first place i.e. the workplace's approach towards employees' health was more curative than preventive. In order to avoid

progression to disease and its adverse consequences, employees could be made aware of their risk factors and their effective management. Also, the industry offered health screening facilities and medical reimbursement only to the higher level employees. There is scarcity of literature on workplace canteen services in India. However, data is available from a study conducted by Mehan et al in 2009 on 14 industries located in urban Baroda city. Only 50% of these industries offered regular health check-ups. Also, similar to the findings of the present study where only manager level employees were offered regular free health checkups, Mehan et al also reported that regular free health checkups were provided only to the higher level of employees (Mehan et al 2009). Ideally, all levels of employees, no matter where in the hierarchical structure should be provided with health screening facilities as well as reimbursement in keeping with the basic health and nutrition rights of all individuals (WHO Factsheet on Right to Health 2013).

The WHO Global Plan of Action on worker's health (2008-2017) stipulates the need to address all aspects of worker's health including – promotion of health at work and improved response from health systems to workers' health. It is well documented that in addition to providing a safe and healthy work environment, workplace health promotion programmes tend to enhance an employee's self-esteem, reduce stress, improve morale, increase job satisfaction as well as serve to improve the general health and well-being of an employee. The organization in turn obtains increased productivity, reduced absenteeism, reduced health care/insurance cost and happier employees (WHO Factsheet on Workplace Health Promotion 2013). The workplace directly influences the physical, mental, economic & social well-being of workers and in turn health of their families, communities and society. It offers an ideal setting & infrastructure to support the promotion of health of a large audience. The concept of health promotion in the workplace is becoming increasingly relevant as more private and public organizations recognize that future success in a globalizing marketplace can only be achieved with a healthy, qualified & motivated workforce. Occupational health is fundamental to public health because major diseases, especially chronic degenerative diseases such as diabetes and heart problems need workplace programmes as part of the disease control strategy.

The United Nations high-level meeting on non-communicable disease prevention and control in 2011 called on the private sector to "promote and create an enabling environment for practicing healthy behaviors among workers by establishing tobacco-free workplaces, safe and healthy working environments through occupational safety and health measures, including, where appropriate, through good corporate practices, workplace wellness programmes and health insurance plans. Workplace as a "setting" for health promotion was recognized by the Ottawa Charter way back in 1986 (WHO 1986). Workplace Health Promotion was also given the utmost

importance in the Jakarta Declaration of 1997 (WHO 1997) where it was recognized as one of the most important settings affecting the physical, mental, economical & social well-being of employees. Thus, the WHO (World Health Organization) emphasizes the importance of workplaces with well-equipped comprehensive nutrition health policies focusing on behavior change, and communication to promote healthy diets and lifestyles amongst all employment categories.

With regards to policies and practices pertaining to availability of healthy diet in the selected workplace, data revealed that in the absence of an in-house canteen which could provide healthy and nutritious meals to the employees a considerable proportion of the employees depended on food available in and around the workplace for their daily meals (breakfast, lunch and evening snacks). Also, the food services that were available in the workplace (caterer and tiffin service) were not following any kind of healthy menus but mainly focused on palatability and preference. There was also a section of the employees who also visited nearby restaurants and eateries for their daily meals. There was lack of any written policies that ensured that the employees would get nutritious meals on campus, given the fact they spent 8-9 hours of their day at the workplace. Nevertheless, the studies conducted in industrial population having canteen facilities also revealed catering of unhealthy diets to employees in the workplace. The industrial canteens are still catering food to the employees based in old concepts that the industrial worker has higher energy needs. However, it is now well established that due to mechanization, even in industry, healthy diets based on sound nutrition principles have to be provided. A study conducted by Mehan et al in 2009 to assess the canteen facility in a selected industry of Baroda city reported that the food provided in these canteens was exceptionally rich in calories, provided 5-10 gm sodium per day, used hydrogenated oil (trans fat) for cooking and the amount of fruits and vegetables served at the canteen was almost 1/4$^{th}$ of the recommended amount (400gm/day). Detailed study of the canteen menu also revealed that 'puri' (fried) was routinely included in the menu due to the fact that it is easy to prepare, especially in industrial canteen setup where there are a huge number of people to be served. In addition to being an unhealthy option due to its high fat content, it is a source of trans fat due to the fact that the oil used for frying them is reused over considerable period of time, thus becoming a source of harmful trans fats. Overweight and obesity which stem from unhealthy eating habits and are a major risk factor for development of NCDs has doubled since 1980 (WHO Factsheet on Overweight & Obesity 2013). These issues are exactly contrary to current recommendation of WHO wherein reduction of fat, especially trans fat, reducing salt and providing 400 gm of fruits and vegetables daily are the evidence based approaches for reducing NCD burden.

It is well documented in literature that unhealthy diet (rich in trans fats, sugars and salt) is a major unhealthy behavior which is strongly and causally linked to development of NCDs including hypertension, cardiovascular diseases, diabetes and some types of cancers (WHO Global Burden of Disease Update 2004). The 3 main components of unhealthy diet which influence the development of chronic non communicable diseases are: inadequate consumption of fruits and vegetables, high intake of salt and elevated fat intake (WHO Global Health Observatory on Unhealthy Diet 2013).

The positive link between salt consumption and blood pressure is well established (INTERSALT co-operative group 1988). In view of this, high salt intake can be considered as a major unhealthy behavior. In contrast to the recommended allowance of 5 gm iodized salt/day (or 2 gm sodium/day) given by WHO/FAO consultation (Nishida et al 2004) data from various countries indicates that most populations are consuming much more salt than this, for example India, where a research conducted in south India to determine the mean salt intake among of the population reported the average daily salt intake of the study subjects to be as high as 8.5gm/day (Radhika et al 2007).

Another major component of unhealthy diet is high consumption of saturated fats and trans-fatty acids which is linked to overweight and obesity which in turn are precursors for myriad chronic degenerative diseases such as diabetes, cancer and heart problems. There is enough evidence indicating high-fat diet is the major cause of obesity and insulin resistance (Misra and Khurana 2008). There is convincing evidence that the consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables (WHO/FAO Expert consultation on Diet, Nutrition and Prevention of Chronic Diseases 2003)

With regards to the physical activity facilities at the workplace, though there was provision of on-site facility for playing table-tennis and volleyball, no time allocation was made for indulging in physical activities or any sports on regular basis which can be major reason for physical inactivity among the employees who find it difficult to find time for physical activity beyond working hours Additionally, no free/discounted gym membership was provided to employees in absence of an in-house fitness facility to ensure regular physical activity. Van den Heuvel conducted a study on 1228 workers from 21 Dutch companies in 2005 to investigate the effect of sporting activities on absenteeism of employees. Registered data on illness related absenteeism covering a period of 4 years were collected from the 1,228 workers and a 3 year follow-up showed that sporting activities have a favourable impact on absenteeism with those participating in sports having less sick leaves. A significant higher mean duration of absenteeism

of about 20 days over a period of 4 years was observed among those not practicing sports compared to their sporting colleagues. Physical activity plays a major role in improving the health, morale and productivity of employees on the one hand and lowering turnover of workplace, improved work output and lower medical reimbursement for the industry. It has thus been identified by the WHO as a 'best-buy' intervention for addressing NCD risk factors and should be part of a comprehensive workplace health promotion programme to achieve maximum benefit.

In spite of the fact that some or the other health related information was imparted to the employees on and off via email or lectures sessions (participation in which was voluntary for employees), there were no sustained efforts taken to ensure continuing nutrition health education and reinforcement of health education and awareness messages. Also, no regular monitoring of health parameters was done and though regular sessions on different health issues were held at the industry, participation in the same was voluntary. The health and well being of the employees was thus dependent on the initiative and interest of the employee himself/herself with no focused efforts from the side of the workplace. Studies suggest that smokers, hypertensives, employees with elevated cholesterol levels and those who lead sedentary lifestyles are less likely to join health promotion programmes in the workplace (Heany and Inglish 1995). Even when programs are available, participation rates are not equivalent across workers. Participants are most likely to be salaried, white-collar employees whose general health is better than average (Linnan et al 2001). It can be seen from reported literature that, in fact, the most critical target group who need to be given focused interventions are the ones who do not turn up for the health and nutrition intervention sessions. This highlights the need for mandatory and sustained efforts in the form of regular nutrition health promotion sessions for optimal success.

All in all, the selected industry fared poorly when it came to assessment of the industry with regards to worksite policies and programmes pertaining to nutrition and health but the score of the workplace under study was better for the section on "Health Promotion for Employees". However, as pointed out earlier, several loop holes were identified in the ongoing policies and programs despite the good score. The findings of the present study are corroborated by an earlier study conducted by Mehan et al (2009) using the worksite wellness index. Under this study, 14 industries of urban Baroda city were assessed for adequacy of nutrition and health policies and programmes along with employee wellness facilities present in the industry. Results demonstrated that half of the industries under survey had no clearly documented policies on nutrition and health.

While there are well documented policies and programmes in place for workplace health in countries such as Canada (Health Canada's Workplace Health System) and USA (Health People 2010), India still lags behind in this area with most of our workplace policies focusing on 'employee safety' (Quintilliani et al 2007). There are no national guidelines in place for creation of 'healthy workplaces' which include provision of time and infrastructure for physical activity and availability of nutritious meals to employees at the workplace, thus helping them battle the emerging NCD epidemic. The growing NCD burden in India, particularly among the productive age population warrants an urgent need to frame policies ensuring creation of 'healthy workplaces' i.e. creation of enabling environments where the preventive healthcare of employees is taken care of adequately.

## PHASE 2

## SURVEILLANCE OF NCD RISK FACTORS IN EMPLOYEES

The second phase involved assessment of the risk factor profile of the consenting employees (n=504) using pretested, standardized and adapted WHO STEPS Questionnaire which was modified according to the local conditions (Appendix 3). Before enrolling, each employee was explained the objectives of the study and his/her involvement in the same. A written, informed consent (Appendix 1) was obtained from each employee before collection of baseline data.

Baseline data was collected regarding:

- Background information
  - Education level
  - Designation
  - Housing status – whether living alone/with family
  - Marital status
- Behavioral risk factors
  - Addiction pattern
  - Low Fruit and Vegetable intake (< 400 gm/day)
  - Frequency of eating out
  - Dependence on food service available at workplace for meals
  - Physical activity status
  - Medical history
- Anthropometric measurements
  - Height
  - Weight
  - Waist circumference
  - Hip circumference
- Blood pressure measurement

The baseline assessment was done on 450 male employees and 54 female employees who consented to participate in the study. The selected industry was male dominated, having a marginal female employee population. The background information of the subjects is presented in Table 3.

**BACKGROUND INFORMATION**

As can be seen from the data in Table 4.3, highest percentage of the subjects (45.4%) were in the age range of 25-30 years. About 34% were 30 years old or more while nearly 20% were less than or equal to 25 years of age.

The study population was found to be spread across a wide range of age groups and the mean age of the study population was 29.5 years. Majority (77%) of the population were well-educated with education level of graduation or higher while 17.7% were diploma holders and 5.4% had done certificate courses in the relevant field. About 21% of the population under study were managers, 52% were executives, 16.7% were supervisors, 7.1% were trainees, 3% were contractual workers and a small percentage of them (0.6%) were clerical staff. Majority of the subjects (61.5%) were married and most (78%) of the study subjects lived with their families. Subjects living alone (away from their families) and thus largely dependent on outside foods as part of daily diet were 22%.

*Gender differences*

No sex differences existed in the mean age of the employees of the selected workplace. Most of the population, males (51.8%) as well as females (53.7%) were executive level employees. A much higher proportion of males (22%) were higher up the hierarchical structure i.e. at manager level compared to only 9.3% females. The remaining population, (26.2% males and 37.3% females) were supervisors, trainees, clerical staff or contractual workers. More than 60% of the male as well as female population comprised of graduates with higher percentage of females possessing post graduate degrees compared to their male counterpart (18.5% vs 16.4%). Compared to males, higher percentage of females (21.8% vs 24.1%) enrolled in the study lived alone in the city (away from their family).

| Table 4.3 Background Information of the Subjects in the Selected Workplace (n=504) | | | |
|---|---|---|---|
| | **Total (n=504)** | **Males (n=450)** | **Females (n=54)** |
| **Age range** | **% (n)** | **% (n)** | **% (n)** |
| ≤ 25 years | 20.4 (103) | 19.8 (89) | 25.9 (14) |
| 25-30 years | 45.4 (229) | 46.2 (208) | 38.9 (21) |
| > 30 years | 34.1 (172) | 34 (153) | 35.2 (19) |
| **Designation** | **% (n)** | **% (n)** | **% (n)** |
| Manager | 20.6 (104) | 22.0 (99) | 9.3 (5) |
| Executive | 52.0 (262) | 51.8 (233) | 53.7 (29) |
| Supervisor | 16.7 (84) | 16.9 (76) | 24.8 (8) |
| Trainee | 7.1 (36) | 6.2 (28) | 14.8 (8) |
| On contract | 3.0 (15) | 3.1 (14) | 1.9 (1) |
| Clerical staff | 0.6 (3) | 0.0 (0) | 5.6 (3) |
| **Education** | **% (n)** | **% (n)** | **% (n)** |
| Certificate course | 5.4 (27) | 6.0 (27) | 0.0 (0) |
| Diploma | 17.7 (89) | 17.3 (78) | 20.4 (11) |
| Graduate | 60.3 (304) | 60.21 (271) | 61.1 (33) |
| Post graduate | 16.7 (84) | 16.4 (74) | 18.5 (10) |
| **Marital Status** | **% (n)** | **% (n)** | **% (n)** |
| Unmarried | 38.5 (194) | 37.3 (168) | 48.1 (26) |
| Married | 61.5 (310) | 62.7 (282) | 51.9 (28) |
| **Living Status** | **% (n)** | **% (n)** | **% (n)** |
| Living alone | 22.0 (111) | 21.8 (98) | 24.1 (13) |
| Living with family | 78.0 (393) | 78.2 (352) | 75.9 (41) |
| | **Mean ± S.D.** | **Mean ± S.D.** | **Mean ± S.D.** |
| **Age (years)** | 29.52 ± 6.18 | 29.59 ± 6.30 | 28.90 ± 5.05 |

**BEHAVIORAL PROFILE**

***Addiction Pattern***

Looking at the addiction pattern of the subjects under study (Table 4.4), it can be seen that only 9% of the population (all males) reported that they smoked and nearly 5% of them admitted smoking daily. The average age of initiation for smoking was as low as 22 years and on an average, these smokers had been smoking for more than 7 years. The subjects who smoked on a daily basis were found to smoke around 3 cigarettes/day (on an average). Smoking was the only form of tobacco usage found in the study population. With regards to alcohol consumption, about 17.7% of the population reported that they consumed alcohol but none of them consumed it more than once a month.

*Gender differences*

None of the females reported smoking while 10.2% of the male population said that they currently smoked cigarettes and 5.3% admitted to being daily smokers. Nearly 20% of the male subjects and a small percentage (1.9%) of females reported that they occasionally consumed alcohol (Table 4.4).

| Table 4.4 Addiction Pattern of the Subjects in the Selected Workplace (n=504) | | | |
|---|---|---|---|
| | **Total (n=504)** | **Males (n=450)** | **Females (n=54)** |
| | **% (n)** | **% (n)** | **% (n)** |
| **Current smoking** | 9.1 (46) | 10.2 (46) | 0.0 (0) |
| **Current daily smoking** | 4.8 (24) | 5.3 (24) | 0.0 (0) |
| | **% (n)** | **% (n)** | **% (n)** |
| **Currently consuming alcohol** | 17.7 (89) | 19.6 (88) | 1.9 (1) |
| | **Mean ± S.D.** | | |
| **Past & Current Smokers :** | **n = 61** | **n = 61** | **n = 0** |
| Age of initiation (Years) | 21.84±4.28 | 21.84±4.28 | - |
| **Daily smokers:** | **n = 24** | **n = 24** | **n = 0** |
| Amount of usage (Cigarettes/Day) | 2.83±1.95 | 2.83±1.95 | **-** |
| Age of initiation (Years) | 21.08±3.57 | 21.08±3.57 | - |
| Duration of Smoking (Years) | 7.63±4.26 | 7.63±4.26 | |
| *Figure in parenthesis () indicates numbers* | | | |

***Physical activity pattern***

With regards to physical activity, less than 1% of the total population walked/cycled to their workplace regularly while the rest used some form of mechanical transport e.g. bus, two-wheeler or car to commute to and from the workplace. Some kind of VIE - Vigorous Intensity Exercise (i.e. any kind of aerobic activity while doing which, a person cannot say more than a few words without pausing for a breath) was undertaken by only 5.8% of the subjects (all males). Also, 33.3% of the subjects under study were involved in some kind of MIE (i.e. any kind of aerobic activity while doing which, a person can talk, but not sing).

However, the mean duration of physical activity undertaken by 77% of the individuals was less than the recommended levels (150 min of Moderate Intensity Exercise (MIE)/week OR 60 min of Vigorous Intensity Exercise (VIE)/week OR an equivalent mix of MIE & VIE) used to classify subjects as being 'physically active'. Therefore, prevalence of physically active subjects was only 23%. Data regarding the same has been presented in Table 4.5.

*Gender differences*

Looking at physical activity pattern across the genders, while 0.7% of the male subjects walked/cycled to work, none of the females did so, instead, used mechanized transport. While a small percentage of male subjects (6.4%) performed some form of VIE on a regular basis, none of the females reported it. Even in case of MIE, higher percentage of the males compared to the females (33.8% vs 29.6%) reported that they indulged in some form of MIE regularly. On calculating the physical activity status according to guidelines given by Misra et al in 2009, only 23.8% males and 16.7% females could be classified as being physically active.

| Table 4.5 Physical Activity Pattern of the Subjects in the Selected Workplace (n=504) | | | |
|---|---|---|---|
| | **Total (n=504)** | **Males (n=450)** | **Females (n=54)** |
| | **% (n)** | **% (n)** | **% (n)** |
| **Walk/Cycle to work** | 0.6 (3) | 0.7 (3) | 0.0 (0) |
| **Vigorous Intensity Exercise (VIE)** | 5.8 (29) | 6.4 (29) | 0.0 (0) |
| | **% (n)** | **% (n)** | **% (n)** |
| **Moderate Intensity Exercise (MIE)** | 33.3 (168) | 33.8 (152) | 29.6 (16) |
| **Physical Activity Status[#]** | **% (n)** | **% (n)** | **% (n)** |
| Physically inactive | 77.0 (388) | 76.2 (343) | 83.3 (45) |
| Physically active | 23.0 (116) | 23.8 (107) | 16.7 (9) |
| *[#]CDC 2008 Physical Activity Guidelines for Americans & Consensus for Asians 2009 criteria* | | | |

***Dietary pattern***

Eating out

Data regarding dietary pattern of the subjects is presented in Table 4.6 & 4.7. Nearly half of the study population (48%) ate out at least once a week. About 10% of the population reported that they ate out on a daily basis, 12% said they ate out 2 to 4 times a week and more than half of the subjects (52%) ate out occasionally (less than once a week).

*Gender differences*

While more females than males ate out at least once a week (50% vs 47.8%), a much higher percentage of males ate out daily (10.7% vs 3.7%). Also, eating out 'occasionally' i.e. less than once a week was higher in case of males (52.2% vs 50%).

Meals at office

When asked about the food service facilities in the office premises, regarding breakfast consumption pattern, 19.4% subjects reported that they had breakfast at office and out of them 82% ate breakfast at office daily. Further, when asked about lunch habits, it was revealed that the majority of the subjects (71.2%) had home-made lunch, while nearly 29% depended on outside food (tiffin service/caterer/restaurant) for their daily lunch on working days. Out of those who ate their lunch outside the home regularly, nearly 56.5% of the subjects ate lunch provided by caterers in the office canteen, about 36% of the subjects reportedly availed the tiffin service available at workplace for their lunch and a small percentage of subjects (7.6%) said that they went to nearby restaurant for their lunch. A large proportion of the subjects (62.7%) reportedly had evening snacks at the office with 27.3% of them being daily consumers of the same. Detailed results have been presented in Table 4.6 and 4.7.

*Gender differences*

A much higher percentage of males (20.9%) had breakfast at office compared to females (7.4%). Out of these, 50% female subjects reported having office breakfast daily while 75.5% of the males did so. A much higher proportion of the females ate home-made lunch compared to male subjects (85.2% vs 69.6%). Out of all the female subjects who ate out, majority (87.5%) depended on the tiffin service while the remaining 12.5% ate food provided by caterers. None of the female subjects reportedly went to nearby restaurants for lunch, preferring to have their lunch on company premises. In case of male subjects, most of those who had outside food for lunch used the catering service (59.2%) while 32.8% ate tiffin lunch and a small percentage

(8%) went to nearby restaurant for lunch. Detailed results have been presented in Table 4.6 & 4.7. As in the case of eating out and having breakfast and lunch at office, a higher percentage of males (64.9%) had office snacks than females (44.4%).

Fruit and Vegetable Intake

With respect to fruit and vegetable (excluding tubers) intake, infrequent and inadequate intake of the same was universal in the study population. None of the subjects were found to consume the recommended amount of fruits & vegetables i.e. at least 400 gm/day (WHO 2003, NIN 2007). Less than ¼th of the subjects (24.2%) consumed fruits on a daily basis, with highest percentage of the subjects (46.4%) who eat fruits 2-4 times a week. Nearly 19% reported that they ate fruits once a week and about 11% said that their fruit consumption was less frequent than once a week. Average daily fruit intake was categorized as being in any of the following 3 categories: <100 gm/day, 100-150 gm/day and 150-200 gm/day. The per-day consumption of fruits for most of them (88.9%) was very less (< 100 gm/day) while 8.9% were found to be eating 100-150 gm of fruits/day and less than 3% ate 150-200 gm of fruits per day.

Looking at data pertaining to vegetable intake of the subjects, all subjects (100%) ate vegetables daily as part of lunch and/or dinner. The per day intake of vegetables was 100-150 gm/day for majority of the subjects (69%) while 28% of them consumed less than 100 gm of vegetables/day and only 3% subjects were found to have 150-200 gm/day vegetable intake.

*Gender differences*

A higher percentage of females reported daily consumption of fruits (42.6% vs 22%) while 100% of the male as well as female subjects ate vegetables on a daily basis, as part of daily meals. Higher percentage of males (2.2%) consumed 150-200 gm fruits/day as compared to females (1.9%). Further, 8.4% males and 13% of the females ate 100-150 gm fruits/day while a majority of them (89.3% males & 85.2% females) consumed less than 100 gm of fruit per day. In case of average daily intake of vegetables, more females than males (3.7% vs 2.9%) ate 150-200 gm of vegetables per day. However, for the majority subjects, vegetable intake was much lower than the recommendation and consequently none of them (males or females) met the recommended dietary allowance of fruit & vegetable (> 400 gm/day).

| Table 4.6 Dietary Pattern of the Subjects in the Selected Workplace (n=504) | | | |
|---|---|---|---|
| | **Total % (n)** | **Males % (n)** | **Females % (n)** |
| **Frequency of eating out** | **(n = 504)** | **(n = 450)** | **(n = 54)** |
| **At least once a week** | **48 (242)** | **47.8 (215)** | **50 (27)** |
| Daily | 9.9 (50) | 10.7 (48) | 3.7 (2) |
| 2-4 times a week | 11.9 (60) | 12 (54) | 11.1 (6) |
| Weekly | 26.2 (132) | 25.1 (113) | 35.2 (19) |
| Occasionally (less than once a week) | 51.9 (262) | 52.2 (235) | 50 (27) |
| | **(n = 504)** | **(n = 450)** | **(n = 54)** |
| **Breakfast at office** | 19.4(98) | 20.9(94) | 7.4(4) |
| **Frequency of breakfast at office** | **(n=98)** | **(n=94)** | **(n=4 )** |
| Daily | 82.0 (73) | 75.5 (71) | 50.0(2) |
| 2-4 times a week | 16.3 (16) | 15.9 (15) | 25 (1) |
| Weekly | 4.5 (4) | 4.7(4) | 0.0(0) |
| Occasionally | 5.1 (5) | 4.7(4) | 25 (1) |
| **Place of lunch** | **(n=504)** | **(n=450)** | **(n=54)** |
| Home made | 71.2 (359) | 69.6(313) | 85.2(46) |
| Outside home | 28.8 (145) | 30.4 (137) | 14.8 (8) |
| | **(n=145)** | **(n=137)** | **(n=8)** |
| *Tiffin service* | 35.9 (52) | 32.8 (45) | 87.5 (7) |
| *Caterer* | 56.5 (82) | 59.2 (81) | 12.5 (1) |
| *Restaurant* | 7.6 (11) | 8 (11) | 0.0 (0) |
| **Frequency of Tiffin lunch** | **(n=52)** | **(n=45)** | **(n=7)** |
| Daily | 98.1 (51) | 100(45) | 85.7(6) |
| 3-4/week | 1.9(1) | 0.0(0) | 14.3(1) |
| **Frequency of Canteen lunch** | **(n=82)** | **(n=81)** | **(n=1)** |
| Daily | 84.1(69) | 83.9(68) | 100(1) |
| 2-4/week | 8.5 (7) | 8.6 (7) | 0.0 (0) |
| Weekly | 4.9 (4) | 4.9 (4) | 0.0 (0) |
| Occasionally (less than once a week) | 2.4 (2) | 2.5 (2) | 0.0 (0) |
| **Frequency of lunch at Restaurant** | **(n=11)** | **(n=11)** | **(n=0)** |
| Daily | 81.9 (9) | 81.9 (9) | 0.0 (0) |
| Rarely | 18.2 (2) | 18.2 (2) | 0.0 (0) |

| Table 4.7 Dietary Pattern of the Subjects in the Selected Workplace (n=504) | | | |
|---|---|---|---|
| | **Total % (n)** | **Males % (n)** | **Females % (n)** |
| | **n=504 n (%)** | **n=450 n (%)** | **n=54 n (%)** |
| **Snacks at office** | 62.7 (316) | 64.9 (292) | 44.4 (24) |
| **Frequency of Snacks at Office** | **n=316 n (%)** | **n=292 n (%)** | **n=24 n (%)** |
| Daily | 27.3 (81) | 28.9 (79) | 8.3 (2) |
| 2-4 times a week | 45.2 (143) | 44.8 (131) | 50 (12) |
| Weekly | 14.5 (43) | 14.7 (40) | 12.5 (3) |
| Occasionally (less than once a week) | 15.5 (49) | 14.4 (42) | 29.2 (7) |
| **Frequency of fruit intake** | **% (n)** | **% (n)** | **% (n)** |
| Daily | 24.2 (122) | 22.0 (99) | 42.6 (23) |
| 2-4 times a week | 46.6 (235) | 47.5 (214) | 38.9 (21) |
| Weekly | 18.5 (93) | 19.3 (87) | 11.1 (6) |
| Occasionally (less than once a week) | 10.7 (54) | 11.1 (50) | 7.4 (4) |
| **Per day Fruit Intake** | **% (n)** | **% (n)** | **% (n)** |
| <100 gm | 88.9 (448) | 89.3 (402) | 85.2 (46) |
| 100-150 gm | 8.9 (45) | 8.4 (38) | 13.0 (7) |
| 150-200 gm | 2.2 (11) | 2.2 (10) | 1.9 (1) |
| **Frequency of Veg. Intake** | **% (n)** | **% (n)** | **% (n)** |
| Daily | 100 (504) | 100 (450) | 100 (54) |
| **Per day Veg. Intake** | **% (n)** | **% (n)** | **% (n)** |
| <100 gm | 28.0 (141) | 27.8 (125) | 29.6 (16) |
| 100-150 gm | 69.0 (348) | 69.3 (312) | 66.7 (36) |
| 150-200 gm | 3.0 (15) | 2.9 (13) | 3.7 (2) |
| **Fruit + Veg. Intake** | **n (%)** | **n (%)** | **n (%)** |
| < 400 gm/day | 100 (504) | 100 (450) | 100 (54) |

## ANTHROPOMETRIC PROFILE, BLOOD PRESSURE MEASUREMENTS & MEDICAL HISTORY OF SUBEJCTS

### *Anthropometric Profile*

Anthropometric data (Table 4.8) revealed an unhealthy profile of the study population wherein less than half (40.9%) could be classified as well nourished while malnutrition was 59.9% with majority of the subjects being overweight and obese (53.4%). The mean average BMI (23.4 $kg/m^2$) itself was in the 'overweight' range. More than $1/3^{rd}$ of the total population (35.5%) had abdominal obesity characterized by high waist circumference i.e. WC (Males: WC > 90 cm, Females: WC > 80 cm). With regards to waist-to-hip ratio (WHR), 47.8% of the subjects had higher than normal WHR (Males <0.9 & Females <0.85).

*Gender differences*

With respect to BMI, overweight and obesity (i.e. BMI $\geq$ 23 $kg/m^2$) was more prevalent among the male (54.7%) subjects than females (42.6%). Underweight was also present among the study subjects with more females than males (7.4% and 5.6% respectively) being in underweight category. Looking at the mean BMI of the subjects, it is clear that in case of males, the mean value itself (23.5 $\pm$ 3.3 $kg/m^2$) lies in the 'overweight category' while in case of females, it is just under the 'normal' cut off (22.9 $\pm$ 3.8 $kg/m^2$). More males than females (37.3% v/s 20.4%) had high waist circumference (Males: WC > 90 cm, Females: WC > 80 cm) and were classified as being 'abdominally obese'. Similarly, elevated WHR (Table 4.8) was more prevalent among male (50.7%) subjects than female (24.1%).

| Table 4.8 Anthropometric Profile of the Subjects in the Selected Workplace (n= 504) | | | |
|---|---|---|---|
| | **Total n=504** | **Males n = 450** | **Females n = 54** |
| **BMI classification*** | **% (n)** | **% (n)** | **% (n)** |
| Underweight | 5.8 (29) | 5.6 (25) | 7.4 (4) |
| Normal Weight | 40.9 (206) | 39.8 (179) | 50.0 (27) |
| Overweight | 23.4 (118) | 24.0 (108) | 18.5 (10) |
| Obese | 30.0 (151) | 30.7 (138) | 24.1 (13) |
| Malnutrition (underweight, overweight & obesity) | 59.1 (298) | 60.2 (271) | 50 (27) |
| **Abdominal Obesity*** | **% (n)** | **% (n)** | **% (n)** |
| Absent | 64.5 (325) | 62.7 (282) | 79.6 (43) |
| Present | 35.5 (179) | 37.3 (168) | 20.4 (11) |
| **Waist-Hip Ratio**** | **% (n)** | **% (n)** | **% (n)** |
| Normal | 52.2 (263) | 49.3 (222) | 75.9 (41) |
| High | 47.8 (241) | 50.7 (228) | 24.1 (13) |
| | **Mean ± S.D.** | **Mean ± S.D.** | **Mean ± S.D.** |
| **Waist to Hip Ratio (WHR)***** | 0.9 ± .05 | 00.9 ± 0.1 | 0.8 ± 0.1 |
| **BMI (kg/m²)*** | 23.4 ± 3.4 | 23.5 ± 3.3 | 22.9 ± 3.8 |
| **Waist Circumference*** | 85.9 ± 9.2 | 87.23 ± 8.5 | 74.8 ± 7.9 |
| ** Abdominal Obesity characterized by WC > 90 cm in males and > 80 cm in females (Misra et al 2009)* | | | |
| ****Report of WHO Expert Consultation 2008* | | | |

***Current Blood Pressure Profile& Medical History of Hypertension***

Looking at the data regarding medical history and current B.P. profile of the subjects (Table 4.9), it can be seen that more than 80% of them had their B.P. measured in the past sometime. Out of these, majority of the subjects (65.4%) had their last B.P. measurement taken during the past year, while for 34.5% it was more than a year before the date of survey. Most of them had their B.P. measured during medical examination conducted in the industry and majority were unaware of their B.P. readings. No records were maintained in the industry regarding the same. Out of those who had their B.P. measured in the past, 2.7% reported that they had a history of hypertension. When these numbers were compared to percent prevalence of high blood pressure found in the present study, it was revealed that only 1.2% of the pre hypertensive subjects (identified by researcher) and 2.8% of those detected with hypertension (identified by researcher) reported past history of hypertension. When those subjects who reported history of hypertension were asked if they were taking any measures to manage the same, it was found that only 27% took medication for the same, 9.1% said they had reduced their salt intake and 54.5% had started exercising after being told they had high B.P. Nearly half of the study population (49.4%) was pre hypertensive and 23.6% were hypertensive as per JNC VII classification for blood pressure. The average SBP and DBP values of total population (SBP 128.5$\pm$13.5 mm Hg & DBP 80.2$\pm$8.9mm Hg) were above the optimal B.P. readings.

*Gender differences*

When asked about whether they had ever gotten their B.P. measured, higher percent of female subjects replied in the affirmative than male subjects (87% vs 80.9%). Also, a higher percentage of females (87.2%) had their last B.P. measured more recently (during past year) compared to males (62.6%). Out of these, only 3% of males reported having a hypertension history, while none of females reported the same. Prevalence of isolated systolic hypertension was more frequently observed among females than males (27.8% vs 20%). Also, the mean SBP and DBP values of male subjects were much higher than that of females. Overall prevalence of elevated B.P. prehypertension+hypertension) was much higher (76.4%) for male subjects enrolled in the study in comparison to their female counterparts (44.4%).

***Medical History of Diabetes***

In the case of Fasting Blood Sugar (FBS), 56% subjects reported having had their FBS measured (Table 4.9). About 60% of these measurements were done during past year and rest of the 40% subjects had their FBS tests done more than a year before the date of this survey. Only 1.1% reported that they were aware of their diabetic state and were under medical care for the same.

*Gender differences*

There was very little difference in the percentage of male and female subjects who reported having had their FBS previously measured. However, while more than 80% of the female subjects said that their last FBS measurement was during the past year, the percentage was 57.3% in case of males while the remaining 43% of male subjects had their last FBS test more than a year back.

| Table 4.9 Medical History and Current Blood Pressure Profile of the Subjects in the Selected Workplace (n= 504) | | | |
|---|---|---|---|
| | **Total n=504 % (n)** | **Males n = 450 % (n)** | **Females n = 54 % (n)** |
| **Medical History of Blood Pressure** | | | |
| **Blood Pressure - Ever measured** | 81.5 (411) | 80.9 (364) | 87.0 (47) |
| | **n = 411 % (n)** | **n=364 % (n)** | **n=47 % (n)** |
| **History of Hypertension** | 2.7 (11) | 3.02 (11) | 0.0 (0) |
| **If hypertensive, are you:** | **n=11** | **n=11** | **n=0** |
| Taking medication for managing B.P. | 27 (3) | 27 (3) | 0.0 (0) |
| Reduced salt intake | 9.1 (1) | 9.1 (1) | 0.0 (0) |
| Started exercising | 54.5 (6) | 54.5 (6) | 0.0 (0) |
| **Time of last B.P. measurement** | **n = 411 % (n)** | **n=364 % (n)** | **n=47 % (n)** |
| During past year | 65.4 (269) | 62.6 (228) | 87.2 (41) |
| More than a year back | 34.5 (142) | 37.4 (136) | 12.8 (6) |
| **Current Blood Pressure Profile of Subjects** | | | |
| | **n = 504** | **n = 450** | **n=54** |
| **Hypertension Status#** | **% (n)** | **% (n)** | **% (n)** |
| Normal | 27.0 (136) | 23.6 (106) | 55.6 (30) |
| Pre hypertensive | 49.4 (249) | 50.4 (227) | 40.7 (22) |
| Hypertensive | 23.6 (119) | 26.0 (117) | 3.7 (2) |
| **History of Hypertension among identified prehypertensive & hypertensives** | | | |
| | **(n=249)** | **(n=227)** | **(n=22)** |
| Prehypertensive | 1.2 (3) | 1.3 (3) | 0.0 (0) |
| | **(n=119)** | **(n=117)** | **(n=2)** |
| Hypertensive | 2.8 (7) | 3.1 (7) | 0.0 (0) |
| **Medical History of Diabetes** | **n=504 % (n)** | **n=450 % (n)** | **n=54 % (n)** |
| **Fasting Blood Sugar – Ever measured** | 56.3 (284) | 56.2 (253) | 57.4 (31) |
| | **n=284 % (n)** | **n=253 % (n)** | **n=31 % (n)** |
| **History of Diabetes** | 1.1 (3) | 1.2 (3) | 0 (0.0) |
| **Time of last FBS measurement** | **n=284 % (n)** | **n=253 % (n)** | **n=31 % (n)** |
| During past year | 59.9 (170) | 57.3 (145) | 80.6 (25) |
| More than a year back | 40.1 (114) | 42.7 (108) | 19.3 (6) |
| | **Mean ± S.D. n=504** | **Mean ± S.D. n=450** | **Mean ± S.D. n=54** |
| SBP (mm Hg) | 128.5 ± 13.5 | 129.9±13.2 | 117.5±10.8 |
| DBP (mm Hg) | 80.2±8.9 | 81.1±8.6 | 73.1±7.7 |
| *# JNC VII classification for Blood Pressure* | | | |

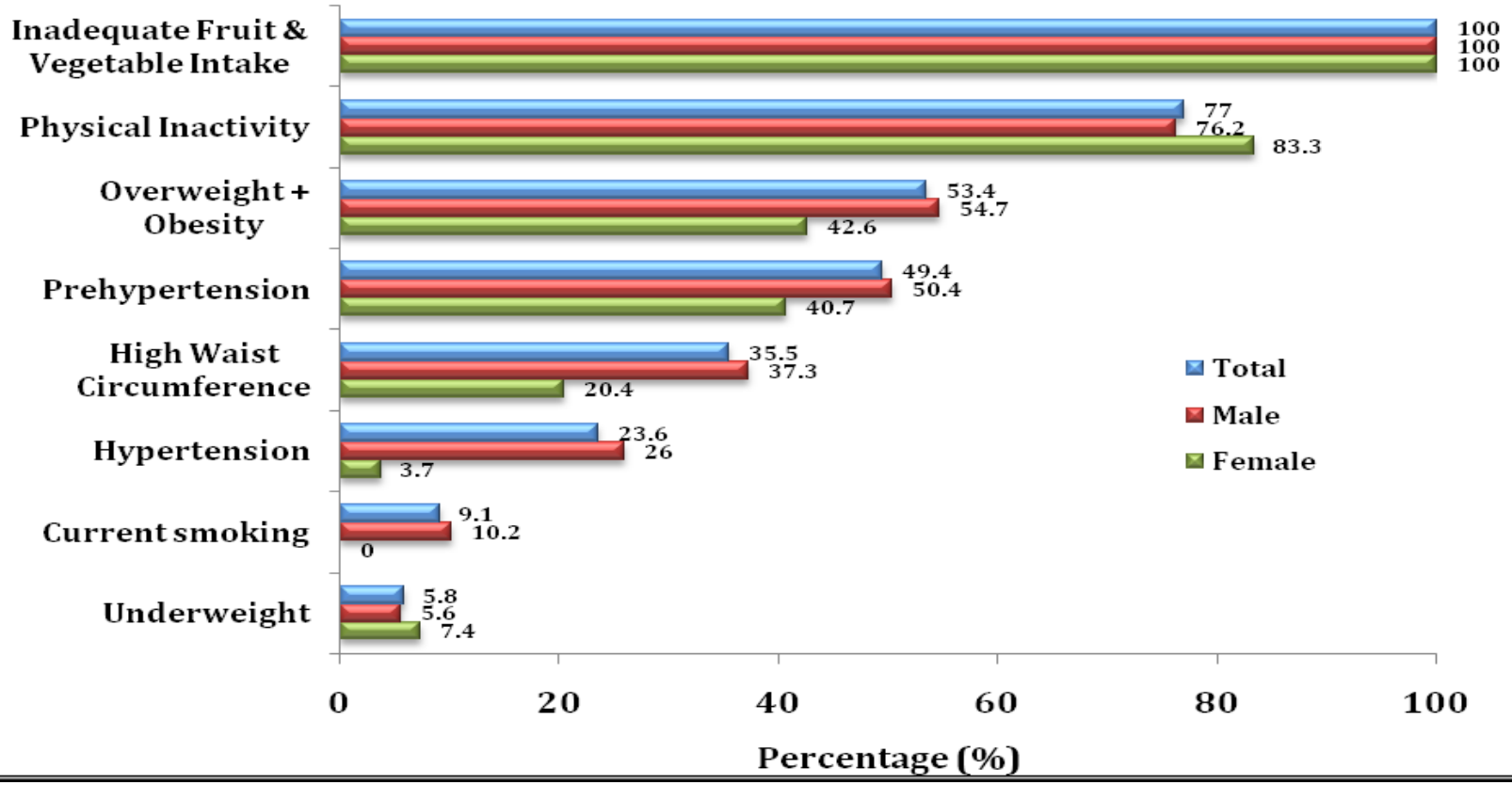
***Risk Factor Profile***

The detailed risk factor profile of the study population is presented in Figure 4.1. Inadequate fruit and vegetable intake was found to be universal (100%) and was the leading risk factor among the study population, followed by physical inactivity (77%) and elevated BMI (53.4%). Prehypertension was found to be the fourth highest risk factor in the study population affecting 49.4% of the subjects. This was followed by high WC at 35.5% and hypertension (23.6%). Around 9% of the subjects reported that they currently smoked. Underweight was present in 5.8% of the subjects (BMI < 18.5 $kg/m^2$).

*Gender differences*

Looking at the risk factor distribution across genders (Figure 4.1), it can be seen that inadequate fruit & vegetable intake was universal in both men and women and thus, the leading risk factor. This was followed by physical inactivity which was much more rampant among female subjects (83.3%) than males (76.2%) but was nonetheless the $2^{nd}$ leading risk factor among both the sexes. The third highest percent prevalence was seen for elevated BMI, the prevalence of which was higher among males than females (54.7% v/s 42.6%). This was followed by elevated B.P., high WC, smoking and underweight.

**Figure 4.1 Percent Prevalence of Unhealthy Behaviors and Negative Health Status among the Subjects in the Selected Workplace (n=504)**



***Interrelationship between different parameters***

*Relationship of Gender with Age, BMI as well as SBP & DBP values*

On analyzing age, BMI and B.P. values based on gender, it was found that the mean age (males: 29.59±6.3, females: 28.90±5.05) and BMI (males: 23.51±3.32, females: 22.87±3.83) of males and females were comparable i.e. the difference between them was not statistically significant. However, the SBP and DBP values of males (SBP 129.87±13.17 and DBP 81.06±8.65) were significantly higher than those of their female counterparts (SBP 117.52±13.17 and DBP 73.06±7.73 respectively) at $p<0.001$. It can also be seen from the data in Table 4.10 that while the mean B.P. values of females were within the normal range, both SBP & DBP values of males were in the 'pre hypertension' range.

*Relationship of Gender with BMI Status, Abdominal Obesity, WHR, Hypertension Status and Physical Activity Status of Subjects*

Gender differences were also explored in relation to various anthropometric parameters, presence of hypertension as well as physical activity status (Table 4.11). Compared to females, significantly higher number of males were abdominally obese ($p<0.05$), had high WHR ($p<0.001$) and high B.P. ($p<0.001$).

*Relationship of Age with Anthropometric Profile and Hypertension Status of Subjects*

Differences in the anthropometric profile and hypertension status among the age groups (≤ 25 years, > 25 years) was explored using chi-square test. The findings of the same have been presented in Table 4.12. Older subjects (> 25 years of age) had statistically higher prevalence of abdominal obesity ($p<0.001$), high WHR ($p<0.001$) and BMI ($p<0.01$) compared to their younger counterparts (≤ 25 years of age).

| Table 4.10 Body Mass Index (BMI) and Blood Pressure profile Based on Gender (Mean ± S.D.) | | | | |
|---|---|---|---|---|
| **Parameter** | **Males (Mean ± S.D.)** | **Females (Mean ± S.D.)** | **t value** | **p value** |
| | **n=450** | **n=54** | | |
| Age (years) | 29.59±6.3 | 28.90±5.05 | 0.776 | 0.438$^{NS}$ |
| BMI (kg/m$^2$) | 23.51±3.32 | 22.87±3.83 | 1.313 | 1.90 $^{NS}$ |
| SBP (mm Hg) | 129.87±13.17 | 117.52±13.17 | 6.628 | 8.78 E-11*** |
| DBP (mm Hg) | 81.06±8.65 | 73.06±7.73 | 6.492 | 2.038 E-11*** |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS= Not Significant* | | | | |

| Table 4.11 Anthropometric Profile, Hypertension Status & Physical Activity Status of Subjects in Relation to Gender (n=504) | | | | |
|---|---|---|---|---|
| **Gender** | **Overweight + Obesity (n=269) % (n)** | **Normal weight (n=206) % (n)** | **Chi-square $X^2$** | **p value** |
| **Male** | 91.4 (246) | 86.9 (179) | 2.57 | 0.12 NS |
| **Female** | 8.6 (23) | 13.1 (27) | | |
| | **Abdominally obese (n=179) % (n)** | **Normal (n=325) % (n)** | **Chi-square $X^2$** | **p value** |
| **Male** | 93.8 (168) | 86.8 (282) | 6.06 | 0.01* |
| **Female** | 6.1 (11) | 13.2 (43) | | |
| | **High WHR (n=241) % (n)** | **Normal (n=263) % (n)** | **Chi-square $X^2$** | **p value** |
| **Male** | 94.6 (228) | 84.4 (222) | 13.66 | 0.0002*** |
| **Female** | 5.4 (13) | 15.6 (41) | | |
| | **High Blood Pressure (n=368) % (n)** | **Normal (n=136) % (n)** | **Chi-square $X^2$** | **p value** |
| **Male** | 93.5 (344) | 77.9 (106) | 25.06 | 0.0000006*** |
| **Female** | 6.5 (24) | 22.1 (30) | | |
| | **Physically inactive (n=388) % (n)** | **Physically active (n=116) % (n)** | **Chi-square $X^2$** | **p value** |
| **Male** | 88.4 (343) | 92.2 (107) | 1.01 | 0.49 NS |
| **Female** | 11.6 (45) | 7.8 (9) | | |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant* | | | | |

| Table 4.12 Differences in Anthropometric Profile, Hypertension Status & Physical Activity Status of Subjects in Relation to Age (n=504) | | | | |
|---|---|---|---|---|
| **Age group** | **Overweight + Obesity (n=269) % (n)** | **Normal weight (n=206) % (n)** | **Chi-square $X^2$** | **p value** |
| **> 25 years** | 85.9 (231) | 74.3 (153) | 10.14 | 0.001** |
| **≤ 25 years** | 14.1 (38) | 25.7 (53) | | |
| | **Abdominally obese (n=179) % (n)** | **Normal (n=325) % (n)** | **Chi-square $X^2$** | **p value** |
| **> 25 years** | 88.8 (159) | 74.5 (242) | 14.65 | 0.0001*** |
| **≤ 25 years** | 11.2 (20) | 25.5 (83) | | |
| | **High WHR (n=241) % (n)** | **Normal (n=263) % (n)** | **Chi-square $X^2$** | **p value** |
| **> 25 years** | 87.9 (212) | 71.9 (189) | 20.06 | 0.000008*** |
| **≤ 25 years** | 12 (29) | 28.1 (74) | | |
| | **High Blood Pressure (n=368) % (n)** | **Normal (n=136) % (n)** | **Chi-square $X^2$** | **p value** |
| **> 25 years** | 79.3 (292) | 80.1 (109) | 0.04 | 0.843 NS |
| **≤ 25 years** | 20.6 (76) | 19.9 (27) | | |
| | **Physically inactive (n=388) % (n)** | **Physically active (n=116) % (n)** | **Chi-square $X^2$** | **p value** |
| **> 25 years** | 80.9 (314) | 75 (87) | 1.93 | 0.165NS |
| **≤ 25 years** | 19.1 (74) | 25 (29) | | |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant* | | | | |

*Relationship of Designation with Age, BMI and Blood Pressure Profile of Employees*

Employees were divided into 3 categories according to their designation in the industry; 1) managerial level employees 2) executives 3) Supervisors, Trainees, Contract employees & Clerical Staff. The differences in mean age, BMI and blood pressure values of employees belonging to the above mentioned employment categories were compared using ANOVA (Analysis of Variance). The analysis showed that while both age ($p<0.001$) and BMI ($p<0.01$) of managers was significantly higher than that of executives and the third category, there was no statistical difference in their mean SBP and DBP values (Table 4.13).

*Relationship of Addiction pattern with Anthropometric Indices as well as SBP & DBP Values of Subjects*

When data regarding addiction pattern was studied in detail, it was found that alcohol consumers had significantly higher Waist Circumference ($p<0.001$) and BMI ($p<0.01$) than those who did not consume alcohol (Table 4.14). Though the mean BMI and Waist circumference of smokers was higher than non-smokers, there was no significant difference in the same. There was however no significant relationship between addiction pattern (consumption of alcohol & tobacco usage) and B.P. values of the subjects.

*Relationship of BMI status with Abdominal Obesity, high WHR and Hypertension Status of Subjects*

BMI status was studied in relation to waist circumference, waist-to-hip ratio and hypertension in subjects (Table 4.15) and it was found that high BMI was very significantly related to abdominal obesity, high WHR ($p<0.001$) & hypertension ($p<0.01$).

*Relationship of Abdominal obesity with B.P.*

Abdominal obesity (WC > 90 cm in males and WC > 80 cm in females) was significantly associated with hypertension ($p<0.05$). The data is presented in Table 4.16.

| Table 4.13 Difference in Mean Age, BMI and B.P. of Employees Based on Designation in the Selected Workplace (n=504) | | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Designation level (Mean±S.D.)** | | | **f value** | **p value** |
| | **Manager (n=104)** | **Executive (n=262)** | **S,T,Co,Cl (n=138)** | | |
| Age | 34.4±6.1 | 27.7±3.9 | 29.2±7.6 | 53.09 | <0.001*** |
| BMI | 24.2±2.8 | 23.5±3.9 | 22.7±3.6 | 6.05 | 0.003** |
| SBP | 130.2±14 | 128.1±13.7 | 128.2±12.6 | 0.964 | 0.382 |
| DBP | 80±9.2 | 80±9.1 | 80±8.3 | 0.367 | 0.693 |
| *S, T ,Co ,Cl – Supervisors, Trainees, Contract workers, Clerical staff* | | | | | |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant* | | | | | |

**Table 4.14 Anthropometric & Blood Pressure Profile of the Subjects in Relation to Smoking and Alcohol Consumption (Mean ± S.D.)**

| Parameter | Non consumers of alcohol (Mean ± S.D.) (n=415) | Consumers of alcohol (Mean ± S.D.) (n=89) | t value | p value |
|---|---|---|---|---|
| Waist circumference (cm) | 85.27±9.11 | 89.02±9.00 | -3.518 | <0.001*** |
| BMI (kg/m$^2$) | 23.25±3.35 | 24.30±11.38 | -2.668 | 0.008** |
| SBP (mm Hg) | 128.15±13.60 | 130.41±12.77 | -1.442 | 0.150 NS |
| DBP (mm Hg) | 79.99±8.89 | 81.17±8.71 | -1.134 | 0.258 NS |
| | **Non smoker (Mean ± S.D.) (n=458)** | **Smoker (Mean ± S.D.) (n=46)** | **t value** | **p value** |
| Waist circumference (cm) | 85.66±9.14 | 88.59±9.90 | -2.052 | 0.041 NS |
| BMI (kg/m$^2$) | 23.35±3.33 | 24.28±3.78 | -1.789 | 0.074 NS |
| SBP (mm Hg) | 128.42±13.55 | 129.78±12.8 | -0.651 | 0.515 NS |
| DBP (mm Hg) | 81.18±8.54 | 79.91±9.33 | 0.228 | 0.820 NS |

*Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant*

| Table 4.15 Anthropometric & Blood Pressure Profile of the Subjects in Relation to their BMI Status (n=504) | | | | |
|---|---|---|---|---|
| | **Abdominally obese[#] (n=179) % (n)** | **Normal (n=296) % (n)** | **Chi-square $X^2$** | **p value** |
| **Overweight+Obese** | 95.5 (171) | 33.1 (98) | 176.97 | <0.001*** |
| **Normal** | 4.5 (8) | 66.9 (198) | | |
| | **High WHR (n=240) % (n)** | **Normal (n=235) % (n)** | **Chi-square $X^2$** | **p value** |
| **Overweight+Obese** | 74.2 (178) | 38.7 (91) | 60.73 | <0.001*** |
| **Normal** | 25.8 (62) | 61.3 (144) | | |
| | **High Blood Pressure (n=348) % (n)** | **Normal (n=127) % (n)** | **Chi-square $X^2$** | **p value** |
| **Overweight+Obese** | 60.9 (212) | 44.9 (57) | 9.74 | 0.001** |
| **Normal** | 39.1 (136) | 55.1 (70) | | |

*[#]Abdominal obesity defined by WC > 90 cm in males and WC > 80 cm in females*

*Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant*

| Table 4.16 Hypertension Status of Subjects in Relation to Abdominal Obesity (n=504) | | | | |
|---|---|---|---|---|
| | **High Blood Pressure (n=368) % (n)** | **Normal (n=136) % (n)** | **Chi-square $X^2$** | **p value** |
| **Abdominal obesity** | 38.3 (141) | 27.9 (38) | 4.67 | 0.03* |
| **Normal** | 61.7 (227) | 72.1 (98) | | |

*[#]Abdominal obesity defined by WC > 90 cm in males and WC > 80 cm in females*

*Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant*

*Relationship of Physical Activity Status with Anthropometric parameters & B.P. Profile of Subjects*

No significant association could be found between physical activity status and anthropometric parameters such as overweight & obesity and abdominal obesity as well as hypertension status and physical activity status of subjects (Table 4.17). However, high WHR was found to be significantly associated ($p<0.05$) with physical inactivity among the study population. Subjects who had high WHR have 1.5 times more risk of being physically inactive compared to those having normal WHR (Odds Ratio 1.538, 95% CI/1.008-2.344). The relationship between history of hypertension and physical activity status was also explored using chi-square test. It was found that the chances of those having history of hypertension to be physically inactive were 1.4 times higher than those who do not have history of hypertension (Odds Ratio 1.402, 95% CI/0.298-6.600).

| Table 4.17 Anthropometric Profile, Hypertension Status, Medical History of Hypertension & Designation level of Subjects in Relation to their Physical Activity Status (n=504) | | | | | |
|---|---|---|---|---|---|
| **P.A. status** | **Overweight+Obesity (n=269) % (n)** | **Normal weight (n=206) % (n)** | | **Chi-square $X^2$** | **p value** |
| **Physically inactive** | 75.8 (204) | 78.6 (162) | | 0.52 | 0.47 NS |
| **Physically active** | 24.2 (65) | 21.3 (44) | | | |
| | **Abdominal obesity (n=179) % (n)** | **Normal (n=325) % (n)** | | **Chi-square $X^2$** | **p value** |
| **Physically inactive** | 77.6 (139) | 76.6 (249) | | 0.07 | 0.79 NS |
| **Physically active** | 22.3 (40) | 23.4 (76) | | | |
| | **High WHR (n=241) % (n)** | **Normal (n=263) % (n)** | | **Chi-square $X^2$** | **p value** |
| **Physically inactive** | 80.9 (195) | 73.4 (193) | | 4.02 | 0.04* |
| **Physically active** | 19.1 (46) | 26.6 (70) | | | |
| | **High Blood Pressure (n=368) % (n)** | **Normal (n=136) % (n)** | | **Chi-square $X^2$** | **p value** |
| **Physically inactive** | 76.9 (283) | 77.2 (105) | | 0.01 | 0.94 NS |
| **Physically active** | 23.1 (85) | 22.8 (31) | | | |
| | **History of hypertension (n=11) % (n)** | **No history of hypertension (n=400) % (n)** | | **Chi-square $X^2$** | **p value** |
| **Physically inactive** | 81.8 (9) | 76.2 (305) | | 0.18 | 1.00 NS |
| **Physically active** | 18.2 (2) | 23.8 (95) | | | |
| | **Designation** | | | **Chi-square $X^2$** | **p value** |
| | **Manager (n=104)** | **Executive (n=262)** | **S, T, Co, Cl (n=138)** | | |
| **Physically inactive** | 79.8 (83) | 74 (194) | 80.4 (111) | 2.67 | 0.263NS |
| **Physically active** | 20.2 (21) | 26 (68) | 19.6 (27) | | |

*#Abdominal obesity defined by WC > 90 cm in males and WC > 80 cm in females*
*Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant*

**SUMMARY**

- Mean age of study population was 29.5 years with majority of the subjects (45.4%) belonging to the age group of 25-30 years.
- Majority of the study belonged to 'executive' level category (52%) followed by managers (20.6%) and the others; supervisors, trainees, contractual workers & clerical staff (27.4%).
- Managers were significantly older than executives and the other employees; supervisors, trainees, contractual workers & clerical staff ($p<0.001$).
- Most of the subjects (77%) were well educated (graduation or higher).
- About $1/5^{th}$ of the total population (22%) lived alone in the city (away from family), having migrated here for job opportunity.
- Less than $1/4^{th}$ of the study population (23%) were physically active.
- Nearly 10% of the subjects ate out on a daily basis.
- Inadequate intake of fruit and vegetables (<400 gm/day) was universal and was the leading risk factor among the employee population under study, followed by physical inactivity and overweight & obesity.
- Nearly 9% of the subjects smoked cigarettes but only 4.8% smoked daily.
- Alcohol consumption was reported by 17.7% of the subjects (all males).
- Alcohol consumers had significantly higher Waist Circumference ($p<0.001$) and BMI ($p<0.01$) than those who did not consume alcohol.
- Prevalence of overweight and obesity was 53.4% with the mean BMI of the subjects itself being in the 'overweight' range $23.4 \pm 3.4$ kg/m$^2$.
- Percent prevalence of abdominal obesity was 35.5%.
- Nearly half of the population (47.8%) had high Waist-to-Hip Ratio.
- High BMI (overweight and obesity) was very significantly related to abdominal obesity, high WHR ($p<0.001$) & hypertension ($p<0.01$).
- Compared to females, significantly higher number of males were abdominally obese ($p<0.05$), had high WHR ($p<0.001$) and high B.P. ($p<0.001$).
- Older subjects (> 25 years of age) had statistically higher prevalence of abdominal obesity ($p<0.001$), high WHR ($p<0.001$) and BMI ($p<0.01$) compared to their younger counterparts ($\leq$ 25 years of age).
- Abdominal obesity (WC > 90 cm in males and WC > 80 cm in females) was significantly associated with hypertension ($p<0.05$).
- While 73% subjects were found to have high blood pressure during the study, only

4% of them were aware of their condition.

- Male subjects had significantly higher mean values for SBP as well as DBP ($p<0.001$) compared to female subjects.
- Only 56.3% subjects ever had their fasting blood sugar measured and 1.1% of those who did, reported that they suffered from diabetes.

**DISCUSSION**

Non-communicable disease (NCD) epidemics are emerging or accelerating in most developing countries at an alarming rate. Cardiovascular diseases (CVD), cancers, diabetes and chronic obstructive pulmonary diseases are becoming major contributors to the burden of disease and disability. Of 57 million global deaths in 2008, 36 million, or 63%, were due to non communicable diseases (WHO Factsheet on Chronic Diseases 2013). The four main NCDs are cardiovascular diseases, cancers, diabetes and chronic lung diseases. The burden of these diseases is rising disproportionately among lower income countries and populations. In 2008, nearly 80% of non communicable disease deaths (29 million) occurred in low- and middle-income countries with about 29% of deaths occurring before the age of 60 in these countries (WHO Global Health Observatory on Premature NCD Deaths 2013).

These statistics stress the importance of addressing the health needs of productive age population, especially with regards to preventive health care. In view of this, WHO STEPs methodology recommends that the following modifiable risk factors should be used to assess an individual's risk of developing NCDs in the future: low fruit & vegetable, overweight& obesity, central obesity, high blood pressure, physical inactivity, regular (daily) smoking and alcohol consumption. Looking at the global scenario, worldwide, obesity has doubled since 1980 with 35% adults (20 years and above) being overweight and 11% being obese while around 40% of adults aged 25 and over had raised blood pressure in 2008 (WHO Factsheet on Chronic Diseases 2013). India too illustrates the phenomenon of 'health transition', which positions NCDs as a major public health challenge of growing magnitude in the 21st century.

The findings of present study also reveal a similar picture with a majority of the population being overweight and obese (53.4%), nearly 35% being abdominally obese and almost 48% having an elevated WHR. Similar findings have been reported by studies conducted by Mehan et al in industrial populations over the past decade. The prevalence of overweight & obesity found in 4 studies conducted on urban industrial population of Baroda city between 2007 to 2011 ranged from 58% to 79% while abdominal obesity (characterized by high WC) ranged from 32% to 48%. The findings of the present study indicate that a little more than half of the population (56%) had their blood sugar ever measured and were thus completely unaware of their blood sugar levels. Similarly, out of the total population, 81% subjects had their blood pressure measured. The present study reports very high presence of suboptimal blood pressure (prehypertension as well as hypertension) among the study subjects (73%). However, it was more disturbing to see that a very small percentage of these pre hypertensive and hypertensive subjects (4%) was aware that they had high blood pressure. This is an especially worrisome,

given the fact that high blood pressure, due to the absence of signs and symptoms is termed as a 'silent killer'. High blood Pressure or hypertension is a public health problem worldwide. On a global scale, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8% of the total of all deaths. This accounts for 57 million disability adjusted life years (DALYS) or 3.7% of total DALYS. In the Indian context, data from WHO NCD country profile says that in 2008, 32.5% Indians (32% males and 31.7% females) were suffering from high B.P.; SBP >139 mm Hg and/or DBP >89 mm Hg (WHO NCD Country profiles 2011).

Raised blood pressure is a major risk factor for coronary heart disease and ischemic as well as hemorrhagic stroke. Blood pressure levels have been shown to be positively and continuously related to the risk for stroke and coronary heart disease (WHO Global Health Observatory on Raised Blood Pressure 2013). Contrary to popular belief that only hypertensives are at risk of developing stroke and CHD, literature has revealed that there is an increased risk in the 'normotensive' individuals as well as their SBP and DBP readings rise (Macmohan et al 1997). The risk of developing adverse consequences of rising blood pressure levels is thus continuous and constant, steadily increasing with a rise in blood pressure.

As has been well established and documented in literature, in the present study also, age and high BMI were strongly associated with abdominal obesity and high blood pressure indicating that these associations hold true in the Indian context too (Redon 2001, Willett et al 1999, Mikhail et al 1999, Stamler 1991, Stamler and Wentworth 1989). Siani et al (2002), and Guagnano et al (2001) have established that central distribution of body fat is associated with increased blood pressure. In keeping with this finding a positive relation also emerged between high WC and high blood pressure in the present study.

Abdominal obesity is defined by easy-to-use parameters; WC and WHR. Though BMI, WC or WHR correlate well with each other, it is also believed that combined use of these parameters of generalized and abdominal obesity may be better in identifying people at risk of CVD than either of them alone (Janiszewski et al 2007, Ardern et al 2003, Meisinger et al 2006). Additionally, overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year as a result of it. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to overweight and obesity (WHO Factsheet on Obesity & Overweight 2013).

BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals. Also, while it accurately measures whether an individual's weight exceeds the healthy limit, it does not

provide any information on the distribution of body fat in a person. To rectify this, it can be used in conjunction with an indicator of central obesity (Waist circumference) as central obesity, like elevated BMI is an important marker of cardiac health as well as diabetes (Wang et al 2005, Yusuf et al 2005). The 2009 Consensus Statement for Asians (Misra et al 2009) suggests that both BMI and WC should be used together (with equal importance) for population- and clinic-based metabolic and cardiovascular risk stratification.

With regards to physical inactivity patterns of the subjects in the present study, a large majority (77%) were physically inactive. This has been widely reported in past literature also. Studies on industrial population conducted by Mehan et al in 2006, 2007 and 2008 reported prevalence of physical inactivity to be 19% to 38% among the industrial population. In addition to physical inactivity, unhealthy diet has been identified by the WHO as a leading preventable risk for development of NCDs. Among all unhealthy eating habits, prime importance is given by the World Health Organization to the NCD risk attributable to insufficient consumption of fruits and vegetables. Low fruit and vegetable intake is among the top 10 selected risk factors for global mortality. Approximately 1.7 million (2.8%) of deaths worldwide are attributable to low fruit and vegetable consumption. Worldwide, insufficient intake of fruit and vegetables is estimated to cause around 14% of gastrointestinal cancer deaths, about 11% of ischaemic heart disease deaths and about 9% of stroke deaths (WHO World Health Report 2002, WHO factsheet on Fruit and Vegetable intake 2013). The WHO International Agency for Research on Cancer (IARC) estimates that the preventable percentage of cancer due to low fruit and vegetable intake ranges from 5–12 per cent for all cancers, and up to 20–30 per cent for upper gastrointestinal tract cancers (WHO IARC 2010). Various studies conducted by Mehan et al in Baroda city report widespread inadequacy in fruits and vegetable intake. Mehan et al (2006) reported the prevalence of inadequate fruit and vegetable intake among urban, free-living population of Baroda city to be as high as 76%. Studies conducted on industrial population of Baroda city have reported widespread prevalence of inadequate fruit and vegetable intake among productive age population: 92% (Mehan et al 2011), 69% (Mehan et al 2008) and 93% (Mehan et al 2007).

Another unhealthy eating habit which was seen among nearly 10% of the subjects was eating out daily. Keeping in mind the fact that food available at restaurants or other eateries focuses on palatability and preference of customers rather than on nutrition, (such as use of high salt, fat; particularly saturated fat and trans fat) it is a major risk factor predisposing individuals to NCDs.

In accordance to the WHO STEPS recommendations, in addition to assessment of dietary pattern and physical activity behaviors of subjects, their addiction habits pertaining to use of alcohol and tobacco were also looked at as part of the study. While smoking, which was the only form of

tobacco consumption among the study population was found to be practiced by nearly 10% of the population, its daily usage was reported by about 5% of them. Looking at past literature where industrial population belonging to similar urban industry of Baroda city have been found to have higher prevalence of tobacco use (about 32%), the percentage prevalence of the same in the present study seems to be under reported. This could be due to the fact that the subjects were aware of the harmful effects of smoking and thus, wanting to portray themselves as healthy, denied using the same even if they used it. Another reason behind the low prevalence of smoking among study population could be the "no smoking on premises" policy which was strictly enforced in the workplace, thus discouraging the employees from developing or continuing the habit. Also, keeping in mind that tobacco usage is a strongly addictive habit, it seems unlikely that about half of those who smoked did not do so on a daily basis but restricted themselves to less frequent usage. It is also noteworthy that the 'no smoking on premises' policy that was strictly implemented in the industry was unable to deter the smokers who used to step out of the workplace's main gates (i.e. out of the industry's premises) and smoke during their breaks or after working hours. It can thus be said that a 'no smoking on premises' policy is not in itself sufficient to completely stop the smoking among employees but it definitely would discourage the use of cigarettes/bidi/pipe during working hours which comprised a major portion of the employees' day.

With regards to consumption of alcohol, a very small percentage of subjects (17.7%) admitted that they consumed it. This low consumption cannot be attributed entirely to good awareness in the subjects regarding harmful effects of excess use of alcohol. The main underlying reason behind this low consumption of alcohol is the fact that the state where the research study was conducted (Gujarat) is a dry state where use of alcohol is prohibited. Earlier studies conducted in industrial population of Gujarat reported similar findings regarding consumption of alcohol which ranged from 14-18% (Mehan et al 2007, Mehan et al 2008, Mehan et al 2011). Though none of the subjects reported regular/excessive consumption of alcohol, the risk posed by moderate consumption can also not be ruled out because while there are studies that say that in addition to causal effects relationship of heavy drinking and diabetes, light to moderate drinking may be beneficial while heavy drinking is detrimental (Baliunas et al 2009), research also says that alcohol consumption has detrimental effects on hypertension, cardiac dysrhythmias and hemorrhagic stroke, regardless of the drinking pattern (Rehm et al 2010).

Data clearly indicates that productive age population (18-60 years) is highly vulnerable to NCDs, given that they have such a high prevalence of NCD risk factors such as overweight, obesity and

high blood pressure. The present study also presents similar picture with high prevalence of NCD risk factors among a young population with average age of 29 years.

Various studies have been conducted in different regions of India to assess the prevalence and distribution of risk factor among working age, productive population. The findings of these studies are a reflection of the results found in the present study and present a very similar unhealthy picture of the productive age population of the country with high percentage prevalence of elevated BMI, hypertension, dyslipidaemia and diabetes. Extensive research has also been done on NCDs in industrial population in the Department of Foods and Nutrition by Mehan et al (2007, 2008, 2011) and findings similar to those in present study have been reported.

The growing NCD epidemic is fast spreading in low and middle income countries such as India. In 2008, more than half (53%) of all deaths in India were due to NCDs. Also, as seen earlier, burden of NCDs among productive population is considerable which makes it critical to ensure healthy environment at the workplace which includes availability of nutritious meals in the workplace at affordable, subsidized rates, provision of time and infrastructure to facilitate the employees' physical activity and regular health checkups and screening to ensure preventive health care. As can be seen from the data presented in this chapter, the workplace population demonstrates a very unhealthy profile across designation levels and gender. However, as per the industry's policy regular, free health checkups and medical reimbursement facility is provided only to the manager level employees. This means that only 20% of the population that was under study is given the benefit of these facilities which is insufficient because it is clear from the reported data that all employees, irrespective of their age and designation are vulnerable to the NCD risks and need to be screened regular for early detection and subsequent prevention of NCD risk factors and development of NCDs among them.

It is also a cause for concern that a majority of the subjects in the present study who were suffering from hypertension and/or impaired glucose tolerance were completely unaware of this fact. Nearly 81% subjects had their blood pressure ever measured and an even lesser proportion of subjects ever had their blood sugar checked (56.3%). Earlier studies have reported similar findings, bringing to light the necessity of sensitizing individuals towards the importance of regular screening of these vital health parameters. Mohan et al (2007) reported in a study conducted in urban Chennai that only about 32% of the population who was suffering from hypertension were aware of the same. Further, 71% of them were under treatment for the same and 46% had their B.P. under control. Similar findings have been reported in a Delhi based study conducted by Chaturvedi et al in 2005 where about half the hypertensives enrolled in the study

(53.4%) were aware of their condition out of which 43% were taking treatment and 8.5% were able to manage their B.P.

It is noteworthy that the disease burden which was found in present study was among young and educated population thereby suggesting that IEC programmes or mass media can be used to impart knowledge regarding the importance of following a healthy lifestyle, thereby preventing development of NCDs and their risk factors. However, in spite of the fact that most of the subjects were well educated, their knowledge regarding the prevention and management of various NCDs and their risk factors was very superficial. While majority of the study population were aware of the importance of maintaining normal levels of important health parameters such as weight, blood pressure, cholesterol and blood sugar. Most of them had incorrect or no knowledge about the normal levels of vital health parameters and they did not know of the correct ways and time intervals for monitoring these health parameters which is shown by data which has low prevalence of subjects who checked their weight, B.P., lipid profile and blood sugar regularly as required. The main reason behind this low level of knowledge is lack of media campaigns or government run awareness drives or similar other population based efforts to raise awareness regarding NCDs and their related risk behaviours. It can thus be recommended on the basis of these observations that there is a need to plan and implement awareness campaigns focusing on NCD prevention and management by taking help of mass media. Another way to do this is to include & mainstream nutrition health education course across all disciplines in college and school curriculum which will enable and empower them not only to combat the growing NCD epidemic but also learn about nutrition during entire life cycle and lead healthier lives.

## PHASE 3

## IDENTIFICATION OF "AT RISK" SUBJECTS & SUBSEQUENT BIOCHEMICAL ESTIMATION

The data collected in Phase 2 was analyzed and subjects who showed presence of 3 or more risk factors out of all the following were identified as being 'at risk':

- Current Tobacco consumption
- High Alcohol consumption (CDC 2010)
- Low fruit and vegetable intake (< 400 gm/day)
  (WHO/FAO 2002, NIN 2007)
- Physical activity (CDC 2008, Misra et al 2009)
- Medical history of hypertension and/or diabetes
- High blood pressure (JNC VII 2004)
- High Body Mass Index (Misra et al 2009)
- High Waist Circumference (Misra et al 2009)

After analysing the results of STEP 1 and STEP 2, it was found that 391 (77.6%) of the study subjects were "at risk" of developing Non Communicable Disease(s) in the future (Figure 4.2).

*Gender differences*

Gender based analysis showed that nearly 79.2% of the male subjects and 64.8% of female subjects enrolled in the study were "at risk". Further detailed information regarding distribution of risk factors among population (Figure 4.3) shows that maximum number of subjects (32%) had presence of 3 risk factors, followed by 4 (24.4%), 5 (19.8%), 2 (19.3%), 1 (3.2%), 6 (1.2%) and 7 risk factors (0.2%). This pattern was uniform across genders.

These results were communicated to the Administrative and Personnel Head of the industry as well as subjects themselves. All the subjects were contacted by email and informed about their risk profile. They were explained that being "at risk" meant that they had a higher risk of developing diabetes or high cholesterol problem in future, or they might unknowingly have high levels of these even at present.

Arrangement for blood test was made at the workplace itself for a period of three weeks and eligible "at risk" employees were sent daily reminders during this time via email to come for

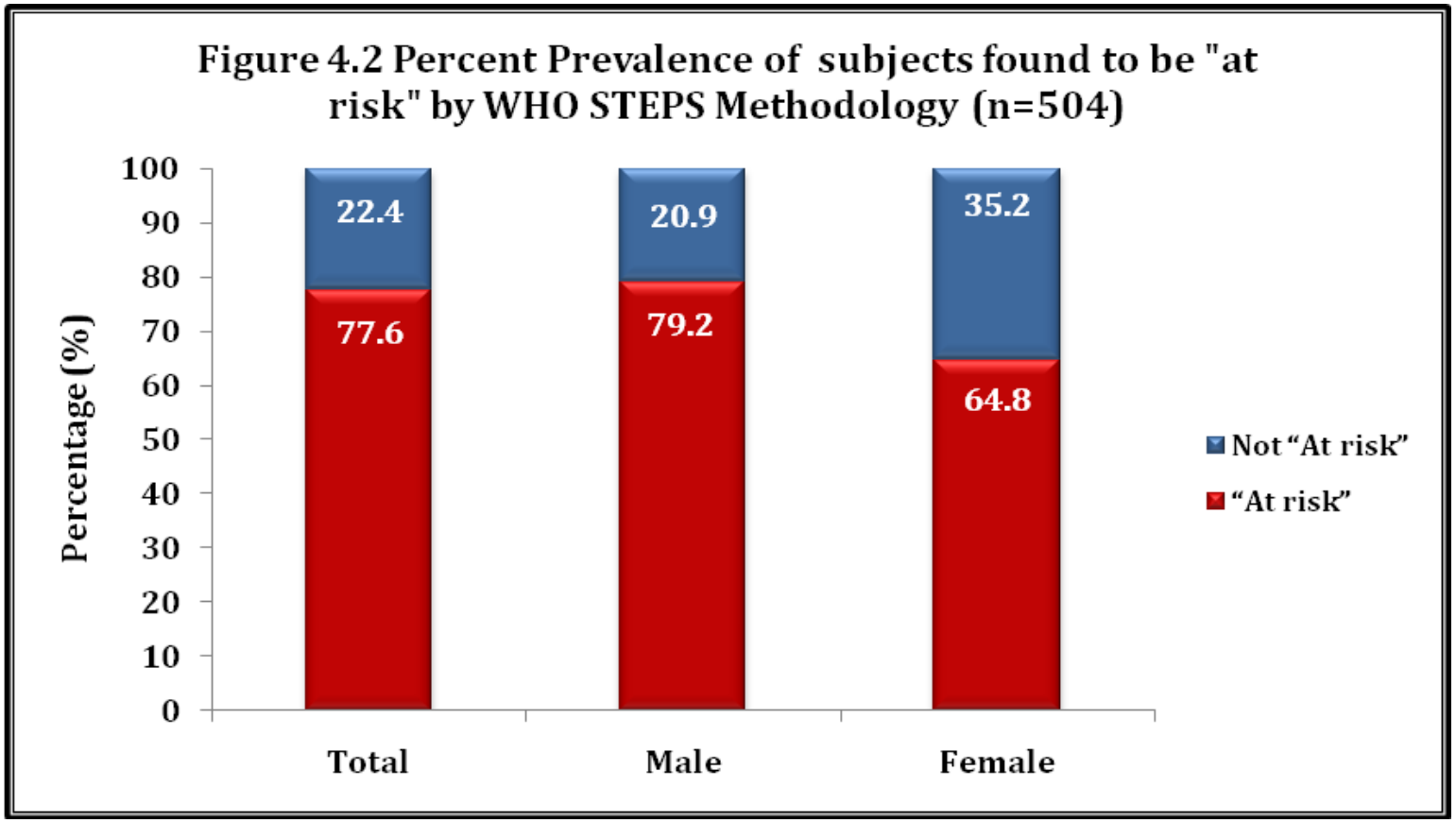


Figure 4.2 Percent Prevalence of subjects found to be "at risk" by WHO STEPS Methodology (n=504)
Percentage (%)
100
90
80
70
60
50
40
30
20
10
0
22.4
77.6
20.9
79.2
35.2
64.8
Total
Male
Female
Not "At risk"
"At risk"

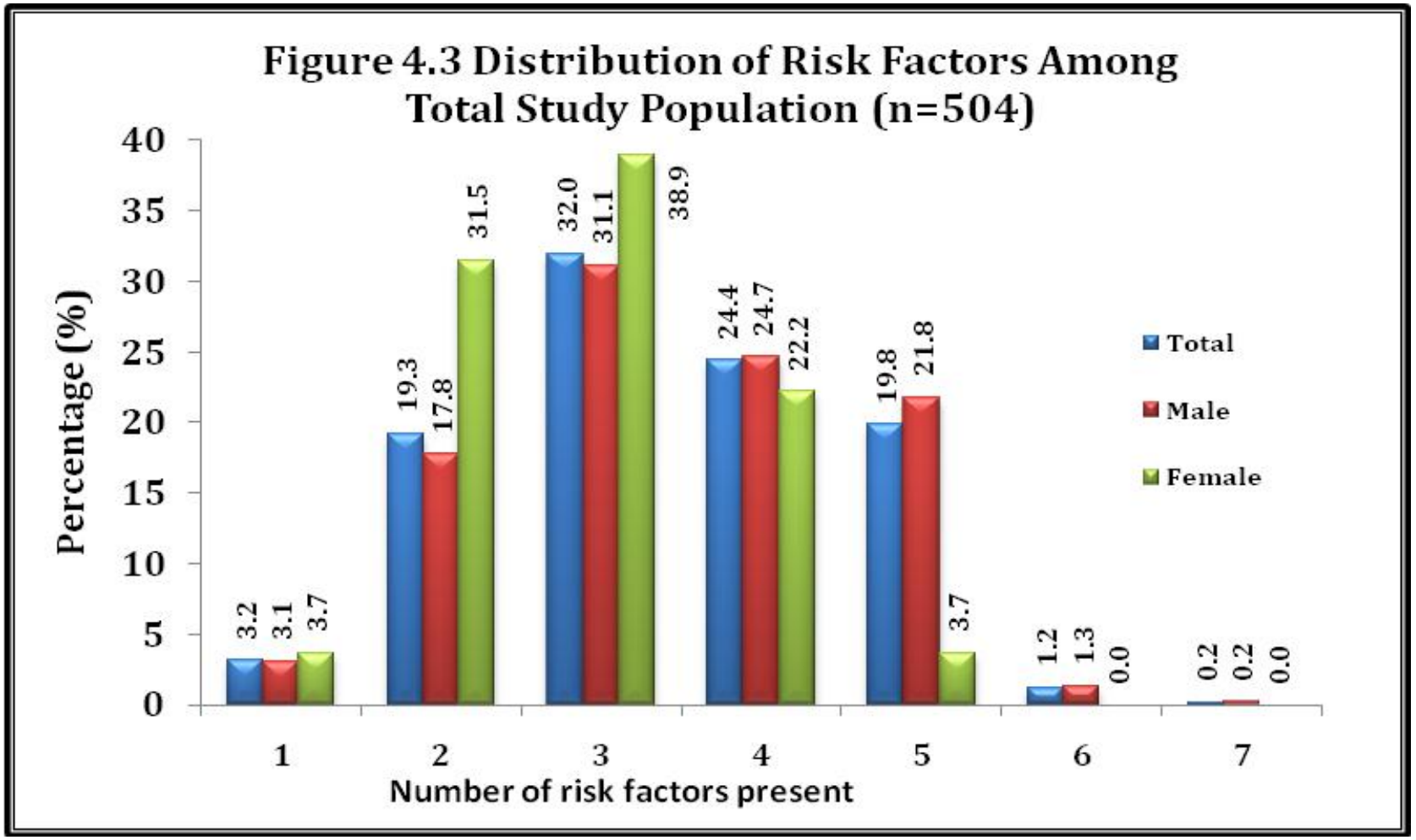


Figure 4.3 Distribution of Risk Factors Among Total Study Population (n=504)
Percentage (%)
40
35
30
25
20
15
10
5
0
3.2
3.1
3.7
19.3
17.8
31.5
32.0
31.1
38.9
24.4
24.7
22.2
19.8
21.8
3.7
1.2
1.3
0.0
0.2
0.2
0.0
1
2
3
4
5
6
7
Number of risk factors present
Total
Male
Female

blood test on an empty stomach on any day out of these 3 weeks, at their convenience. However, out of the 391 "at risk" subjects, 158; 142 males and 16 females came for the blood tests. The verbatim responses received from some of the subjects who did not come for the blood test have been summarized in Table 4.18.

The data of those who came for the blood test has been presented in this section.

**Biochemical Estimations**

For the consenting subjects, fasting (12 hour) samples of venous whole blood were collected by a registered lab technician for the blood estimations. The biochemical estimations were performed by Thyrocare Laboratories which is an ISO 9001-2008 certified organization, accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL), a national accrediting agency in the year 2005 and by College of American Pathologists (CAP), a global accrediting organization in the year 2007. Fasting blood sugar estimation was done by enzymatic kit procured from Accurex Biochemicals Pvt. Ltd. using GOD/POD method. Lipid profile estimations were done using kits procured from Aggape. Total cholesterol was estimated by enzymatic end point method (Allain et al 1974) while serum triglycerides were measured using GPO/PAP method (McGowan et al 1983). Direct HDL-cholesterol estimation was done using enzymatic kit procured from Aggape. LDL-cholesterol, VLDL-cholesterol, TC/HDL and LDL/HDL ratios were then calculated using Freidewald's formulae (Friedewald et al 1972).

The results of the blood tests were communicated to the employees and each employee was given a photo copy of their respective test report. Also, a brief interpretation of the test results along with health and dietary guidelines to prevent and manage high levels of blood sugar and cholesterol were provided to all of them via e-mail.

<u>Lipid Profile</u>

The results of the biochemical estimations are presented in Table 4.19. Dyslipidaemia was present in almost 84.8% of the 'at risk' population. Out of all the lipid profile fractions, the highest prevalence was for abnormal LDL-C levels (100 mg/dl); 60.7%-total 'at risk' population, followed by HDL-C levels (40-60 mg/dl for males & 50-60 mg/dl for females); 42.4%, Total Cholesterol (>200 mg/dl)

28.5% and Triglycerides (>150 mg/dl); 24%. Percent prevalence of high VLDL-C, TC/HDL ratio and LDL/HDL ratio was 12%, 22.1% and 21.9% respectively. The same has been graphically represented to give a clearer picture (Figure 4.4).

The mean values of various lipid fractions were calculated and are presented in Table 4.20. The mean Total Cholesterol of the study population was 179.4 ± 37.1 mg/dl which fell in the normal range. The trend was more or less similar in case of Triglycerides with the mean values for total population being 125.5 ± 65.2 mg/dl. The LDL-C mean values for the subjects was itself in the 'borderline high' range (110.5 ± 30.9 mg/dl). The average HDL-C levels for males (43.3 ± 7.1 mg/dl) were just a little above the normal cut-off (40-60 mg/dl) while in case of females (48.5 ± 11.2 mg/dl) it was a little below the normal level (50-60 mg/dl).

*Gender Differences*

On analyzing the data regarding lipid profile obtained from 'at risk' population (Table 4.19), gender wise distribution showed that 83% males and all females (100%) were dyslipidemic (i.e. had at least one lipid fraction altered). In case of males, out of all the lipid fractions, the highest prevalence was for elevated LDL-C levels. A much higher percentage of males (63.3%) had high LDL-C compared to females (37.5%). In case of mean LDL-C values, (Table 28), the values for male population (112.3 ± 30.6 mg/dl) were higher than those for females (94.4± 29.6 mg/dl) as well as the mean of the total 'at risk' population (110.5 ± 30.9 mg/dl). In case of female subjects, the highest prevalence was for abnormal HDL-C values with 87.4% women having higher (18.7%) and lower (68.7%) than normal HDL-C values. In case of males this percentage was 43% with 36.6% of 'at risk' males having lower than optimal HDL-C levels and 1.4% having high HDL-C. Total Cholesterol was elevated in 29% of the 'at risk' male subjects while a lower proportion (18.7%) of 'at risk' female subjects had high TC. Also, the mean TC for males was much higher than that of females (181.4 ± 36.6 vs. 161.5 ± 37.9) but both were well within the normal range of TC (<200 mg/dl). While nearly 26% of the 'at risk' male population were suffering from hypertriglyceridemia (TG > 150 mg/dl), none of the females had it. Also, mean TG for men was 129.2 ± 67.0 as opposed to 93.2 ± 30.9 in case of 'at risk' females.

| Table 4.18 Verbatim Responses Received from the Subjects in the Selected Workplace |
|---|
| *I am too young to worry about having high cholesterol and Diabetes.* |
| *All members of my family are healthy, with no B.P. and Sugar issues. So I am also healthy and see no need to give blood test.* |
| *I have my medical check-up done regularly so I don't want to get it done by you.* |
| *I am afraid that blood test will show high cholesterol so I don't want to do it.* |
| *I am very busy.* |

| Table 4.19 Percent Prevalence of Dyslipidaemia & Abnormal Lipid Profile Fractions among the Consenting 'At Risk' Subjects (n=158) | | | |
|---|---|---|---|
| | **Total (n=158)** | **Male (n=142)** | **Female (n=16)** |
| **LP status** | **% (n)** | **% (n)** | **% (n)** |
| Dyslipidaemia present | 84.8 (134) | 83 (118) | 100 (16) |
| **TC Status** | **% (n)** | **% (n)** | **% (n)** |
| Borderline | 24.1 (38) | 24.6 (35) | 18.7 (3) |
| Higher than normal | 28.5 (45) | 29.0 (42) | 18.7 (3) |
| **TG Status** | **% (n)** | **% (n)** | **% (n)** |
| Borderline | 12 (19) | 12.7 (18) | 6.3 (1) |
| Higher than normal | 24 (38) | 26.1 (37) | 6.3 (1) |
| **HDL-C Status** | **% (n)** | **% (n)** | **% (n)** |
| Abnormal | 42.4 (67) | 38 (54) | 81.3 (13) |
| Normal | 57.6 (91) | 62 (88) | 18.7 (3) |
| **LDL-C Status** | **% (n)** | **% (n)** | **% (n)** |
| Borderline | 56.3 (89) | 58.4 (83) | 37.5 (6) |
| Higher than normal | 60.7 (96) | 63.3 (90) | 37.5 (6) |
| **VLDL-C Status** | **% (n)** | **% (n)** | **% (n)** |
| Abnormal | 12.0 (19) | 13.4 (19) | 0.0 (0) |
| **TC/HDL** | **% (n)** | **% (n)** | **% (n)** |
| Abnormal | 22.1 (21) | 14.8 (21) | 0.0 (0) |
| **LDL/ HDL** | **% (n)** | **% (n)** | **% (n)** |
| Abnormal | 20.9 (24) | 21.8 (31) | 12.6 (2) |
| *National Heart, Lung and Blood Institute, National Cholesterol Education Programme, Adult Treatment Panel III guidelines for Lipid Profile 2001* | | | |

Fasting Blood Sugar

A considerable portion of the population (12%) was found to have higher than normal Fasting Blood Sugar levels. When data regarding self-reported history of diabetes was compared to percent prevalence of Impaired Glucose tolerance (IGT), it was revealed that while a sizeable percentage of the population (12%) were found to have IGT during the survey, only 5.3% of those who had IGT reported being aware that they were diabetic while 73.7% of subjects with elevated FBS (i.e. presence of IGT) were unaware of their condition and 21.1% had never gotten their blood sugar measured and hence were unable to answer the question regarding whether they were diabetic. The mean values for fasting blood sugar of total population (89.4 $\pm$ 15.4 mg/dl) were well within the normal range of fasting blood sugar. The detailed results are presented in Table 4.21.

*Gender Differences*

When gender-based analysis was done with the data regarding fasting blood sugar values of the 'at risk' population (Table 4.21) it indicated that a much higher percentage of males (12.6%) had Impaired Glucose Tolerance (IGT) compared to females (6.2%). While 12.6% of the male subjects were found to have IGT, only 5.6% reported that they were diabetic and 72.2% replied that they did not have diabetes. Nearly 22% had never had their blood sugar measured. In case of female population, none were detected to have IGT during the survey in keeping with self-reported prevalence of 0%. Nearly 53% females reported that they did not have a history of diabetes while the remaining 44.7% said that they never had their blood sugar measured. Gender differences were also found when mean fasting blood sugar values of males and females were compared. Males had a higher mean FBS value (89.8 $\pm$ 15.9 mg/dl) than females (85.9 $\pm$ 8.0 mg/dl). However, the mean values for both the genders fell in the normal category of FBS as defined by the American Diabetes Association in 2011.

| Table 4.20 Biochemical Profile of Consenting 'At Risk' Subjects (Mean ± S.D.) n=158 | | | |
|---|---|---|---|
| **Lipid Profile** | **Total (n=158) Mean ± S.D.** | **Males (n=142) Mean ± S.D.** | **Females (n=16) Mean ± S.D.** |
| **TC (mg/dl)** | 179.4 ± 37.1 | 181.4 ± 36.6 | 161.5 ± 37.9 |
| **TG (mg/dl)** | 125.5 ± 65.2 | 129.2 ± 67.0 | 93.2 ± 30.9 |
| **LDL (mg/dl)** | 110.5 ± 30.9 | 112.3 ± 30.6 | 94.4 ± 29.6 |
| **VLDL (mg/dl)** | 25.1 ± 13.0 | 25.8 ± 13.4 | 18.6 ± 6.2 |
| **HDL (mg/dl)** | 43.8 ± 7.8 | 43.3 ± 7.1 | 48.5 ± 11.2 |
| **TC/HDL** | 4.2 ± 1.0 | 4.3 ± 1.0 | 3.4 ± 0.7 |
| **LDL/HDL** | 2.6 ± 0.8 | 2.6 ± 0.8 | 2.0 ± 0.6 |

| Table 4.21 Fasting Blood Sugar Profile of 'Consenting 'At Risk' Subjects (n=158) | | | |
|---|---|---|---|
| | **Total (n=158)** | **Male (n=142)** | **Female (n=16)** |
| **Diabetes status** | **% (n)** | **% (n)** | **% (n)** |
| Low FBS | 0.6 (1) | 0.0 (0) | 6.2 (1) |
| Normal | 87.3 (138) | 87.3 (124) | 87.5 (14) |
| Impaired Glucose Tolerance | 12.1 (19) | 12.6 (18) | 6.2 (1) |
| **IGT prevalence in relation to self-reported history of Diabetes (n=158)** | | | |
| **Self-reported history of Diabetes** | | **IGT Present (n=19) % (n)** | **IGT Absent (n=139) % (n)** |
| Yes | | 5.3 (1) | 0.7 (1) |
| No | | 73.7 (14) | 60.4 (84) |
| Never had FBS measured | | 21.1 (4) | 38.8 (54) |
| **IGT prevalence in relation to self-reported history of Diabetes in male subjects (n=142)** | | | |
| **Self-reported history of Diabetes** | | **IGT Present (n=18) % (n)** | **IGT Absent (n=124) % (n)** |
| Yes | | 5.6 (1) | 0.8 (1) |
| No | | 72.2 (13) | 61.3 (76) |
| Never had FBS measured | | 22.2 (4) | 37.9 (47) |
| **IGT prevalence in relation to self-reported history of Diabetes in female subjects (n=16)** | | | |
| **Self-reported history of Diabetes** | | **IGT Present (n=1) % (n)** | **IGT Absent (n=15) % (n)** |
| Yes | | 0.0 (0) | 0.0 (0) |
| No | | 100 (1) | 53.34 (8) |
| Never had FBS measured | | 0.0 (0) | 46.67 (7) |
| **Mean fasting blood sugar values of consenting 'at risk' population (n=158)** | | | |
| | **Total (n=158) Mean ± S.D.** | **Males (n=142) Mean ± S.D.** | **Females (n=16) Mean ± S.D.** |
| **Fasting Blood Sugar (mg/dl)** | 89.4 ± 15.4 | 89.8 ± 15.9 | 85.9 ± 8.0 |
| *Guidelines of the American Diabetes Association 2011* | | | |

Metabolic Syndrome

The results of biochemical estimations done on subjects were used to estimate the percent prevalence of subjects suffering from Metabolic Syndrome according to ATP III guidelines. Metabolic Syndrome can be defined as a combination of medical disorders which, when occurring together, increase the risk of a person of developing heart problems or diabetes. The clinical identification of metabolic syndrome is done on basis of presence of 3 or more of the following risk factors: abdominal obesity, high triglycerides, abnormal HDL-C, high fasting blood sugar and hypertension.

The results for these have been summarized in Table 4.22. About 29% of the 'at risk' population was identified as having Metabolic Syndrome. Detailed risk factor analysis showed that highest percentage of subjects (38.6%) had 2 risk factors of Metabolic Syndrome followed by subjects having 3 or more risk factors (29.1%). None of the females had 3 or more risk factors and hence none were classified as being suffering from Metabolic Syndrome. Nearly 28% subjects showed presence of 1 risk factor while less than 5% had no risk factors of Metabolic Syndrome. Further, 1 and 0 risk factors were present in 8.9% and 1.3% of the subjects.

*Gender Differences*

While a considerable proportion of the 'at risk' male subjects (32.4%) showed presence of MS, none of the female subjects suffered from it. Highest percentage of 'at risk' males showed presence of 2 risk factors of MS (38.7%) followed by 1 risk factor (25.3%), 3 risk factors (21.1%), 4 risk factors (9.9%), 0 risk factors (3.5%) and 5risk factors (1.4%). In the case of 'at risk' females, in descending order of prevalence, highest percentage of females had 1 risk factor (50%) followed by those having 2 risk factors (37.5%) and 0 risk factors (12.5%). Since none of the females had more than 2 risk factors of MS, none could be classified as having MS.

Relationship between Impaired Glucose Tolerance and various parameters

No significant association was found between age, gender, designation, frequency of eating out, BMI status, abdominal obesity, high WHR, elevated blood pressure and presence of Impaired Glucose Tolerance among the study population.

Relationship between dyslipidaemia and various parameters

The strength of association between various demographical, anthropometric as well as biophysical parameters and occurrence of dyslipidaemia was found using chi-square analysis and it was found that abdominal obesity ($p<0.05$) and high WHR were significantly associated with dyslipidaemia ($p<0.05$). However, no such significant association was found between

presence of dyslipidaemia and parameters such as age, gender, designation, BMI status, frequency of eating out and B.P. of subjects. When addiction patter was studied in relation to lipid profile levels, it was observed that smokers had significantly higher HDL cholesterol ($p<0.05$) and significantly lower TC/HDL ratio ($p<0.05$) as compared to non-smokers (Table 4.24). However, no such significant differences were seen in the mean lipid profile values of physically active and physically inactive subjects (Table 4.25).

*Gender Differences*

When mean lipid profile values of male and female subjects were compared, it was found that the mean values for male subjects were significantly higher than those of female subjects in all parameters except HDL cholesterol. Detailed result has been presented in Table 4.23.

Relationship between biochemical profile and age of the subjects (n=158)

The relationship between age and lipid profile & fasting blood sugar values was analyzed using t-test and it was found that older subjects (≥ 30 years) had significantly higher Total Cholesterol ($p<0.05$), LDL Cholesterol ($p<0.05$) and TC/HDL ratio ($p<0.05$). Detailed results have been presented in Table 34. In case of other lipid profile fractions (Triglycerides, HDL Cholesterol, VLDL Cholesterol and LDL/TC ratio) and fasting blood sugar, mean values were higher for older population, but not significantly higher.

*Gender Differences*

In case of male population when the same analysis was done, it was found that except for HDL Cholesterol and fasting blood sugar, other all lipid fractions were significantly higher for older subjects (≥ 30 years) compared to their younger counterparts (Table 34). Older male subjects had significantly higher Total Cholesterol ($p<0.001$), Triglycerides ($p<0.05$), LDL Cholesterol ($p<0.001$), VLDL Cholesterol ($p<0.05$), TC/LDL ratio ($p<0.001$) and HDL/LDL ratio ($p<0.001$). This analysis could not be performed for female subjects in absence of adequate sample size.

The data was first checked for normality after which the appropriate tests were applied to it. It was found that the following variables followed normal distribution: TC, HDL, LDL, TC/HDL and LDL/HDL while the variables TG, VLDL, and FBS were not found to follow normal distribution. Accordingly, for those variables which follow normal distribution, parametric tests were applied (t-test) and mean and standard deviation are reported for the same. For those variables that did not follow normal distribution, Mann Whitney test was applied and the corresponding median and inter quartile range (IQR) are reported.

| Table 4.22 Percent prevalence of Metabolic Syndrome (MS) and percent distribution of MS risk factors among the Consenting 'At Risk' Subjects (n=158) | | | |
|---|---|---|---|
| | **Total (n=158)** | **Male (n=142)** | **Female (n=16)** |
| **Metabolic Syndrome (ATP 3 )** | **% (n)** | **% (n)** | **% (n)** |
| **Present** | 29.1 (46) | 32.4 (46) | 0.0 (0) |
| **Absent** | 70.9 (112) | 67.6 (96) | 0.0 (0) |
| **No. of Metabolic Syndrome risk factors present** | **% (n)** | **% (n)** | **% (n)** |
| **0** | 4.43 (7) | 3.5 (5) | 12.5 (2) |
| **1** | 27.8 (44) | 25.3 (36) | 50.0 (8) |
| **2** | 38.6 (61) | 38.7 (55) | 37.5 (6) |
| **≥3 risk factors** | 29.1 (46) | 32.4 (46) | 0.0 (0) |
| **3** | 19.0 (30) | 21.1 (30) | 0.0 (0) |
| **4** | 8.9 (14) | 9.9 (14) | 0.0 (0) |
| **5** | 1.3 (2) | 1.4 (2) | 0.0 (0) |

| Table 4.23 Differences in Mean Cholesterol & Fasting Blood Sugar Values of Male & Female Subjects (n=158) | | | | |
|---|---|---|---|---|
| | **Male (n=142)** | **Female (n=16)** | **t value** | **p value** |
| | **Mean ± S.D.** | **Mean ± S.D.** | | |
| **Total Cholesterol** | 181.36±36.58 | 161.56±37.95 | -2.045 | 0.043* |
| **HDL Cholesterol** | 43.27±7.15 | 48.50±11.24 | 1.818 | 0.087$^{NS}$ |
| **LDL Cholesterol** | 112.34±30.59 | 94.31±29.47 | -2.242 | 0.026* |
| **TC/HDL** | 4.27±1.07 | 3.37±0.62 | -5.024 | <0.001*** |
| **LDL/HDL** | 2.65±0.80 | 1.98±0.61 | -3.198 | 0.002** |
| | **Male (n=142)** | **Female (n=16)** | **z value** | **p value** |
| | **Median ± IQR** | **Median ± IQR** | | |
| **Triglycerides** | 114.00±72.75 | 89.00±55.00 | -2.118 | 0.034* |
| **VLDL Cholesterol** | 23.00±14.25 | 18.00±10.75 | -2.100 | 0.036* |
| **Fasting Blood Sugar** | 87.00±12.00 | 87.00±7.75 | -0.335 | 0.738 $^{NS}$ |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant* | | | | |

| Table 4.24 Differences in Mean Cholesterol & Fasting Blood Sugar Values of Smokers and Non Smokers (n=158) | | | | |
|---|---|---|---|---|
| | **Smoker (n=17)** | **Non smoker (n=141)** | **t-value** | **p value** |
| | **Mean ± S.D.** | **Mean ± S.D.** | | |
| **Total Cholesterol** | 183.82±38.60 | 178.82±37.01 | 0.524 | 0.601$^{NS}$ |
| **HDL Cholesterol** | 40.28±7.90 | 44.23±7.68 | -1.996 | 0.048* |
| **LDL Cholesterol** | 112.18±31.86 | 110.31±30.86 | 0.234 | 0.815 $^{NS}$ |
| **TC/HDL** | 4.76±1.20 | 4.11±1.03 | 2.407 | 0.017* |
| **LDL/HDL** | 2.85±0.86 | 2.55±0.80 | 1.406 | 0.162 $^{NS}$ |
| | **Smoker (n=17)** | **Non smoker (n=141)** | **z value** | **p value** |
| | **Median ± IQR** | **Median ± IQR** | | |
| **Triglycerides** | 124.00±75.00 | 112.00±62.00 | -1.397 | 0.162 $^{NS}$ |
| **VLDL Cholesterol** | 25.00±15.00 | 22.00±12.00 | -1.421 | 0.155 $^{NS}$ |
| **Fasting Blood Sugar** | 90.00±20.50 | 87.00±11.00 | -0.893 | 0.372 $^{NS}$ |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant* | | | | |

| Table 4.25 Differences in Mean Cholesterol & Fasting Blood Sugar Values Physically Active and Physically Inactive Subjects (n=158) | | | | |
|---|---|---|---|---|
| | **Physically inactive (n=131)** | **Physically active (n=27)** | **t value** | **p value** |
| | **Mean ± S.D.** | **Mean ± S.D.** | | |
| **Total Cholesterol** | 179.07±36.78 | 180.74±39.25 | 0.212 | 0.832 NS |
| **HDL Cholesterol** | 43.81±7.50 | 43.78±9.17 | -0.019 | 0.985 NS |
| **LDL Cholesterol** | 110.51±30.86 | 110.52±31.55 | 0.001 | 0.999 NS |
| **TC/HDL** | 4.17±1.04 | 4.26±1.23 | 0.403 | 0.688 NS |
| **LDL/HDL** | 2.58±0.80 | 2.59±0.86 | 0.046 | 0.964 NS |
| | **Physically inactive (n=131)** | **Physically active (n=27)** | **z value** | **p value** |
| | **Median ± IQR** | **Median ± IQR** | | |
| **Triglycerides** | 112.00±61.00 | 124.00±80.00 | -0.855 | 0.393 NS |
| **VLDL Cholesterol** | 22.00±12.00 | 25.00±16.00 | -0.895 | 0.371 NS |
| **Fasting Blood Sugar** | 87.00±12.00 | 85.00±12.00 | -1.611 | 0.107 NS |
| *Level of significance: * = p < 0.05 ** = p < 0.01 *** = p < 0.001 NS = Not Significant* | | | | |

**SUMMARY**

- Out of the 391 subjects who were found to be "at risk", only 40.4% (158) subjects; 142 males and 16 females consented to undergo biochemical estimation i.e. withdrawal of blood for estimation of fasting blood sugar and lipid profile.
- Almost 78% of the subjects (79.2% males and 64.8% females) were 'at risk' as per WHO STEPS Methodology.
- A large majority (84.8%) of the 'at risk' population was dyslipidemic with highest percentage of them having high LDL-C (60.7%), followed by abnormal HDL-C (43%), high Total Cholesterol (28.5%) and elevated Triglycerides (23.4%).
- Out of consenting 'at risk' subjects, 12% (12.6% males & 0% females) had Impaired Glucose Tolerance (IGT).
- Metabolic Syndrome prevalence was 29% (32.4% males and 0% females) in the 'at risk' population.
- Males had significantly higher TC, LDL cholesterol TG and VLDL cholesterol ($p<0.05$) compared to female subjects.
- Smokers had significantly lower HDL cholesterol levels compared to non smokers ($p<0.05$).

**DISCUSSION**

The industrial population under survey was found to have a very unhealthy profile which was reflected in the high prevalence of 'at risk' subjects (77.6%) as per WHO STEPS Methodology. A much higher proportion of males (nearly 80%) contributed to this number as compared to females (about 65%). However, this gender based comparison cannot be considered fair in the present study because the gender ratio (male v/s female) was skewed in study population. Similar results have been reported in previous studies conducted on young, productive age population in workplace setting (Mehan et al 2007, Mehan et al 2011). As per WHO STEPS, presence of more than 3 risk factors poses the same risk as presence of 3 risk factors. However, it is noteworthy that a sizeable proportion of the population had more than 3 risk factors as well. These high numbers are a cause of serious concern, augmented by the fact that the study population was so young with an average age of 29 years.

Although major efforts were undertaken to sensitize the subjects regarding high rate of risk present among them, not all of them agreed to undergo blood tests for fasting blood sugar and lipid profile. Certain common reasons were cited by various subjects for not participating in further phases of the study such as; being too young to have such health concerns, being too busy, being convinced that they were healthy & therefore did not require health interventions, absence of any NCD family history leading them to believe that they were immune to it as well. Some subjects also candidly confessed to being afraid of the outcome of blood test and therefore refused to appear for the same.

Overall participation rates are important throughout the study period and ideally, to gain the maximum benefits in terms of diseases prevention, employees who are 'at risk' of adverse health outcomes particularly need to participate. Results from previous studies conducted in workplace conclude that hypertensives, employees with elevated cholesterol levels and those who lead sedentary lifestyle are less likely to join health promotion programs and activities (Heany and Inglish 1995). Studies also suggest that participation rates differ according to the focus of the program e.g. irrespective of the fact whether they were normal weight or overweight & obese, women were more likely to participate in weight-loss or awareness programmes related to weight management compared to males (Spilman 1988, Davis1967). Hence, it can be hypothesized based on current data that subjects did not find it worthwhile to invest their time in the nutrition health promotion activities because most of them were convinced that they were already healthy or too young to be concerned about NCDs and thus have no use for the information imparted during the nutrition health promotion programme. Similar findings have

been reported by previous studies conducted on workplace wellness programmes. In an employee wellness programme conducted in North Carolina, barriers such as insufficient incentives, inconvenient locations, time limitations, not interested in topics presented, schedule, marketing, health beliefs, and not interested in the program were found and negatively impacted participation rates in this employee wellness program. The participation rate in the study was around 10% i.e. only 10% of the employees attended at least one session out of the 10 sessions that were offered on campus during a period of 10 weeks (Person et al 2010).

It is well documented in literature that there is on an average, less than 50% participation from employees in workplace wellness programmes (Robroek et al 2009, McLellan et al 2009, Person et al 2010). Several studies have illustrated various barriers to employee participation. A systematic review conducted on 23 worksite wellness observed that employee participation levels rose when; an incentive was offered, when the programme consisted of multiple components, or when the programme was aimed at multiple behaviors (Robroek et al 2009). Considering the above literature, it can be said that further insight is essential to develop intervention programmes with the ability to reach many employees, including those who need it most and to increase the generalizability across all workers and some incentives in the form of subsidy on health insurance, medical check-ups could be given.

Out of the consenting 'at risk' subjects, almost 85% were dyslipidemic and 12% had impaired glucose tolerance which is a considerably high percentage It is not surprising since the study population for this phase was subjects who were already identified as being 'at risk' according to WHO STEPS methodology. It also justifies the use of STEPS methodology as an effective tool for screening subjects having NCDs based on risk factor profile analysis, without invasive methods such as blood tests. Several studies have been successfully carried out in the Department of Foods and nutrition, the M.S.University, using the WHO STEPS Methodology. These studies have collected extensive data on NCD risk factors among productive age population of Baroda (an urban Indian city) using the standardized and locally adapted WHO STEPS questionnaire. (Mehan et al 2011, Mehan et al 2007, Mehan et al 2007).

Looking at the detailed lipid profile of 'at risk' subjects, it can be seen that a considerable portion had high TC (28.5%), high percentage had elevated LDL cholesterol levels (60.7%) and low HDL cholesterol levels (43%) which have been linked to increased cardiovascular risk (Chaddha et al 1992, Yusuf et al 2004). Research shows that the percentage of people with high total serum cholesterol who are effectively treated remains small even in selected high- and middle-income countries. It is thus not surprising that CVD is one of the leading causes of mortality in developing countries including India (WHO NCD Country Profiles 2011) and when translated in

terms of pure numbers, India may be the CVD capital of the world. However, the rise and mushrooming of state of the art private cardiac care hospitals emphasize more on interventional cardiology such as bypass surgery and angioplasty with very little focus on preventive cardiac care. Since preventive cardiology is not financially lucrative compared to interventional cardiology, private sector is not likely to invest in it. Therefore, the onus lies on the government to set up preventive cardiology units in all health centres and hospitals with a team of experts like cardiologist, nutritionist, behaviour change specialist and physical fitness trainer in place to not only prevent cardiac events but also to prevent population from falling into poverty trap, given the high cost of interventional cardiology. Many of those affected are unaware of their condition and untreated high blood cholesterol represents a missed opportunity in the face of a global epidemic of chronic diseases (Roth et al 2011).

Prevalence of Metabolic Syndrome was 29% in the study population, all of who were males. None of the females suffered from Metabolic Syndrome. Similar high prevalence of MS (33.5%) has been reported by Prasad et al (2012), based on a study conducted on urban Indian adults, terming it as a public health problem in India. A research study (Sawant et al 2011) conducted on Indian adults to evaluate the prevalence of Metabolic Syndrome among them reports similar findings with 19.5% of the population having MS and significantly higher number of males were found to be suffering from it compared to females ($p<0.001$). Earlier studies conducted on urban free living population of Baroda reported that 37.5% of them suffered from MS (Mehan at al 2006) while industrial population of Baroda city showed prevalence of 33.3% in a study conducted by Mehan et al in 2008. Findings of the present study also say that males are at a much higher risk of Metabolic Syndrome compared to females. MS is a complex web of metabolic factors that are associated with a 2-fold risk of CVD and a 5-fold risk of diabetes. Individuals with MS have a 30%–40% probability of developing diabetes and/or CVD within 20 years, depending on the number of components present (Enas et al 2007). MS is one of the major issues in the management of cardiovascular disease because of its epidemic proportion and its impact on increasing risk of developing both cardiovascular disease and type 2 diabetes. The main therapeutic goal in the management of patients with the MS is to reduce risk for clinical cardiovascular events and to prevent type-2 diabetes (Vitale et al 2006). Hence, the fact that more than $1/3^{th}$ of the 'at risk' population was already suffering from MS is worrisome and indicates the urgent need to address the issue via health education and behaviour change communication strategies to introduce healthy lifestyle changes in the study population.

It is now well documented in literature after decades of research, that, common, preventable risk factors underlie most non communicable diseases. WHO Global Health Observatory (2013)

reiterates that most non communicable diseases are the result of four unhealthy behaviours (tobacco use, physical inactivity, unhealthy diet, and the harmful use of alcohol) that lead to four key metabolic/physiological changes (raised blood pressure, overweight/obesity, raised blood glucose and raised cholesterol). This well established link was also seen in the present data where elevated BMI and central obesity were strongly linked to presence of dyslipidaemia ($p<0.05$). Well-identified risk factors such as; inadequate intake of fruits and vegetables, physical inactivity and high frequency of eating out were also rampant in the study population, indicating the need to assess and improve knowledge, awareness and practices of the population to encourage healthy behaviours and reduce risk factors and thus, potential NCD development among them.

**PHASE 4**

**KNOWLEDGE ATTITUDE AND PRACTICES (KAP) OF EMPLOYEES PARTICIPATING IN NUTRITION HEALTH PROMOTION PROGRAMME IN THE WORKPLACE SETTING**

**KAP Regarding Weight Management**

After the biochemical assessment of subjects (Fasting Blood Sugar & Lipid Profile), power point sessions were conducted in the industry premises as part of the "Nutrition Health Promotion Programme (NHPP)" for which all study subjects were informed and invited to attend at their convenience. One month's time was dedicated by the researcher for imparting the information via 2 presentations to each employee of the industry. Prior to NHPP sessions, KAP assessment of subjects was done using a pretested and standardized questionnaire which required subjects to answer the questions by selecting answers from the given options (Appendix 8). The questionnaires were distributed and explained to all the subjects after which they were instructed to choose the option which was closest to their own answer as per their knowledge, attitude and practices with respect to that question.

After consulting the industry management and obtaining their permission, the intervention sessions were initiated in the industry premises. For the first 2 weeks of the NHPP intervention, sessions of Presentation 1 were held every day from Monday to Friday between 12.00 p.m. and 4.00 p.m. in the industry premises. Similarly, during the following 2 weeks, Presentation 2 sessions were held. Details of the topic of presentation, date, time and duration were communicated to all the consenting employees (n=504) via e-mail by the Admin. & Personnel Head. All these employees were personally contacted by the researcher via e-mail and invited for the power point sessions to ensure good participation in the sessions. These employees were invited to attend any session of their choice during the 2 weeks, as per their convenience.

In addition to this, all the employees (those who attended the sessions as well as others) were provided with soft copy of the presentation via e-mail for ready reference. Along with this, all the industry employees were also provided with the researcher's e-mail address as a helpline which they were encouraged to use to contact the researcher in case of any queries regarding nutrition and health. The queries so received were promptly and efficiently replied to by the researcher. In the next 5 months of the intervention period, the intervention was reinforced using pretested and standardized IEC material:

- **A3 size colored posters** were placed at strategic points (near the water cooler, in the common entrance corridor wall and canteen) in the industry campus. These posters included information regarding – weight management, adequate fruit and vegetable intake, regular

physical activity, prevention and management of diabetes, hypertension and cardiovascular disease (Appendix 5).

- **A4 size black and white sheets** printed with key messages pertaining to healthy diet & lifestyle behaviours were made available to the subjects to be used as table mats at the workplace during meal times (Appendix 6).
- **Point-of-decision prompts** in the form of posters placed near lifts-encouraging use of stairs instead of lift were also placed (Appendix 7).

As can be clearly seen from the data presented in Table 4.26, while all the subjects (100%) said that it was important to maintain healthy weight, blood pressure, cholesterol and blood sugar levels, their awareness and perceptions regarding each individual parameter (out of those mentioned above) differed. Majority (63.5%) of the subjects termed maintaining healthy weight as being 'extremely important' but only about half of the study population (56.4%) could be considered to monitor it regularly because only 56.4% of them had their last weight measurement during past month with the remaining population having their last weight measurement more than a month back. Also, only about half of the study population (52.4%) reportedly made some or the other efforts to maintain/lose weight and 71.6% of those who did not make these efforts felt the need to do so. Almost 35% of the subjects said that they had never tried to find their ideal weight and a few subjects knew the normal BMI values (0.8%) or the correct formula for it (3.2%).

*Gender Differences*

While a majority of the females (80%) termed maintaining health weight as 'extremely important', less than half (46.7%) of the female population reported that they made efforts to lose/maintain their weight and out of the remaining population (i.e. those who made no such efforts), nearly 63% expressed the need to do so. Data shows that 60% of them had their most recent weight measurement in the past month and only about half of the female subjects (53.3%) has tried to find their ideal body weight. None of the females enrolled in the study was able to correctly give the BMI formula or values for normal BMI. In case of male subjects, nearly 61% subjects said that maintaining normal weight is 'extremely important' but only about half of the male subjects (53.2%) said that they were currently making efforts to lose/maintain weight and majority (73.1%) of those who did not, said that they felt the need to start making such efforts. About half of the population (56%) had their weight measured within last month. While many of them (66.7%) had tried to find what their ideal weight should be, less than 1% of them knew the normal value for BMI and only 3.6% could correctly write the BMI formula.

| Table 4.26 Knowledge, Attitude, Practices and Perceptions of Subjects Regarding Maintainance of Vital Health Parameters (n=126) | | | |
|---|---|---|---|
| | **Total (n=126)** | **Male (n=111)** | **Female (n=15)** |
| **Is it important to maintain weight, B.P., Cholesterol & Blood Sugar?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 100 (126) | 100 (111) | 100 (15) |
| No | 0.0 (0) | 0.0 (0) | 0.0 (0) |
| **How important is it to maintain normal weight?** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 63.5 (80) | 61.3 (68) | 80 (12) |
| Somewhat important | 20.6 (26) | 22.5 (25) | 6.7 (1) |
| Important | 15.9 (20) | 16.2 (18) | 13.3 (2) |
| **Last weight measurement** | **% (n)** | **% (n)** | **% (n)** |
| Past week | 16.7 (21) | 15.3 (17) | 26.7 (4) |
| Past month | 39.7 (50) | 40.5 (45) | 33.3 (5) |
| Past 3 months | 39.7 (50) | 39.6 (44) | 33.3 (5) |
| Past 6 months | 0.8 (1) | 0.9 (1) | 0.0 (0) |
| Before that | 3.2 (4) | 3.6 (4) | 6.7 (1) |
| Never | 0.0 (0) | 0.0 (0) | 0.0(0) |
| **Tried to find out ideal body weight?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 65.1(82) | 66.7 (74) | 53.3 (8) |
| No | 34.9 (44) | 30.6 (34) | 46.7 (7) |
| **Knowledge of normal BMI?** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 75.4 (95) | 73.9 (82) | 86.7 (13) |
| Correct knowledge | 0.8 (1) | 0.9 (1) | 0.0 (0) |
| Incorrect knowledge | 23.8 (30) | 25.2 (28) | 13.3 (2) |
| **Aware of correct BMI formula?** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 84.9 (107) | 82.9 (92) | 100 (15) |
| Correct knowledge | 3.2 (4) | 3.6 (4) | 0.0 (0) |
| Incorrect knowledge | 11.9 (15) | 13.5 (15) | 0.0 (0) |
| **Currently making efforts to lose/maintain weight?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 52.4 (66) | 53.2 (59) | 46.7 (7) |
| No | 47.6 (60) | 46.8 (52) | 53.3 (8) |
| **If not, do you feel need to do so?** | **(n=60) % (n)** | **(n=52) % (n)** | **(n=8) % (n)** |
| Yes | 71.6 (43) | 73.1 (38) | 62.5 (5) |
| No | 28.4(17) | 26.9 (14) | 37.5 (3) |

**KAP regarding Blood Pressure (B.P.) Management & Control**

Although the awareness about importance of B.P. maintenance was good (88.9%), only about 22% reported having had their last B.P. measurement recently (during past one month). Also, very few subjects (19%) said that they were making some or the other efforts to lower/maintain B.P. with 51% of those making no such efforts did not feel the need to do so (Table 4.27).

***Gender Differences***

A greater part of the female population (86.7%) gave a lot of importance to maintenance of normal B.P. levels by selecting the option of 'extremely important' when asked how important it is to maintain normal B.P. levels. However, only about 13% currently made any efforts to maintain their B.P. levels and only 27% of them had their last B.P. measurement during the past month and just. Additionally, a small percentage of the female population was found to be knowledgeable about normal B.P. levels (13.3%).

With regards to male subjects, while nearly 89% of them said that maintaining healthy B.P. levels was 'extremely important', only 19.8% made any efforts to maintain the same. Also, just 22% males had their last B.P. measurement during past month and a small proportion of the male subjects (12.6%) could correctly write the correct normal B.P. levels

| Table 4.27 Knowledge, Attitude, Practices and Perceptions of Subjects Regarding Maintainance of Healthy Blood Pressure (n=126) | | | |
|---|---|---|---|
| | **Total (n=126)** | **Male (n=111)** | **Female (n=15)** |
| **How important is it to maintain normal B.P.?** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 88.9 (112) | 89.2 (99) | 86.7 (13) |
| Somewhat important | 4.8 (6) | 4.5 (5) | 6.7 (1) |
| Important | 6.3 (8) | 6.3 (7) | 6.7 (1) |
| **Last B.P. measurement?** | **% (n)** | **% (n)** | **% (n)** |
| Past week | 6.3 (8) | 5.4 (6) | 13.3 (2) |
| Past month | 15.9 (20) | 16.2 (18) | 13.3 (2) |
| Past 3 months | 27.8 (35) | 26.1 (29) | 40.0 (6) |
| Past 6 months | 34.9 (44) | 36.0 (40) | 26.7 (4) |
| Before that | 11.9 (15) | 13.5 (15) | 0.0 (0) |
| Never | 3.2 (4) | 2.7 (3) | 6.7 (1) |
| **Aware of normal B.P. levels?** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 45.2 (57) | 46.8 (52) | 33.3(5) |
| Correct knowledge | 12.7 (16) | 12.6 (14) | 13.3 (2) |
| Incorrect knowledge | 42.1 (53) | 40.5 (45) | 53.3 (8) |
| **Currently making efforts to lower/maintain B.P.?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 19.0 (24) | 19.8 (22) | 13.3 (2) |
| No | 81.0 (102) | 80.2 (89) | 86.7 (13) |
| **If not, do you feel need to do so?** | **(n=102) % (n)** | **(n=89) % (n)** | **(n=13) % (n)** |
| Yes | 49 (50) | 49.4 (44) | 46.2 (6) |
| No | 51 (52) | 50.6 (45) | 53.8 (7) |

**KAP Regarding Cholesterol Management and Control**

When asked how important it is to maintain normal levels of cholesterol, majority of subjects (69%) answered that it was 'extremely important'. However, this view was not reflected in their actions with nearly 30% of subjects who never had their cholesterol checked. Only 2.4% of them were found to know the correct levels of cholesterol and only 22.6% reported that they were making some or the other effort to maintain/lower their cholesterol level (Table 4.28).

***Gender Differences***

While majority of the female subjects (80%) said that maintaining normal cholesterol levels is 'extremely important' less than 7% of them made some or the other efforts to lower/maintain their cholesterol levels. Also, about 13% of the females had never gotten their cholesterol levels checked and just 2.4% of them could correctly write the normal levels of cholesterol.

When data for male subjects was looked at, it was revealed that nearly 68% of them felt that maintaining normal cholesterol was 'extremely important' but only 23.4% of them made some or the other efforts to maintain/lower their cholesterol levels. Also, knowledge regarding normal levels of cholesterol was poor among male subjects with only 2.7% of them being able to give the correct values for normal cholesterol.

| Table 4.28 Knowledge, Attitude, Practices and Perceptions of Subjects Regarding Maintainance of Healthy Cholesterol Levels (n=126) | | | |
|---|---|---|---|
| | **Total (n=126)** | **Male (n=111)** | **Female (n=15)** |
| **How important is it to maintain normal cholesterol levels?** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 69 (87) | 67.6 (75) | 80.0 (12) |
| Somewhat important | 18.3 (23) | 18.9 (21) | 13.3 (2) |
| Important | 12.7 (16) | 13.5 (15) | 6.7 (1) |
| **Last cholesterol (lipid profile) measurement?** | **% (n)** | **% (n)** | **% (n)** |
| Past week | 0.8(1) | 0.0 (0) | 6.7 (1) |
| Past month | 4.8 (6) | 5.4 (6) | 0.0 (0) |
| Past 3 months | 20.6 (26) | 18.9 (21) | 33.3 (5) |
| Past 6 months | 19.8 (25) | 18.0 (20) | 33.3 (5) |
| Before that | 23.8 (30) | 25.2 (28) | 6.7 (2) |
| Never | 30.2 (38) | 32.4 (36) | 13.3 (2) |
| **Aware of normal cholesterol levels?** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 87.3(110) | 85.6 (95) | 100 (15) |
| Correct knowledge | 2.4 (3) | 2.7 (3) | 0.0 (0) |
| Incorrect knowledge | 10.3 (13) | 11.7 (13) | 0.0 (0) |
| **Currently making efforts to lower/maintain cholesterol levels?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 21.4 (27) | 23.4 (26) | 6.7 (1) |
| No | 78.6 (99) | 75.7 (85) | 93.3 (14) |
| **If not, do you feel need to do so?** | **(n=99) % (n)** | **(n=85) % (n)** | **(n=14) % (n)** |
| Yes | 51.5 (51) | 50.6(43) | 64.3 (9) |
| No | 48.5 (48) | 49.4 (42) | 35.7 (5) |

**KAP Regarding Blood Sugar Management & Control**

Majority of the subjects (77%) felt it is 'extremely important' to maintain normal blood sugar levels but only about 21% reported making some kind of effort to lower/maintain their blood sugar levels. Also, just a little more than half the study population (54%) had their most recent blood sugar measurement during past 6 months while the remaining subjects had their blood sugar checked more than 6 months back (27%) or never (19%). Data also revealed that none of them were aware of normal blood sugar levels (Table 4.29).

***Gender Differences***

While nearly 87% of the females enrolled in the study termed maintenance of normal blood sugar level as 'extremely important', only about 27% of them reported making efforts to maintain/lower their blood sugar levels. About 7% of the female subjects had never had their blood sugar tested and none of them knew the correct values for normal blood sugar.

In case of males, more than 75% said that it was 'extremely important' to maintain normal levels of blood sugar. However, less than 1/5th of them (19.8%) made any kind of efforts to maintain/lower their blood sugar. Correct knowledge of normal blood sugar levels was missing in all the male subjects.

| Table 4.29 Knowledge, Attitude, Practices and Perceptions of Subjects Regarding Maintainance of Healthy Blood Sugar Levels (n=126) | | | |
|---|---|---|---|
| | **Total (n=124)** | **Male (n=111)** | **Female (n=15)** |
| **How important is it to maintain normal blood sugar levels?** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 77 (97) | 75.7 (84) | 86.7 (13) |
| Somewhat important | 15.1 (19) | 16.2 (18) | 6.7 (1) |
| Important | 7.9 (10) | 8.1 (9) | 6.7 (1) |
| **Last blood sugar measurement?** | **% (n)** | **% (n)** | **% (n)** |
| Past week | 1.6 (2) | 0.9 (1) | 6.7 (1) |
| Past month | 7.9 (10) | 9.0 (10) | 0.0 (0) |
| Past 3 months | 18.3 (23) | 16.2 (18) | 33.3 (5) |
| Past 6 months | 26.2 (33) | 25.2 (28) | 33.3 (5) |
| Before that | 27 (34) | 27.9 (31) | 20 (3) |
| Never | 19 (24) | 20.7 (23) | 6.7 (1) |
| **Aware of normal blood sugar levels?** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 78.6 (99) | 77.5 (86) | 86.7 (13) |
| Correct knowledge | 0.0 (0) | 0.0 (0) | 0.0 (0) |
| Incorrect knowledge | 21.4 (27) | 22.5 (25) | 13.3 (2) |
| **Currently making efforts to lower/maintain blood sugar levels?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 20.6 (26) | 19.8 (22) | 26.7 (4) |
| No | 79.4 (100) | 80.2 (89) | 73.3 (11) |
| **If not, do you feel need to do so?** | **(n=100) % (n)** | **(n=89) % (n)** | **(n=11) % (n)** |
| Yes | 46 (46) | 46.1 (41) | 45.5 (5) |
| No | 54 (54) | 53.9 (48) | 54.5 (6) |

**KAP Regarding Weight Gain in Adulthood**

Subjects were asked what; according to them were the reasons for weight gain during adulthood. They were asked to choose one or more of the given options. Out of the 5 given options, highest percentage of subjects chose 'desk job requiring little physical activity' (80.9%) followed by 'more availability of junk foods' (38.1%), 'increased use of vehicles for transport' (34.1%), 'more than 2 hours per day spent on TV/computer games & less involvement in outdoor activities' (33.3%) and 'eating out more than 3 times a week' (23.8%).

***Gender Differences***

Similar result were seen when gender based data was studied. Percent responses from males and females respectively were highest for 'desk job requiring little physical activity' (79.3% & 93.3%) followed by 'more availability of junk foods' (36.9% & 46.7%), 'increased use of vehicles for transport' (34.2% & 33.3%), 'more than 2 hours per day spent on TV/computer games & less involvement in outdoor activities' (33.3% & 33.3%), and 'eating out more than 3 times a week' (22.5% & 33.3%). Detailed results have been graphically depicted in Figure 4.4.

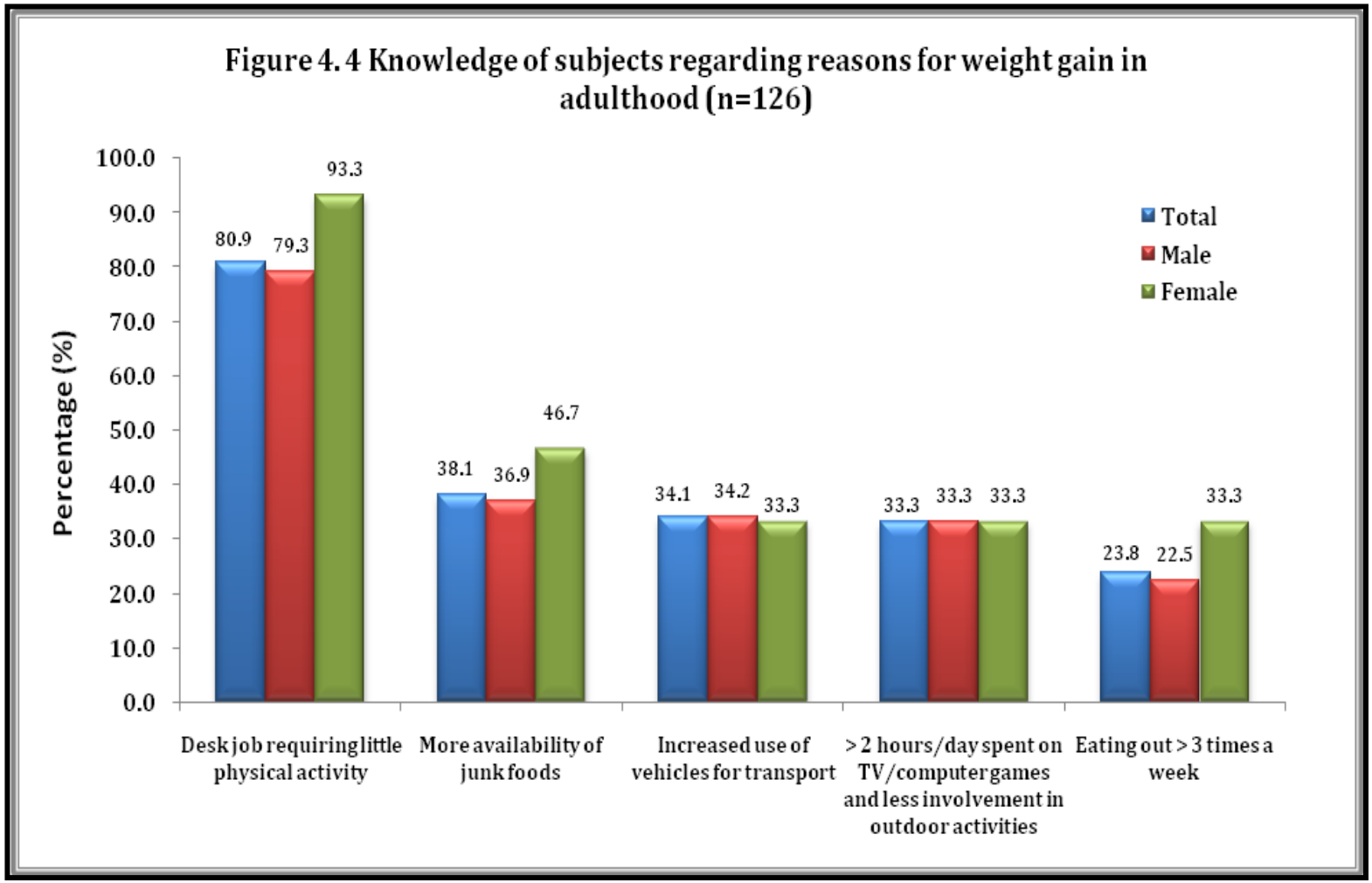


Figure 4. 4 Knowledge of subjects regarding reasons for weight gain in adulthood (n=126)
Percentage (%)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
80.9
79.3
93.3
38.1
36.9
46.7
34.1
34.2
33.3
33.3
33.3
33.3
23.8
22.5
33.3
Total
Male
Female
Desk job requiring little physical activity
More availability of junk foods
Increased use of vehicles for transport
> 2 hours/day spent on TV/computer games and less involvement in outdoor activities
Eating out > 3 times a week

**Practices of subjects regarding Addiction behaviours**

While most of the study population (99.2%), including 99.1% males & 100% females said that according to them it is important to avoid tobacco, 4% (all males) subjects admitted using tobacco in the form of cigarettes. Smoking was the only form in which tobacco was consumed by the study population. A very high percentage (91.9%) of the population was aware of the harm caused of passive smoking and all the people who smoked (100%) said that they avoided smoking in presence of other people. Also, 80% of the subjects who smoked said that they were trying to quit/reduce the amount of smoking.

While 14.3% (16.2% males and 0% females) of the subjects admitted that they consumed alcohol, none of them (0%) who consumed alcohol indulged in binge drinking (i.e. consumption of more than 60 ml per day). Detailed results have been presented in Table 4.30.

**Practices of subjects regarding healthy behaviours**

A large proportion of subjects said that they made efforts to incorporate small changes in their during daily routine to increase physical activity such as taking the stairs instead of using the lift (85.7%), walking to nearby destinations instead of using vehicle (79.4%) and some of them also said that they spent free time indulging in outdoor activities with friends and family instead of watching TV/using computer (47.6%). On asking if they thought that the adoption of these healthy behaviours would positively influence their health, almost all of them (97.6%) replied in the affirmative. Detailed results have been presented in Table 4.30.

As can be seen in Table 4.30, out of all the healthy behaviours listed in the questionnaire, the highest percentage of study population was found to 'avoid/quit/reduce tobacco in any form' (96%). The second most practiced healthy behaviour was found to be less intake of junk foods (83.3%) followed by preference for whole grains and unrefined foods (73.8%), avoidance of heavy meals & having frequent light meals instead (73%), avoiding use of table salt & salt rich, packaged & processed foods (68.3%), (60.3%), eating at least 2-3 bowls of fruits & vegetables each daily (60.3%) avoiding stress by methods such as yoga, meditation etc. (49.2%) and at least 30 minutes of physical activity per day (37.3%), checking weight, B.P., cholesterol and blood sugar regularly.

| Table 4.30 Knowledge, Attitude, Practices and Perceptions of Subjects Regarding Tobacco and Alcohol Consumption (n=126) | | | |
|---|---|---|---|
| | **Total (n=126)** | **Male (n=111)** | **Female (n=15)** |
| **Taking tobacco in any form?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 4.0 (5) | 4.5 (5) | 0.0 (0) |
| No | 96.0 (121) | 95.5 (106) | 100 (15) |
| **Do you think it is important to avoid tobacco?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 99.2 (125) | 99.1 (110) | 100 (15) |
| No | 0.8 (1) | 0.9 (1) | 0.0 (0) |
| **Aware about harm caused by passive smoking?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 90.5 (114) | 91.9 (102) | 80.0 (12) |
| No | 9.5 (12) | 8.1 (9) | 20.0 (3) |
| **If you are a smoker;** | **(n=5)** | **(n=5)** | **(n=0)** |
| **Are you trying to reduce amount?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 80.0 (4) | 80.0 (4) | - |
| No | 20.0 (1) | 20.0 (1) | - |
| **Do you make sure that you smoke only when no one else is around?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 100 (5) | 100 (5) | - |
| No | 0.0 (0) | 0.0 (0) | - |
| **Consuming alcohol?** | **(n=126) % (n)** | **(n=111) % (n)** | **(n=0) % (n)** |
| Yes | 14.3 (18) | 16.2 (18) | 0.0 (0) |
| No | 85.7 (108) | 83.8 (93) | 100 (15) |
| | **(n=18) % (n)** | **(n=18) % (n)** | **(n=0) % (n)** |
| If consuming alcohol, avoid binge drinking, avoid taking more than 60 ml/day | 100 (18) | 100 (18) | - |

| Table 4.31 Percent Prevalence of Healthy Practices among the Subjects (n=126) | | | |
|---|---|---|---|
| | **Total (n=126)** | **Male (n=111)** | **Female (n=15)** |
| **Making efforts to increase physical activity in small ways** | **% (n)** | **% (n)** | **% (n)** |
| Climbing stairs instead of lift | 85.7 (108) | 90.1 (100) | 53.3 (8) |
| Walk to nearby destinations instead of vehicle | 79.4 (100) | 81.1 (90) | 66.7 (10) |
| Spend free time in outdoor sports instead of using TV/computer | 47.6 (60) | 51.4 (57) | 20 (3) |
| **Do you think that these behaviours will positively influence your health?** | **% (n)** | **% (n)** | **% (n)** |
| Yes | 97.6 (123) | 97.3 (108) | 100 (15) |
| No | 2.4 (3) | 2.7 (3) | 0.0 (0) |
| **Which of the following practices do you follow to decrease chances of developing NCDs?** | **% (n)** | **% (n)** | **% (n)** |
| Avoiding / quitting / reducing tobacco in any form (paan, gutka, padiki, inhalation, smoking etc.) | 96 (121) | 95.5 (106) | 100 (15) |
| Less intake of junk foods like pizzas, pastries, Indian Mithai, puffs & bakery products, fried foods including fried savories, aerated drinks, sugary syrups & squashes (not more than once a week) | 83.3 (105) | 84.7 (94) | 73.3 (11) |
| Prefer to eat whole grain foods rather than refined foods : Fruits instead of Fruit juice, Atta bread (Brown bread)/ Mix grain bread instead of maida bread, multi grain atta instead of wheat flour | 73.8 (93) | 73.0 (81) | 80.0 (12) |
| Avoiding heavy meals & consuming small frequent meals instead | 73.0 (92) | 73.9 (82) | 66.7 (10) |
| Avoiding use of Table salt, avoid eating packaged and processed foods, namkeens | 68.3 (86) | 69.4 (77) | 60 (9) |
| Checking your weight & blood pressure regularly (once/month), lipid profile & blood sugar (once/year) | 60.3 (76) | 63.1 (70) | 40 (6) |
| Taking at least 2-3 bowls of fruits & 2-3 cups of vegetables daily | 60.3 (76) | 60.4 (67) | 60 (9) |
| Avoiding stress (by meditation, yoga etc.) | 49.2 (62) | 48.6 (54) | 53.3 (8) |
| Engaging in at least 30 minutes of physical activity daily which slightly increases your heart rate | 37.3 (47) | 38.7 (43) | 26.7 (4) |

**Comparison between self-reported and actual practice of subjects**

Although 37.3% subjects claimed to be indulging in at least 30 minutes of MIE (Moderate Intensity Exercise) on a daily basis, the information collected from these subjects during STEP 1 revealed that only 24.5% of them were actually 'physically active' as per physical activity guidelines for Asians (Consensus for Asians 2009). Similarly, while 60.3% subjects said that they consumed at least 4-6 bowls of fruits & vegetables, according to detailed fruit & vegetable intake survey conducted in STEP 1, none of them actually met the criteria for recommended fruit & vegetable intake i.e. >400 gm/day (Dietary Guidelines for Indians – A Manual. NIN, Hyderabad – 1998, reprint 2007). Data regarding this has been presented in Table 4.32.

| Table 4.32 Self-Reported v/s Actual Prevalence of Healthy Practices among the Subjects (n=126) | | | |
|---|---|---|---|
| | **Total (n=126) % (n)** | **Males (n=111) % (n)** | **Females (n=15) % (n)** |
| **Physical Activity** | | | |
| Self –reported | 37.3 (47) | 38.7 (43) | 26.7 (4) |
| Actual prevalence | 24.2 (30) | 25.7 (28) | 13.4 (2) |
| **Adequate fruit & vegetable intake** | | | |
| Self –reported | 60.3 (76) | 60.4 (67) | 60 (9) |
| Actual prevalence | 0.0 (0) | 0.0 (0) | 0.0 (0) |

**SUMMARY**

- About 18% of the 'at risk' subjects and 49.5% of those not 'at risk' participated in the nutrition health promotion programme.
- Nearly 64% subjects said it is 'extremely important' to maintain normal weight.
- About 57% of population had their last weight measurement in past week/month while 3.2% said that their last weight measurement was more than 6 months back.
- Nearly 35% had never tried to find their ideal body weight.
- Almost 99% subjects had incorrect/no knowledge about normal BMI values.
- About 97% of the population had incorrect/no information about BMI formula.
- A little less than half the population (47.6%) currently made no efforts to lose/maintain weight and 71.6% of these subjects felt a need to do so.
- Nearly 89% of the subjects said it is 'extremely important' to maintain normal B.P.
- Almost 22% had their last B.P. measurement during past week/month while 3.8% said that they had never gotten their B.P. measured.
- A large majority (87.3%) had incorrect or no knowledge of normal B.P. values.
- Only 19% were reportedly making efforts to maintain/lower their B.P. levels and out of those who did not make any such efforts, 49% felt the need to do so.
- Nearly 69% subjects said it is 'extremely important' to maintain normal cholesterol levels.
- Less than half of the population (46%) had their last lipid profile measurement during past 6 months while 30.2% had never gotten their cholesterol checked.
- Almost 98% of the population had incorrect/no knowledge about normal levels of serum cholesterol.
- Nearly 79% were currently making no efforts for maintenance/lowering of cholesterol and out of these, 51.5% felt the need to do so.
- A majority of the subjects (77%) said it is 'extremely important' to maintain normal blood sugar levels.
- A little over half of the population (54%) had their last lipid profile measurement during past 6 months while 19% had never gotten their blood sugar tested.
- None of the study subjects had correct knowledge about normal levels of blood sugar.
- Nearly 80% were currently making no efforts for maintenance/lowering of blood sugar and out of these, 46% felt the need to do so.
- Maximum subjects (80.9%) thought 'desk jobs with little physical activity' caused weight gain in adulthood, followed by 'more availability of junk foods' (38.1%), 'increased use of vehicles

for transport' (34.1%), '> 2 hours per day spent on TV/computer games & less involvement in outdoor activities' (33.3%), and 'eating out more than 3 times a week' (23.8%).

- Most subjects (96%) avoided all forms of tobacco.
- Majority of the smokers (80%) said they were trying to cut down/quit smoking.
- Less than 1% of the population felt it was not necessary to avoid tobacco.
- Majority of the subjects (90.5%) were aware of the dangers of passive smoking and all of them said that they avoided smoking in presence of others.
- None of the subjects who consumed alcohol indulged in binge drinking.
- Highest adherence among all healthy practices was for avoided tobacco consumption (94.4%), followed by less consumption of junk foods (83.3%), eating whole grain foods and avoiding refined foods (73.8%), having small & frequent meals (73%), avoiding table salt & processed foods (68.3%), checking vital health parameters regularly (60.3%), adequate fruit & vegetable intake (60.3%), avoiding stress by meditation or yoga (49.2%) and doing regular physical activity (37.3%).
- Nearly 86% took stairs instead of lift, 79.4% walked (instead of using vehicles) to nearby destinations and 47.6% spent free time in outdoor activities instead of watching the TV or using computer.
- The belief that these healthy behaviors would help them become healthier was almost universal (97.6%).
- There was considerable difference between self-reported prevalence and actual prevalence of physical activity status (37.3% v/s 24.2%) and adequate fruit & vegetable intake (60.3% v/s 0%) among the study population.

**DISCUSSION**

The Knowledge Attitude and Practices (KAP) of the study population regarding vital health parameters were assessed and are presented in this phase. Looking at the KAP of subjects regarding healthy weight, it was seen that while majority of them (64%) gave utmost importance to the maintenance of healthy weight, the corresponding knowledge (normal BMI values and correct formula for BMI) and practices (checking weight regularly and making efforts to maintain/lose weight) regarding the same were less than adequate. The same trend was observed repeatedly when the KAP regarding blood pressure, blood sugar and cholesterol was assessed. Earlier studies conducted in urban India report similar inadequate knowledge and practices regarding NCDs, their risk factors and the inter relationship of the two. A study conducted in Chennai, India (urban area) reported that out of all the free living subjects that were enrolled in the study, 25% were unaware of the presence of a condition called 'Diabetes'. About 22% of the entire study population and 41% of the diabetics in the study were aware that diabetes was preventable. A very small percentage (12%) of the study population was aware of the role of obesity and physical inactivity in development of diabetes and less than 20% knew that diabetes can cause further health complications (Mohan et al 2005).

It can be deduced from the findings of the present study that the study population, in addition to having poor knowledge about the various health related topics such as BMI formula, normal levels of BMI, cholesterol and blood sugar were largely apathetic about their health status. Most of them did not bother to get their vital health parameters checked regularly and as a result, many were unaware of their blood sugar levels or cholesterol values, never having had them measured.

While individuals who are currently not suffering from NCDs should also be equipped with knowledge about them, literature shows that even those already suffering from NCDs such as high blood pressure and diabetes are unaware of the complications of their disease. A study conducted on hypertensive subjects to assess knowledge about hypertension among them found that a significant proportion of hypertensive patients have poor knowledge about hypertension. About 10% of them could define hypertension, 76% knew about the role of salt in hypertension and just 6% were aware of the complications caused by uncontrolled hypertension (Shaikh et al 2012). In a study conducted on diabetics in Saurashtra region of Gujarat, knowledge regarding pathophysiology of diabetes was found to be present in less than half (46%) of the diabetic subjects while 50% knew about the secondary complications of diabetes (Shah et al 2009). Vaidya et al conducted a study on a free living population of an semi-urban community of Nepal in 2013 to know the KAP of subjects regarding cardiovascular health and found that subjects

showed poor knowledge of heart disease causes; 11% identified overweight and obesity as causes of heart diseases while only 2.2% thought that high blood pressure also plays a contributing role in development of heart diseases.

In the present study, it was reassuring to see that most of the subjects identified tobacco consumption as a major health risk and avoided it while a large number of those who smoked were trying to cut down or quit. It was also encouraging to know that most of them were aware of the dangers of passive smoking and made it a point to avoid smoking in presence of other people. These findings are in keeping with the results of a study conducted in Delhi on free living subjects (30+ years) where a majority of the subjects who were surveyed (64%) were aware of the hazards of smoking. Additionally, 25% of those who smoked had quit due to health problems (Garg et al 2012). Thus, in case of smoking, a large majority exhibited awareness as well as followed a 'no smoking' policy but this cannot be attributed 100% to the awareness levels among them. The industry's strict "no smoking on premises" rule plays an important role here in discouraging employees from smoking during working hours which comprise a large part of their day (7-8 hours). The low incidence of smoking and alcohol in the presence of rules prohibiting them clearly indicates that strict, documented policies go a long way in shaping the habits and behaviours of the population.

Data also revealed that self-reported prevalence of healthy practices among the study population was clearly exaggerated, as proved by the supporting anthropometric and biophysical data. Either of the following two deductions can be made based on this. Either the subjects presented a false healthy profile about themselves in order to appear health conscious. Another hypothesis is that the subjects perceived their current behaviour as healthy and thus reported so, while it was not actually the case. For example, a subject might be going for a 30 minute walk on a daily basis and might thus consider himself/herself as being physically active but in reality, the walk would not be strenuous enough to be considered as 'physical activity'.

This insufficiency in the knowledge regarding preventive as well as curative aspects of NCDs such as high blood pressure and diabetes is worrisome, considering the fact that the most efficient way of managing these diseases and thus averting future complications is their timely identification and opportune treatment and management. Failure to do so enhances the vulnerability for development of NCD in those at risk and occurrence of secondary complications among those who are already suffering from an NCD. It is thus imperative to ensure that awareness is spread among the population at large in order to empower individuals to become healthier and thus curb further spread of NCDs by timely management and treatment of risk factors by early identification and rectification of unhealthy behaviours and faulty diet patterns.

## PHASE 5

## IMPACT OF NUTRITION HEALTH PROMOTION PROGRAMME IN THE WORKPLACE SETTING

Post intervention data regarding STEP 1 and STEP 2 as well as KAP was collected at the end of the 6 month intervention period. Data in this phase represents comparison between baseline and post intervention information of those subjects who completed the study. When feedback regarding the Nutrition Health Promotion Programme was collected from these subjects, the following highlights emerged:

- Every subject said that they had read the posters which had been put up in the premises.
- Point-of-Decision prompts which were put up on the premises at strategic locations (near lifts and as table mats to be used during meals) were noticed and read by all the employees who came for the post intervention data collection.

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Vital Healthy Parameters***

The knowledge and attitude of subjects was assessed after intervention and compared to the responses received at baseline (before intervention) to see if some differences existed in their knowledge, attitudes and practices as a result of the intervention (Table 4.33).

At baseline, the knowledge of the subjects was already y good i.e. all subjects said that it was 'extremely important' to maintain vital health parameters which remained so after intervention also. Also, at baseline itself, majority subjects termed maintainance of healthy weight as 'extremely important' (65%) which further increased to 88% after intervention. Data also showed a rise in people who knew the correct BMI values by the end of the study (1.2% v/s 13.2%). Also, compared to 1.2% of subjects who knew the correct BMI formula at baseline, after the health promotion programme, 21.7% were able to give the correct formula for BMI. There was also an appreciable rise in the percentage of subjects who reportedly made efforts to maintain/lose weight (57.8% v/s 72.3%).

***Gender Differences***

The trend seen in the total population was more or less same across genders too. Male subjects showed improvement in knowledge about normal BMI values (1.4% v/s 11.1%) as well as correct BMI formula (1.4% to 18.1%). There was also an appreciable rise in the percentage of males who reportedly made efforts to lose/maintain their weight (58.3% to 75%).

With respect to female population under study, there was a considerable rise in the percentage of females who had correct knowledge of normal BMI values (0% v/s 27.3%) as well as those who could correctly write the formula for BMI (0% to 45.5%). However, there was no change in the percentage of women who reportedly made efforts to lose/maintain weight after the intervention, as compared to baseline. The data is presented in Table 4.33.

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge of Subjects Regarding the Reasons for Weight Gain in Adulthood***

The percent prevalence of subjects citing various reasons for weight gain in adulthood (before & after intervention) was calculated and is summarized in Table 4.34. The highest percent improvement was in subjects citing eating out frequently as a reason for weight gain in adulthood (55.3%) followed by increased use of vehicles (50.9%), watching TV/computer (43.8%), increased intake of junk foods (43.5%) and desk jobs (15.2%). A large majority of subjects cited desk jobs as a reason at baseline itself (80.7%). Therefore, in spite of the lower percent increase in this, the prevalence became almost universal by the end of the study.

***Gender Differences***

In males, highest percentage increase was in subjects who cited more availability of junk food (37.5%) and eating out frequently (37.4%) as reasons for weight gain, followed by increased use of vehicle (31.9%), more time spent on TV (29.2%) and desk job (16.7%). Compared to baseline, 45.4% more females said increased use of vehicles caused weight gain. Percent increase in subjects who said frequent eating out and more time on TV led to weight gain was 36.3% and after intervention, 27.2% more females said that higher junk food availability led to increase in weight. Desk job was cited by all women as a cause before and after the intervention was given.

| Table 4.33 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Vital Healthy Parameters (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total (n=83)** | | **Male (n=72)** | | **Female (n=11)** | |
| | **Before** | **After** | **Before** | **After** | **Before** | **After** |
| | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| **Important to maintain weight, B.P., Cholesterol & Blood Sugar?** | 100 (83) | 100 (83) | 100 (72) | 100 (72) | 100 (11) | 100 (11) |
| **How important is it to maintain normal weight?** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 65.1 (54) | 88.0 (73) | 63.9 (46) | 86.1 (62) | 72.7 (8) | 100 (11) |
| Somewhat important | 18.1 (15) | 6.0 (5) | 19.4 (14) | 6.9 (5) | 9.1 (1) | 0.0 (0) |
| Important | 16.9 (14) | 6.0 (5) | 16.7 (12) | 6.9 (5) | 18.2 (2) | 0.0 (0) |
| **Tried to find out ideal body weight** | 67.5 (56) | 90.4 (75) | 69.4 (50) | 90.3 (65) | 54.4 (6) | 90.9 (10) |
| **Knowledge of normal BMI** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 78.3 (65) | 69.9 (58) | 77.8 (56) | 70.8 (51) | 81.8 (9) | 63.6 (7) |
| Correct knowledge | 1.2 (1) | 13.2 (11) | 1.4 (1) | 11.1 (8) | 0.0 (0) | 27.3 (3) |
| Incorrect knowledge | 20.5 (17) | 16.9 (14) | 20.8 (15) | 18,.1 (13) | 18.2 (2) | 9.1 (1) |
| **Aware of correct BMI formula** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 87.9 (73) | 78.3 (65) | 86.1 (62) | 81.9 (59) | 100 (11) | 54.4 (6) |
| Correct knowledge | 1.2 (1) | 21.7 (18) | 1.4 (1) | 18.1 (13) | 0.0 (0) | 45.5 (5) |
| Incorrect knowledge | 10.8 (9) | 0.0 (0) | 12.5 (9) | 0.0 (0) | 0.0 (0) | 0.0 (0) |
| **Making efforts to lose/maintain weight** | 57.8 (48) | 72.3 (60) | 58.3 (42) | 75 (54) | 54.4 (6) | 54.4 (6) |

| Table 4.34 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge of Subjects Regarding the Reasons for Weight Gain in Adulthood (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total** | | **Males** | | **Females** | |
| | **Before (n=83) % (n)** | **After (n=83) % (n)** | **Before (n=72) % (n)** | **After (n=72) % (n)** | **Before (n=11) % (n)** | **After (n=11) % (n)** |
| **Reasons for weight gain in adulthood** | | | | | | |
| Eating out > 3 times/week | 30.1 (25) | 67.5 (56) | 30.6 (22) | 68 (49) | 27.3 (3) | 63.6 (7) |
| Increased use of vehicles for transport | 32.5 (27) | 66.3 (55) | 33.4 (24) | 65.3 (47) | 27.3 (3) | 72.7 (8) |
| > 2 hrs/day spent on TV/comp. games & less involvement in outdoor activities | 38.6 (32) | 68.7 (57) | 38.9 (28) | 68.1 (49) | 36.4 (4) | 72.7 (8) |
| More availability of junk foods | 47.0 (39) | 83.1 (69) | 47.2 (34) | 84.7 (61) | 45.5 (5) | 72.7 (8) |
| Desk job requiring very little Physical activity | 80.7 (67) | 95.2 (79) | 77.8 (56) | 94.5 (68) | 100 (11) | 100 (11) |

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Healthy Blood Pressure Levels***

Table 4.35 contains data regarding Knowledge, Attitude & Practices of subjects with respect to B.P. As can be seen from the data, at baseline itself, majority of the subjects (84.3%) were aware of the need to maintain blood pressure which became almost universal (94%) after intervention. However, regarding the normal B.P. values, very few subjects (14.3%) at baseline were aware which increased to 39.7% after intervention. Also, when it came to changing practices or making efforts to reduce B.P., the change from baseline (18.1%) was 42.3%. This also suggests that consistent and continuous efforts in the form of health promotion are necessary to change practice levels of subjects.

***Gender Difference***

Data shows that higher percentage of male subjects termed maintaining normal B.P. as 'extremely important' after intervention as compared to baseline (86.1% v/s 93.1%). Compared to baseline where only 13.9% males were aware of normal B.P., a much higher percentage (36.1%) exhibited correct knowledge about it after the intervention period. There was also an increase in the percentage of males who reportedly made efforts to maintain normal blood pressure (20.8% v/s 36.1%).

As compared to baseline, higher percentage of females (72.7% v/s 100%) termed maintaining normal B.P. as 'extremely important'. Also, there was an increase in the percentage of female subjects who knew normal blood pressure values (18.2% v/s 63.6%). However, when it came to practice, none of the females reportedly made any efforts to maintain their B.P.

| Table 4.35 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Healthy Blood Pressure Levels (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total (n=83)** | | **Male (n=72)** | | **Female (n=11)** | |
| **How important is it to maintain normal blood pressure?** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 84.3 (70) | 94.0 (78) | 86.1 (62) | 93.1 (67) | 72.7 (8) | 100 (11) |
| Somewhat important | 7.2 (6) | 3.6 (3) | 6.9 (5) | 4.2 (3) | 9.1 (1) | 0.0 (0) |
| Important | 8.4 (7) | 2.4 (2) | 6.9 (5) | 2.8 (2) | 18.2 (2) | 0.0 (0) |
| **Aware of normal B.P. levels** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Does not know | 49.4 (41) | 48.2 (40) | 51.4 (37) | 52.8 (83) | 36.4 (4) | 18.2 (2) |
| Correct knowledge | 14.4 (12) | 39.7 (33) | 13.9 (10) | 36.1 (26) | 18.2 (2) | 63.6 (7) |
| Incorrect knowledge | 36.1 (30) | 12.0 (10) | 5.6 (4) | 11.1 (8) | 45.5 (5) | 18.2 (2) |
| **Making efforts to lower/maintain B.P.** | 18.1 (15) | 31.3 (26) | 20.8 (15) | 36.1 (26) | 0.0 (0) | 0.0 (0) |

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Healthy Cholesterol Levels i.e. Lipid Profile***

Following the earlier trend, in case of lipid profile also, a sizeable increase was found in the percentage of subjects considering maintenance of normal cholesterol levels as 'extremely important' (68.7% v/s 91.6%). None of the subjects had correct knowledge about normal cholesterol levels prior to intervention. However, 4.8% of them were able to reply correctly when asked about the normal levels of serum cholesterol at the end of the intervention. It was also encouraging to see that as compared to baseline where only 21.7% of the subjects said that they were making efforts to maintain their cholesterol levels, the percentage rose to 41% after intervention period. Data has been shown in Table 4.36.

***Gender Differences***

When gender differences were looked at, data of male subjects showed that there was an increase in percentage of males who termed maintaining cholesterol as 'extremely important' (69.4% v/s 90.3%) as well as those who knew the normal values for cholesterol (0% v/s 4.2%). The percentage of males who reportedly made efforts to lower/maintain their cholesterol levels almost doubled after the intervention period (23.6% v/s 41.7%)

As compared to baseline where 63.6% of females said that maintaining cholesterol was 'extremely important', after intervention, all female subjects (100%) said so. Also, while none of the females were aware of normal cholesterol levels at baseline, 9.1% became aware of it after intervention. However, when it came to practice, there was no change in the percentage of females making efforts to maintain/lower their cholesterol (9.1%).

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Healthy Blood Sugar Levels***

As can be seen from the data presented in Table 4.37, compared to 73.5% subjects who said that maintaining normal blood sugar was 'extremely important' before the intervention, 91.6% said so after the intervention. While none of the subjects were able to correctly answer the question about normal blood sugar values before intervention was given, 3.6% were able to correctly state the normal blood sugar values when post-intervention data was collected. Data also indicated a rise in the self-reported prevalence of subjects who were making efforts to maintain/lower blood sugar rose from 18.1% to 28.9% in case of total population.

***Gender Differences***

Looking at the data of male population before and after intervention, it can be seen that there was an appreciable rise in the percentage of males who termed maintaining normal blood sugar as 'extremely important' (73.6% v/s 90.3%). While none of the male subjects could correctly state normal blood sugar values at baseline, 4.2% of them were able to do so after intervention. With respect to practices for maintaining normal blood sugar, there was an increase in the self-reported prevalence of the same among males (18.1% to 30.6%).

While the percentage of females who gave utmost importance to maintainance of normal blood sugar as 'extremely important' increased (72.7% v/s 90.3%), none of the females were aware of normal blood sugar values before or after the intervention and none of them made any efforts for maintaining normal blood sugar before or after the intervention period. Data is presented in Table 4.37.

| Table 4.36 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Healthy Cholesterol Levels i.e. Lipid Profile (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total (n=83)** | | **Male (n=72)** | | **Female (n=11)** | |
| **How important is it to maintain normal cholesterol?** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 68.7 (57) | 91.6 (76) | 69.4 (50) | 90.3 (65) | 63.6 (7) | 100 (11) |
| Somewhat important | 18.1 (15) | 6.0 (5) | 18.1 (13) | 6.9 (5) | 18.2 (2) | 0.0 (0) |
| Important | 13.3 (11) | 2.4 (2) | 12.5 (9) | 2.8 (2) | 18.2 (2) | 0.0 (0) |
| **Aware of normal cholesterol levels** | **% (n)** | **% (n)** | | | | |
| Does not know | 91.6 (76) | 92.8 (77) | 90.3 (65) | 93.1 (67) | 100 (0) | 90.9 (10) |
| Correct knowledge | 0.0 (0) | 4.8 (4) | 0.0 (0) | 4.2 (3) | 0.0 (0) | 9.1 (1) |
| Incorrect knowledge | 8.4 (7) | 2.4 (2) | 9.7 (7) | 2.8 (2) | 0.0 (0) | 0.0 (0) |
| **Making efforts to maintain cholesterol** | 21.7 (18) | 41.0 (34) | 23.6 (17) | 41.7 (30) | 9.1 (1) | 9.1 (1) |

| Table 4.37 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Maintainance of Healthy Blood Sugar Levels (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total (n=83)** | | **Male (n=72)** | | **Female (n=11)** | |
| **How important is it to maintain normal blood sugar?** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** | **% (n)** |
| Extremely important | 73.5 (61) | 91.6 (76) | 73.6 (53) | 90.3 (65) | 72.7 (8) | 100 (11) |
| Somewhat important | 16.9 (14) | 6.0 (5) | 18.1 (13) | 6.9 (5) | 9.1 (1) | 0.0 (0) |
| Important | 9.6 (8) | 2.4 (2) | 8.3 (6) | 2.8 (2) | 18.2 (2) | 0.0 (0) |
| **Aware of normal blood sugar levels** | **% (n)** | **% (n)** | | | | |
| Does not know | 83.1 (69) | 90.4 (75) | 81.9 (59) | 91.7 (66) | 90.9 (10) | 81.8 (9) |
| Correct knowledge | 0.0 (0) | 3.6 (3) | 0.0 (0) | 4.2 (3) | 0.0 (0) | 0.0 (0) |
| Incorrect knowledge | 16.9 (14) | 6.0 (5) | 18.1 (13) | 4.2 (3) | 9.1 (1) | 18.2 (2) |
| **Making efforts to maintain Blood Sugar** | 18.1 (15) | 28.9 (24) | 18.1 (13) | 30.6 (22) | 18.2 (2) | 18.2 (2) |

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Tobacco Consumption***

The smoking and alcohol consumption pattern as well as awareness about their harmful effects was assessed among the study population before and after conducting intervention (Table 4.38). While 7.2% subjects smoked prior to intervention, 3.6% continued to do so even at the end of the study. The knowledge about the harms of passive smoking and the need to avoid tobacco was very good in the study subjects at baseline itself (91.6% and 98.8% respectively).

***Impact of Nutrition Health Promotion Programme Intervention on the Knowledge and Perception of Subjects Regarding Healthy Diet & Lifestyle Behaviours***

When the efforts made by subjects to remain healthy (before and after intervention) were compared (Table 4.39), it was seen that there was appreciable increase in the self-reported prevalence of subjects using the stairs instead of lift (83.1% v/s 100%), walking to nearby destinations instead of using vehicle (85.5% v/s 96.4%) and spending free time in outdoor sports instead of watching TV/ using the computer (47% v/s 61.4%). All the subjects maintained their opinion that these small changes would positively influence their health.

There was also a noticeable increase in the percentage of subjects who avoided/quit/reduced their tobacco intake (91.6% to 98.8%), reduced intake of junk foods (83.1% to 91.6%), had frequent, light meals (74.7% to 91.6%), preferred whole grains & high fibre foods (74.7% to 84.3%), avoided excess use of salt (68.7% to 84.3%), exercised (MIE) for at least 30 minutes per day (26.5% to 33.7%), checked their weight, B.P., blood sugar & cholesterol regularly (54.2% to 74.7%), consumed 4-6 bowls (at least 400 gm per day) of fruits & vegetables daily (57.8% to 72.3%) and used methods such as yoga & meditation to avoid stress (51.8% to 63.9%).

| Table 4.38 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge, Attitude and Practices of Subjects Regarding Tobacco Consumption (n=83) | | |
|---|---|---|
| | **Before (n=83)** | **After (n=83)** |
| **Taking tobacco in any form?** | | |
| Yes | 7.2 (6) | 3.6 (3) |
| **Do you think it is important to avoid tobacco?** | | |
| Yes | 98.8 (82) | 100 (83) |
| **Aware about harm caused by passive smoking?** | | |
| Yes | 91.6 (76) | 100 (83) |
| **If smoking ;** | (n=7) | (n=3) |
| Are you trying to reduce amount? | 28.6 (2) | 0.0 (0) |
| Make sure that you smoke when no one is around? | 57.1 (4) | 0.0 (0) |
| | **n = 11** | **n = 11** |
| If consuming alcohol, avoid binge drinking. Avoid taking more than 30 - 60 ml of alcohol/day | 100 (0) | 100 (0) |

| Table 4.39 Impact of Nutrition Health Promotion Programme Intervention on the Knowledge and Perception of Subjects Regarding Healthy Diet & Lifestyle Behaviours (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | **Total** | | **Males** | | **Females** | |
| | **Before (n=83) % (n)** | **After (n=83) % (n)** | **Before (n=72) % (n)** | **After (n=72) % (n)** | **Before (n=11) % (n)** | **After (n=11) % (n)** |
| **Making efforts to increase PA in small ways** | | | | | | |
| Climbing stairs instead of lift | 83.1 (69) | 100 (83) | 88.9 (64) | 100 (72) | 45.5 (5) | 100 (11) |
| Walk to nearby destinations instead of using vehicle | 85.5 (71) | 96.4 (80) | 88.9 (64) | 97.2 (70) | 63.6 (7) | 90.9 (10) |
| Spend free time in outdoor sports instead of using TV/computer | 47.0 (39) | 61.4 (51) | 51.4 (37) | 63.9 (46) | 18.2 (2) | 45.5 (5) |
| **Do you think that these behaviours will positively influence your health?** | | | | | | |
| Yes | 100 (83) | 100 (83) | 72 (100) | 72 (100) | 100 (11) | 100 (11) |
| **Which of the following practices are followed by you to decrease chances of developing NCDs?** | **Total** | | **Males** | | **Females** | |
| | **Before (n=83) % (n)** | **After (n=83) % (n)** | **Before (n=72) % (n)** | **After (n=72) % (n)** | **Before (n=11) % (n)** | **After (n=11) % (n)** |
| Avoiding / quitting / reducing tobacco in any form (paan, gutka, padiki, inhalation, smoking etc.) | 91.6 (76) | 98.8 (82) | 90.3 (65) | 98.6 (71) | 100 (11) | 100 (11) |
| Less intake of junk foods like pizzas, pastries, Indian Mithai, puffs & bakery products, fried foods including fried savouries, aerated drinks, sugary syrups & squashes (not more than once a week) | 83.1 (69) | 91.6 (76) | 83.4 (60) | 93 (67) | 81.8 (9) | 81.8 (9) |
| Avoiding heavy meals & consuming small frequent meals instead | 74.7 (62) | 91.6 (76) | 76.4 (55) | 90.3 (65) | 63.6 (7) | 100 (11) |
| Prefer to eat whole grain foods over refined foods : Fruits instead of Fruit juice, Atta bread / Mix grain bread instead of maida bread, multi grain atta instead of wheat flour | 74.7 (62) | 84.3 (70) | 73.6 (53) | 84.7 (61) | 81.8 (9) | 81.8 (9) |
| Avoiding use of Table salt, avoid eating packaged and processed foods, namkeens | 68.7 (57) | 84.3 (70) | 68.1 (49) | 81.9 (59) | 72.7 (8) | 100 (11) |
| Engaging in at least 30 min. of physical activity daily which slightly increases your heart rate | 26.5 (22) | 33.7 (28) | 29.1 (21) | 37.5 (27) | 9.1 (1) | 9.1 (1) |
| Checking weight & blood pressure regularly (once a month), lipid profile & blood sugar (once a year) | 54.2 (45) | 74.7 (62) | 56.9 (41) | 72.2 (52) | 36.4 (4) | 90.9 (10) |
| Taking at least 2-3 bowls of fruits & 2-3 cups of vegetables daily | 57.8 (48) | 72.3 (60) | 59.7 (43) | 69.5 (50) | 45.5 (5) | 90.9 (10) |
| Avoiding stress (by meditation, yoga etc.) | 51.8 (43) | 63.9 (53) | 52.8 (38) | 62.5 (45) | 45.5 (5) | 72.7 (8) |

***Gender Differences***

The gender based data showed that more males than females made efforts to increase their physical activity in day to day routine. Consequently, the percent increase in female subjects who started making these efforts was more since their baseline percentages were lower.

There was highest increase in percentage of females who started using stairs instead of lift (54.5%), followed by those who opted to walk to nearby destinations instead of using their vehicles (27.3%) and those who started spending free time in outdoor activities rather than on computer and TV. In case of male subjects, highest rise was in percentage of men who spent their leisure time on outdoor activities (12.5%), followed by those who chose the stairs over the lift (11%) and those who walked over to nearby places instead of using vehicle (8.3%). However, the male population showed higher percentage prevalence of these at baseline itself which accounts for the low percent increase post intervention.

With respect to following of healthy practices which would prevent NCDs, improvement in both male and female subjects mirrored the trends seen in the overall population. Highest improvement was in avoiding tobacco, junk food and heavy meals, followed by increasing preference for whole grains and fibre rich foods, avoiding table salt, exercising regularly, checking weight and blood pressure regularly and eating at least 4 servings of fruits and vegetables daily. The results have been elaborated in Table 4.39.

***Improvement in Knowledge, Attitude, Practice & Perception Scores among the Study Population after the Intervention Period***

In order to get an idea about the improvement in the overall knowledge, attitude, perception and practice scores of the subjects, as assessed by the KAP questionnaire in the present study were calculated as per the criteria presented in Table 4.40, 4.41, 4.42 and 4.43.

Pre-post comparison was then done for these scores; the data for which has been presented in Table 4.44. It can be seen from the results that there was very highly significant improvement in the average knowledge, perception and practice scores of the subjects after the intervention, as compared to baseline ($p<0.001$). With regards to scores on questions assessing the attitude of subjects, chi-square test was applied and it was found that, as compared to baseline where 67.5% of subjects answered both questions correctly, after intervention a much higher percentage (90.4%) were able to do so. This improvement was found to be statistically significant ($p<0.001$).

| Table 4.40 Scoring Method used for Knowledge Scores of Subjects Before and After Intervention (maximum score=6) | | | |
|---|---|---|---|
| **Q. no.** | **KNOWLEDGE Questions** | **Answer** | **Score** |
| 3 | What should be your normal BMI? | Correct | 1 |
| | | Incorrect/ Don't know | 0 |
| 4 | What should be your normal blood pressure? | Correct | 1 |
| | | Incorrect/ Don't know | 0 |
| 5 | What should be your normal blood glucose levels? | Correct | 1 |
| | | Incorrect/ Don't know | 0 |
| 6 | What should be your normal cholesterol levels? | Correct | 1 |
| | | Incorrect/ Don't know | 0 |
| 7 | What is the formula to calculate BMI? | Correct | 1 |
| | | Incorrect/ Don't know | 0 |
| 18 | Aware of the dangers of passive smoking? | Yes | 1 |
| | | No | 0 |

| Table 4.41 Scoring Method used for Attitude Scores of Subjects Before and After Intervention (maximum score=2) | | | |
|---|---|---|---|
| **Q. no.** | **ATTITUDE Questions** | **Answer** | **Score** |
| 2 | Have you ever tried to find out your ideal body weight? | Yes | 1 |
| | | No | 0 |
| 14 | Do you think that adopting the suggested healthy behaviours will help you? | Yes | 1 |
| | | No | 0 |

| Table 4.42 Scoring Method used for Evaluating Perception Scores of Subjects Before and After Intervention (maximum score=23) | | | |
|---|---|---|---|
| **Q. no.** | **PERCEPTION Questions** | **Answers** | **Score** |
| 1 | Think it is important to maintain normal body weight, B.P., lipid profile & blood sugar? | Yes | 1 |
| | | No | 0 |
| 1-A | How important is it to maintain normal body weight? | Extremely imp | 3 |
| | | Somewhat imp | 2 |
| | | Important | 1 |
| 1-B | How important is it to maintain normal blood pressure levels? | Extremely imp | 3 |
| | | Somewhat imp | 2 |
| | | Important | 1 |
| 1-C | How important is it to maintain normal cholesterol (lipid profile) levels? | Extremely imp | 3 |
| | | Somewhat imp | 2 |
| | | Important | 1 |
| 1-D | How important is it to maintain healthy blood glucose levels? | Extremely imp | 3 |
| | | Somewhat imp | 2 |
| | | Important | 1 |
| **8** | Reasons for weight gain in adulthood | Vehicles | 1 |
| | | Desk jobs | 1 |
| | | TV/Computer | 1 |
| | | Eating out | 1 |
| | | Junk foods | 1 |
| 9-A | Do you feel the need to make efforts to lose/maintain weight? | Yes | 1 |
| | | No | 0 |
| 10-A | Do you feel the need to make efforts to maintain normal blood pressure? | Yes | 1 |
| | | No | 0 |
| 11-A | Do you feel the need to make efforts to maintain normal blood glucose levels? | Yes | 1 |
| | | No | 0 |
| 12-A | Do you feel the need to make efforts to maintain normal blood pressure? | Yes | 1 |
| | | No | 0 |
| 16 | Do you think it is important to avoid tobacco? | Yes | 1 |
| | | No | 0 |

| Table 4.43 Scoring Method used for Practice Scores of Subjects Before and After Intervention (maximum score=20) | | | |
|---|---|---|---|
| **Q. no.** | **PRACTICE Questions** | **Answer** | **Score** |
| 9 | Are you currently making efforts to lose/maintain your weight? | Yes | 1 |
| | | No | 0 |
| 10 | Are you currently making efforts to decrease/maintain your B.P.? | Yes | 1 |
| | | No | 0 |
| 11 | Are you currently making efforts to decrease/maintain your blood glucose levels? | Yes | 1 |
| | | No | 0 |
| 12 | Are you currently making efforts to decrease/maintain your cholesterol levels? | Yes | 1 |
| | | No | 0 |
| 13-A | Climb stairs instead of lift/escalator? | Yes | 1 |
| | | No | 0 |
| 13-B | Walk to nearby destinations instead of taking vehicle? | Yes | 1 |
| | | No | 0 |
| 13-C | Spend free time in outdoor sports instead of TV/Computer? | Yes | 1 |
| | | No | 0 |
| 15 | Are you taking tobacco in any form? | Yes | 1 |
| | | No | 0 |
| 17 | If smoking, trying to cut down or quit? | Yes | 1 |
| | | No | 0 |
| 19 | Do you make sure that you smoke when no one is around? | Yes | 1 |
| | | No | 0 |

| Table 4.43 (...contd.) Scoring Method used for Practice Scores of Subjects Before and After Intervention (maximum score=20) | | |
|---|---|---|
| **Q.no. 20**<br>**PRACTICE Questions** | **Answer** | **Score** |
| Avoiding / quitting / reducing tobacco in any form (paan, gutka, padiki, inhalation, smoking etc.) | Yes | 1 |
| | No | 0 |
| Less intake of junk foods like pizzas, pastries, Indian Mithai, puffs & bakery products, fried foods including fried savouries, aerated drinks, sugary syrups & squashes | Yes | 1 |
| | No | 0 |
| Avoiding heavy meals & consuming small frequent meals instead | Yes | 1 |
| | No | 0 |
| Prefer to eat whole grain foods over refined foods : Fruits instead of Fruit juice, Atta bread / Mix grain bread instead of maida bread, multi grain atta instead of wheat flour | Yes | 1 |
| | No | 0 |
| Avoiding use of Table salt, avoid eating packaged and processed foods, namkeens | Yes | 1 |
| | No | 0 |
| Engaging in at least 30 min. of physical activity daily which slightly increases your heart rate | Yes | 1 |
| | No | 0 |
| Checking weight & blood pressure regularly (once a month), lipid profile & blood sugar (once a year) | Yes | 1 |
| | No | 0 |
| Taking at least 2-3 bowls of fruits & 2-3 cups of veg/day | Yes | 1 |
| | No | 0 |
| Avoiding stress (by meditation, yoga etc.) | Yes | 1 |
| | No | 0 |

| Table 4.44 Overall Knowledge, Attitude, Practice & Perception Scores of Subjects Regarding Before & After Intervention (Mean ± S.D.) n=83 | | | | |
|---|---|---|---|---|
| | **Before (n=83)** | **After (n=83)** | **z value** | **p value** |
| **Knowledge scores (out of 6)** | 1.1±0.5 | 3.1±0.6 | -7.979 | <0.001*** |
| | | | **t value** | **p value** |
| **Practice (out of 20)** | 13±3.5 | 15.2±2.6 | -8.476 | <0.001*** |
| **Perceptions (out of 23)** | 17.2±3.3 | 20.5±2.4 | -10.243 | <0.001*** |
| **Percent Prevalence of Subjects with Respect to Attitude Scores (n=83)** | | | | |
| **Attitude (out of 2)** | **Before (n=83)** | **After (n=83)** | **p value** | |
| **1** | 32.5 (27) | 9.6 (8) | <0.001*** | |
| **2** | 67.5 (56) | 90.4 (75) | | |
| *Level of significance:* * = p < 0.05 ** = p < 0.01 *** = p < 0.001 | | | | |

***Impact of Nutrition Health Promotion Programme on Knowledge about Key Health Behaviours***

Subjects were asked what new knowledge (if any) they had gained from the information imparted during the "Health Promotion Programme". Highest response was for information imparted regarding adequate fruit & vegetable intake (77.6%) followed by physical activity (55.4%), harmful effects of junk food (34.9%), normal values of cholesterol & blood sugar (9.6%), BMI formula (8.4%) and types of fats (8.4%). Data has been presented in Figure 4.5.

***Gender Differences***

Compared to a large proportion of males fewer females said that they gained knowledge about fruit & vegetable intake (75% v/s 9.1%), physical activity (58.4% v/s 36.4%), harmful effects of junk food (38.9% v/s 9.1%) and types of fats (9.7% v/s 0%). However, when asked about cut off values for cholesterol and fasting blood sugar and BMI formula, similar percentage of males (9.7% and 8.4%) and females (9.1% and 9.1%) responded positively.

***Impact of Nutrition Health Promotion Programme in the Improvement in Practice of Key Selected Healthy Behaviours***

The study population was also asked whether they had adopted any of the recommended healthy behaviours. As can be seen from Figure 4.6, majority of the subjects (78.3%) said that they have adopted one or more of the recommended healthy behaviours. More than half of the subjects (56.6%) said that they had increased their fruit & vegetable intake while about 49% said they had started exercising regularly. A sizeable proportion of the population (32.5%) claimed to have reduced their intake of outside foods while a small percentage of them (6%) reportedly reduced their table salt consumption.

***Gender Differences***

This trend was more or less the same across genders. Highest percentage of men (77.8%) and women (81.8%) said that they had adopted at least one of the healthy behaviours. About 53% of the males and 81.8% of females said they ate more fruits and vegetables while 51.4% males and 36.4% females claimed to have started regular exercise. About 35% of males and 18.2% females reported that they had reduced their consumption of outside foods and while few men (6.9%) said they had cut down their salt intake, none of the female subjects claimed to have done so.

**Figure 4.5 Impact of Nutrition Health Promotion Programme on Knowledge about Key Health Behaviors**

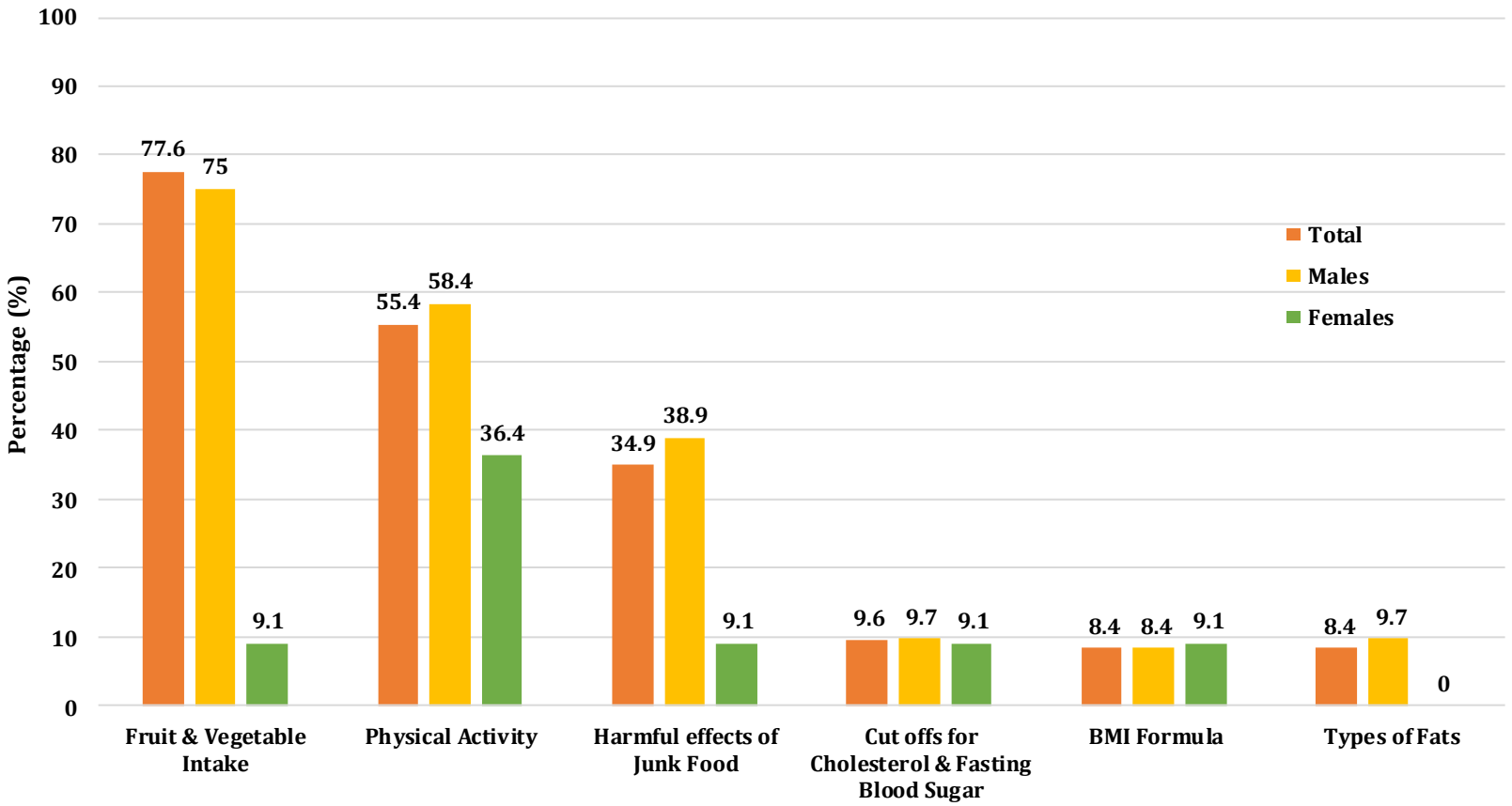
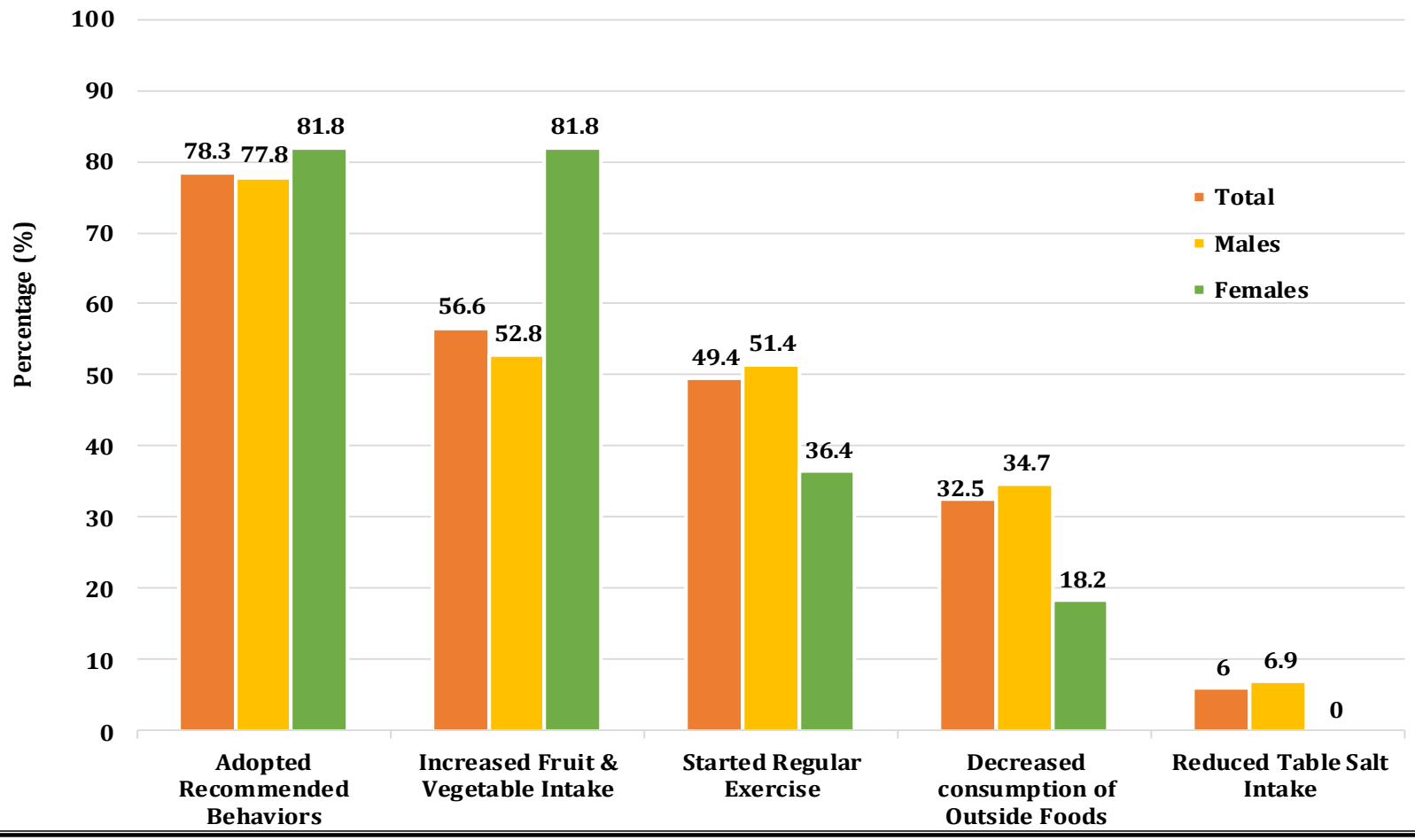


**Figure 4.6 Percentage of Subjects who Adopted the Recommended Healthy Behaviors**



***Percent prevalence of unhealthy behaviours and negative health status among study population before & after intervention***

Data regarding percent prevalence of unhealthy behaviours and negative health status among the total study population (n=83) as well as the data for male subjects (n=72) and female subjects (n=11) before and after the "Nutrition Health Promotion Programme (HPP)" intervention is presented in Figure 4.7, 4.8 and 4.9 respectively.

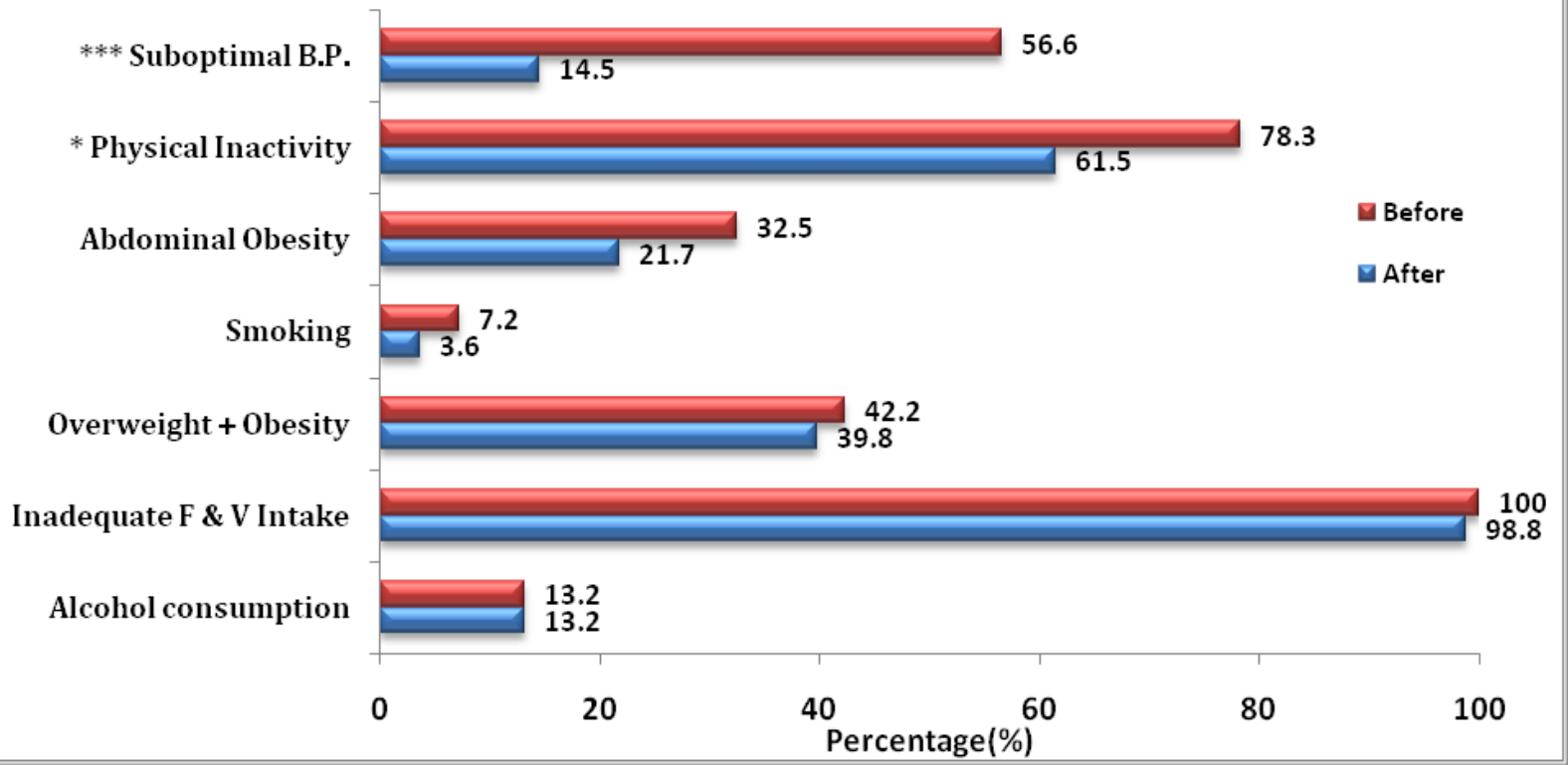
Highest percent reduction was seen in the prevalence of suboptimal blood pressure (74.5%), smoking (50%), high WC (33.3%), physical inactivity (21.5%), high WHR (10.3%), high BMI i.e. overweight and obesity (5.7%), inadequate fruit & vegetable intake (1.2%) and those using mechanized transport to reach workplace (1.2%). Alcohol consumption showed no reduction with the same percentage of people (all males) reporting use of alcohol before and after intervention. These were all, however, occasional consumers of alcohol.

Although the percentage of subjects eating >400 gm fruits & vegetables per day did not increase substantially, there was an overall increase in the percentage of subjects consuming higher quantity of fruits & vegetables as compared to baseline. The detailed results have been presented in Table 4.45. As can be seen from the data, there was an overall improvement in the quantity of average fruit and vegetable consumed by the subjects.

As can be seen from the presented data, reduction was observed in all the unhealthy behaviours and negative health status measured as part of the study.

An attempt was made to see if there was significant improvement in the behaviours and health status of subjects after intervention period. Highest statistical difference was found in the form of reduction in percent prevalence of suboptimal blood pressure ($p<0.001$) from 56.6% to 14.5% as well as physical inactivity ($p<0.05$) from78.3% to 61.5%. Though not statistically significant, there was appreciable decrease in the percent prevalence of smoking, eating out frequently, overweight & obesity, central obesity and high WHR and also a modest reduction in percentage of subjects consuming inadequate fruit & vegetables (Figure 4.7).

Figure 4.7 Percent Prevalence of Unhealthy Behaviors and Negative Health Status among Study Population Before and After Intervention (n=83)




***Level of significance:*** * = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$

| Table 4.45 Changes in Average Fruit and Vegetable Consumption by the Subjects Before and After Intervention (n=83) | | | | | | |
|---|---|---|---|---|---|---|
| | Total | | Males | | Females | |
| Per day Fruit & Vegetable Intake | Before (n=83) % (n) | After (n=83) % (n) | Before (n=72) % (n) | After (n=72) % (n) | Before (n=11) % (n) | After (n=11) % (n) |
| < 200 gm | 19.3 (16) | 9.6 (8) | 16.7 (12) | 9.7 (7) | 36.4 (4) | 9.1 (1) |
| 200-250 gm | 68.7 (57) | 65.1 (54) | 76.4 (55) | 69.5 (50) | 18.2 (2) | 36.4 (4) |
| 250 gm-300 gm | 10.8 (9) | 22.9 (19) | 5.6 (4) | 18.1 (13) | 45.5 (5) | 54.5 (6) |
| 300-350 gm | 1.2 (1) | 1.2 (1) | 1.4 (1) | 1.4 (1) | 0.0 (0) | 0.0 (0) |
| >400 gm | 0.0 (0) | 1.2 (1) | 0.0 (0) | 1.4 (1) | 0.0 (0) | 0.0 (0) |

***Gender Differences***

When gender based data was seen, the following facts emerged. In case of male subjects, highest percent reduction was seen in the prevalence of suboptimal blood pressure (75%) followed by smoking (50%). Male population registered a drop of 31% in prevalence of physical inactivity by the end of the study period while a 28% decrease was seen in prevalence of high WC, 8.3% in high WHR and 6.3% reduction was observed in the prevalence of high BMI. As compared to baseline where none of the male subjects met the recommended intake of fruits and vegetables. Post intervention data showed reduction in this percentage, though very marginally (98.6%). Also, there was a 30% reduction in percentage of males who reportedly ate out frequently (at least once a week). The results have been graphically presented in Figure 4.8.

With regards to female subjects, there was nearly 67% reduction in the prevalence of suboptimal blood pressure. While there was no change in the percent prevalence of physical inactivity and high BMI among female subjects, a considerable decrease was seen in the percent prevalence of high WHR (33%) while prevalence of high WC became 0 at the end of the study period. When diet pattern of females was looked at, it was found that while there was no improvement in number of females eating the recommended amount of fruits and vegetables, there was a 67% reduction in females who ate out frequently (at least once a week). Data has been presented in Figure 4.9.

***Differences in mean values of various health parameters in the study population (Table 4.46)***

The mean values of various health parameters before and after intervention were compared and it was found that there was highly significant reduction in the mean SBP & DBP values of subjects ($p<0.001$) as well as the mean hip circumference measurements ($p<0.001$) after the intervention phase. The mean weight, BMI and waist circumference of subjects remained more or less unchanged.

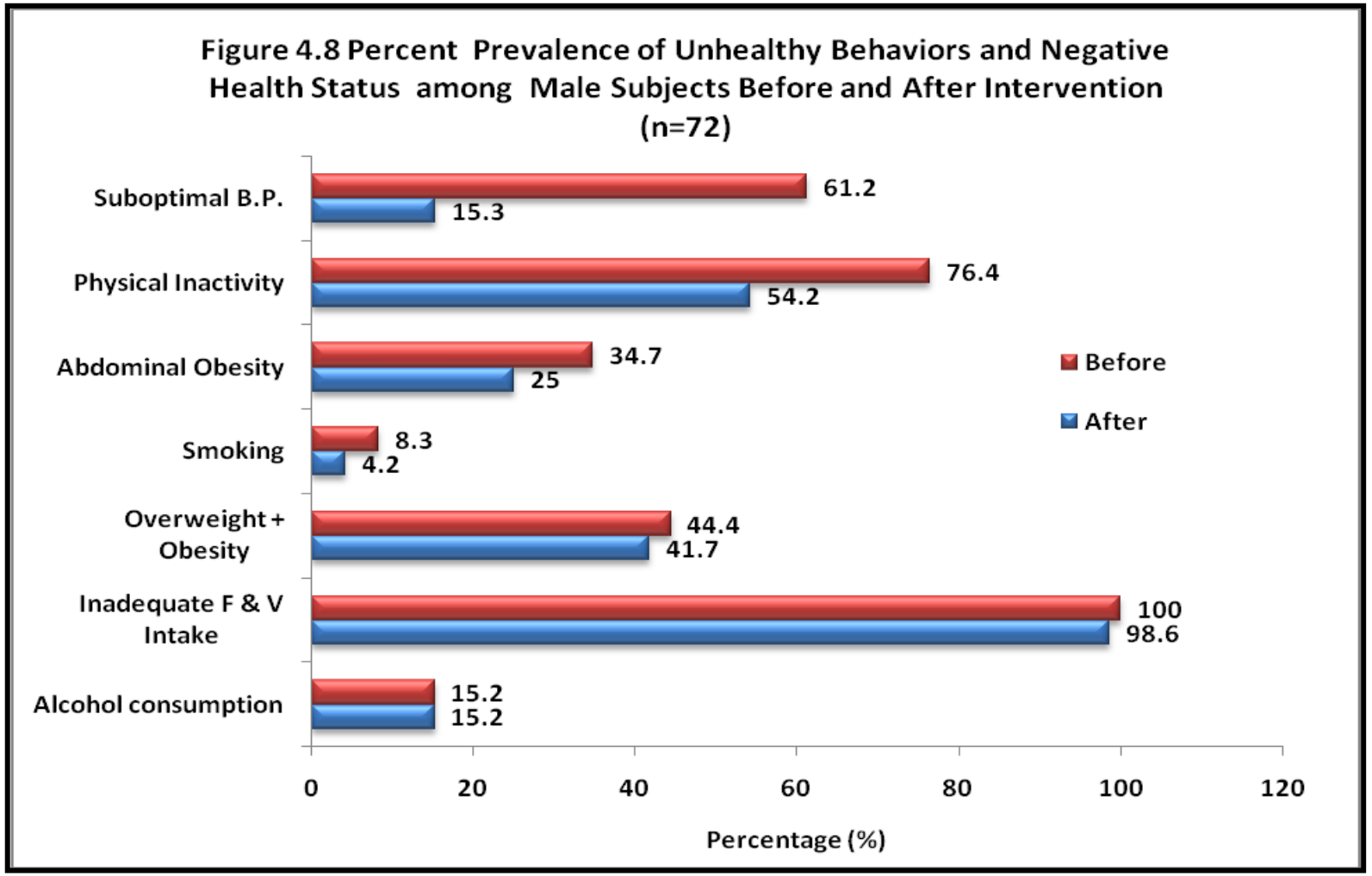


Figure 4.8 Percent Prevalence of Unhealthy Behaviors and Negative Health Status among Male Subjects Before and After Intervention (n=72)
Suboptimal B.P.
61.2
15.3
Physical Inactivity
76.4
54.2
Abdominal Obesity
34.7
25
Smoking
8.3
4.2
Overweight + Obesity
44.4
41.7
Inadequate F & V Intake
100
98.6
Alcohol consumption
15.2
15.2
Before
After
0
20
40
60
80
100
120
Percentage (%)

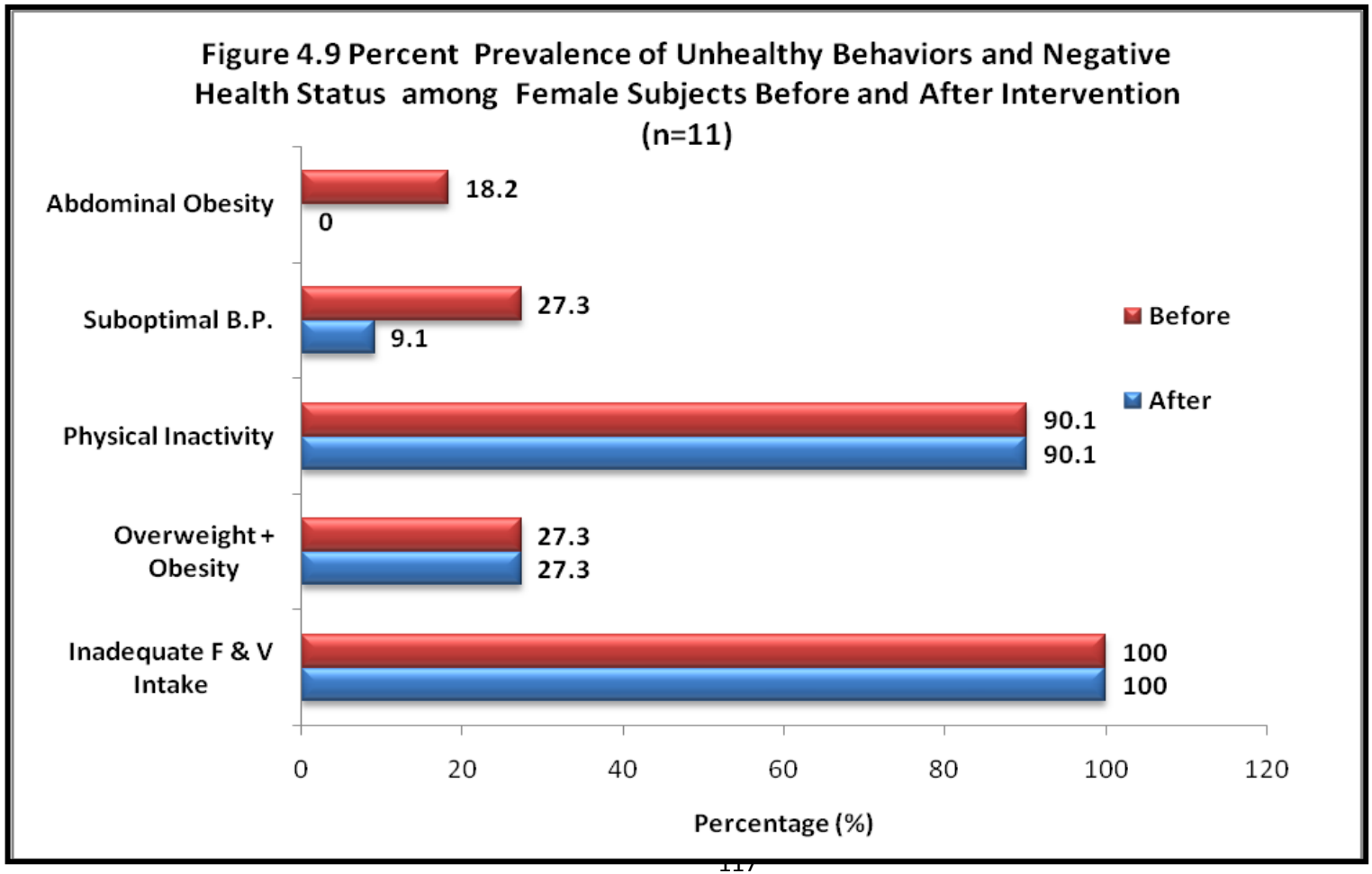


Figure 4.9 Percent Prevalence of Unhealthy Behaviors and Negative Health Status among Female Subjects Before and After Intervention (n=11)
Abdominal Obesity
18.2
0
Suboptimal B.P.
27.3
9.1
Physical Inactivity
90.1
90.1
Overweight + Obesity
27.3
27.3
Inadequate F & V Intake
100
100
Before
After
0
20
40
60
80
100
120
Percentage (%)

| Table 4.46 Differences in the Mean Values of Anthropometric Parameters and Blood Pressure Profile in the Study Population Before and After Intervention (n=83) Mean ± S.D. | | | | |
|---|---|---|---|---|
| | **Before Mean ± S.D.** | **After Mean ± S.D.** | **t value** | **p value** |
| | **(n=83)** | **(n=83)** | | |
| **Weight (kg)** | 67.3±10.9 | 67.4±10.5 | -0.182 | 0.856 |
| **BMI (kg/m$^2$)** | 23.03±3.0 | 23.04±2.8 | -0.102 | 0.919 |
| **Hip Circumference (cm)** | 96.6±6.6 | 95.4±6.2 | 3.751 | <0.001*** |
| **Waist Circumference (cm)** | 85.3±9.3 | 84.7±8.0 | 1.505 | 0.136 NS |
| **SBP (mm Hg)** | 123.3±13.8 | 112.2±9.4 | 7.831 | <0.001*** |
| **DBP (mm Hg)** | 77.7±8.5 | 73.1±6.4 | 5.140 | <0.001*** |
| *Level of significance:* * = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$ | | | | |

***Chi-square Analysis of 'At Risk' Population Before and After Intervention***

On analysing the data regarding prevalence of 'at risk' population before and after intervention, it was found that there was a highly statistically significant reduction (50.6% to 27.7%) in the prevalence of 'at risk' population (i.e. those who showed presence of 3 or more risk factors at baseline) after the intervention period compared to baseline. The data has been presented in Table 4.47.

***Percent prevalence of abnormal lipid fractions, dyslipidaemia and IGT among study population before & after intervention***

Workplace health promotion program initiated in the industry showed considerable reduction in their prevalence of abnormal lipid profile fractions, dyslipidaemia and IGT after intervention. The data regarding changes in these health parameters has been graphically represented in Figure 4.10, 4.11 & 4.12. Looking at changes in the lipid profile fractions, it can be seen that highest percent reduction was in prevalence of IGT (56%) followed by TC/HDL ratio (55%), abnormal HDL cholesterol (41%), VLDL cholesterol (14%) and dyslipidaemia (11%). There was no change in the number of subjects having high TC levels as well as those having abnormal LDL/HDL ratio. Surprisingly, there was a rise in the prevalence of subjects with high TG (25%) and high LDL cholesterol (10%). Chi square analysis was done to see if the reduction in dyslipidaemia as well as impaired glucose tolerance was statistically significant. It was found on performing the analysis that though there was considerable reduction in the prevalence of both dyslipidaemia (11.1%) and IGT (55.5%) among the study population, it failed to reach significance.

***Gender Differences***

When the data was studied, keeping in mind the gender difference (Figure 4.11), it was found that there was also appreciable decline in the prevalence of dyslipidaemia (12.8%) and IGT (50%) among male subjects. With regards to change in percent prevalence of males having abnormal lipid profile fractions, highest percent reduction was seen for abnormal TC/HDL ratio (55%) followed by abnormal HDL cholesterol levels (48%) and VLDL (14%) and so on. Here also, a raised prevalence was observed for high TG (25%) as well as high LDL cholesterol (10%).
In case of females, while there was a huge reduction in IGT prevalence (50%), none of them suffered from dyslipidaemia before or after intervention. The prevalence of abnormal HDL which was universal among female subjects at baseline reduced to 83.4% after intervention. None of

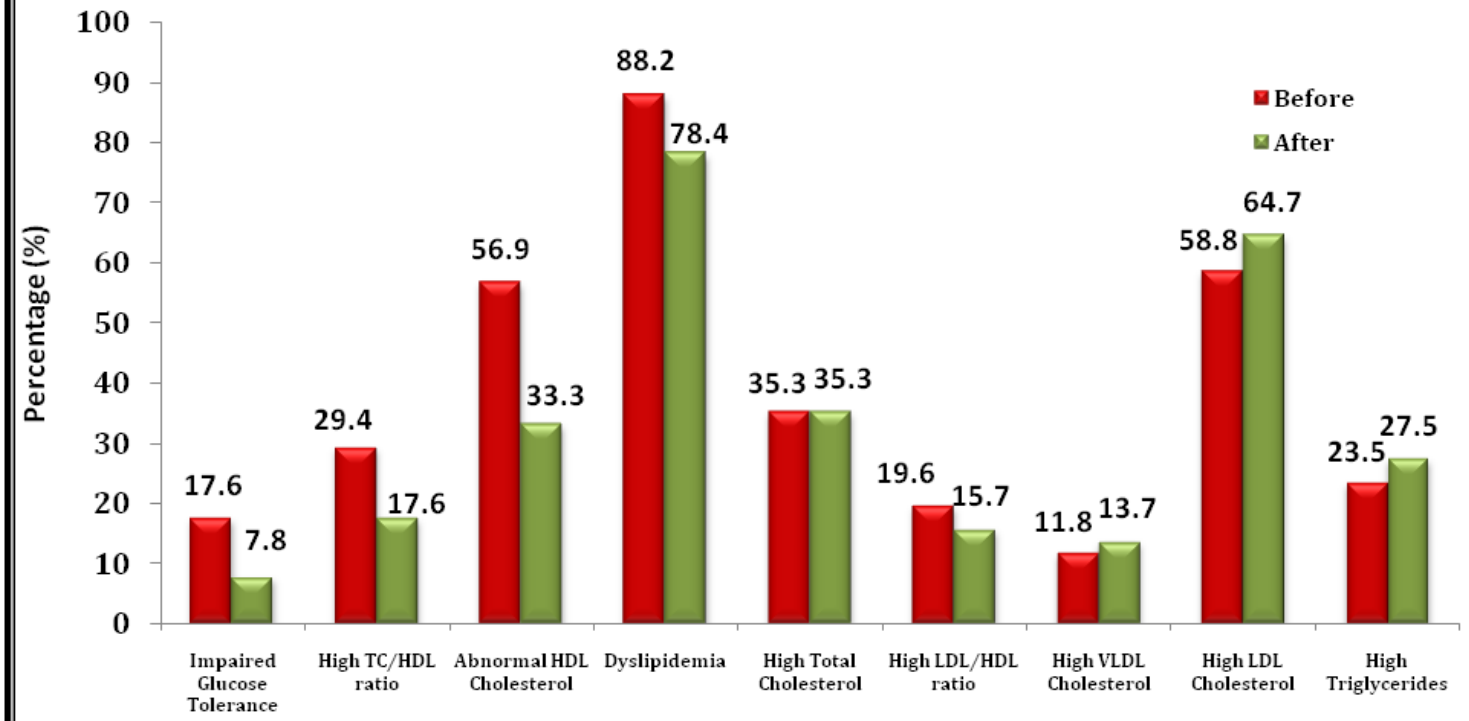
the females were found to have high levels of TC, TG, VLDL or ratios at the beginning or end of the study (Figure 4.12).

***Differences in mean values of various health parameters in study population (Table 4.48)***

In case of biochemical parameters (Lipid Profile & Fasting Blood Sugar), all parameters under study improved except LDL cholesterol where the mean values before and after intervention showed an increase (110.6±37.2 to 115.3±33.2). This rise was however, not statistically significant. Data also revealed that there was a significant increase in the mean HDL cholesterol values of the study population after the intervention period ($p<0.05$) with respect to their baseline values. Further, there was highly significant reduction in the mean fasting blood sugar values of subjects after the intervention period ($p<0.001$). With regards to other lipid profile parameters, though not statistically significant, they also showed reduction in mean values as compared to baseline values.

| Table 4.47 Change in the Percent Prevalence of 'At Risk' Population Before and After Intervention (n=83) | | | | |
|---|---|---|---|---|
| | **Before (n=83)** | **After (n=83)** | **Chi-square $X^2$** | **p value** |
| **'At risk' (≥ 3 risk factors)** | 50.6 (42) | 27.7 (23) | 9.13 | 0.002** |
| **Not 'At Risk' (< 3 risk factors)** | 49.4 (41) | 72.3 (60) | | |
| *Level of significance:* * = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$ | | | | |

**Figure 4.10 Change in Percent Prevalence of Dyslipidemia, Lipid Fractions &Impaired Glucose Tolerance among Study Population Before & After Intervention (n=51)**



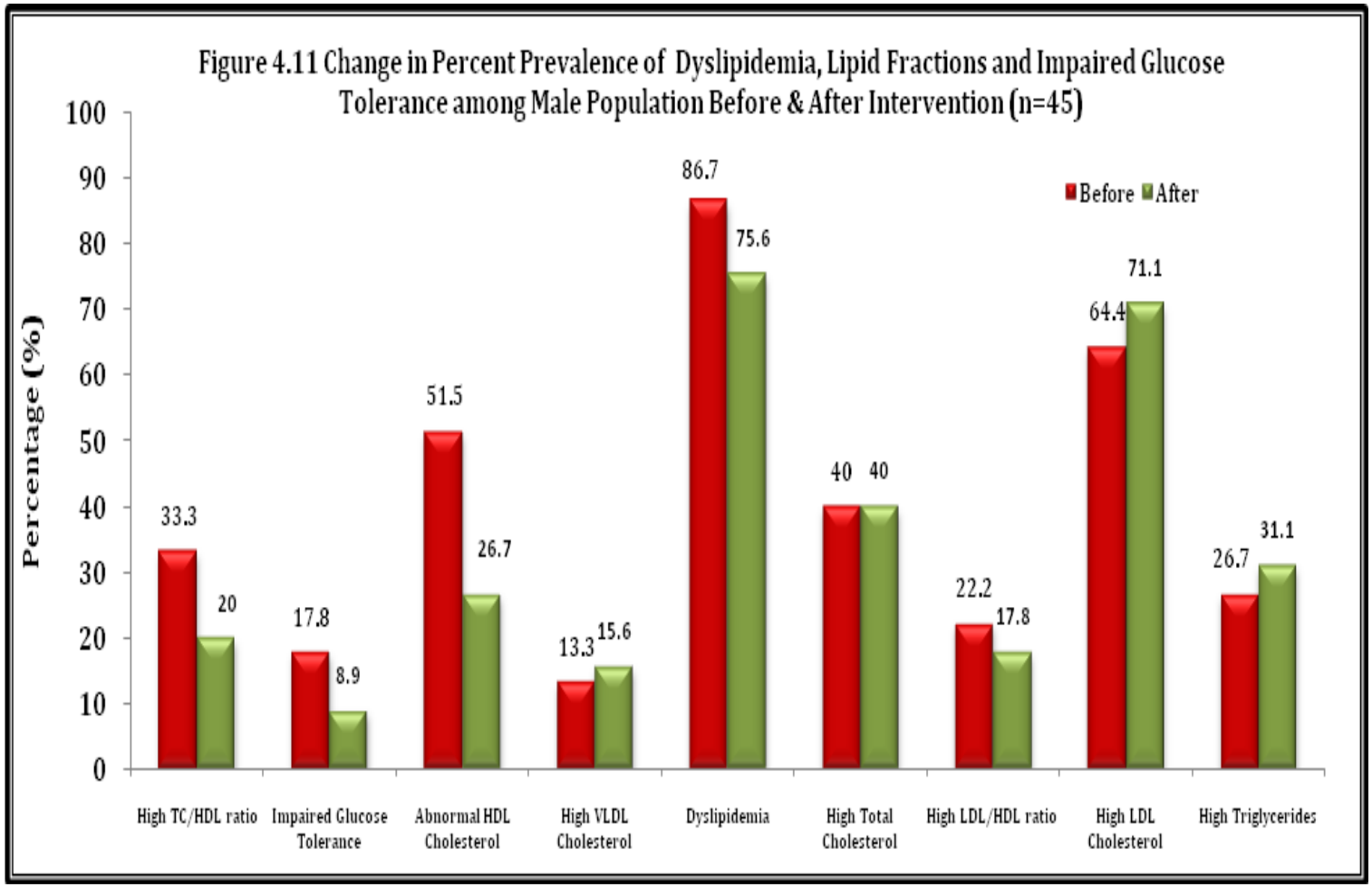
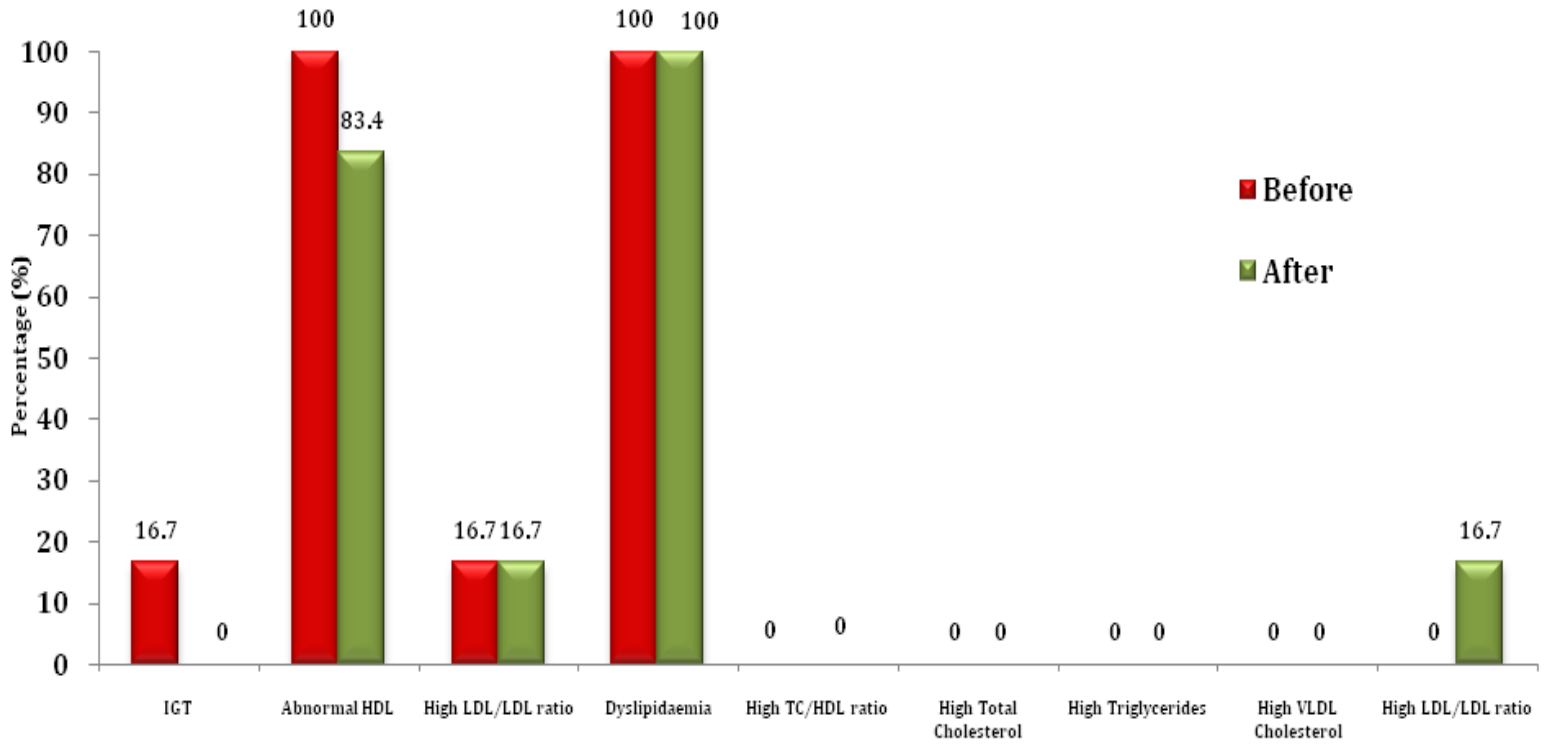


Figure 4.11 Change in Percent Prevalence of Dyslipidemia, Lipid Fractions and Impaired Glucose Tolerance among Male Population Before & After Intervention (n=45)
Percentage (%)
100
90
80
70
60
50
40
30
20
10
0
Before
After
33.3
20
17.8
8.9
51.5
26.7
13.3
15.6
86.7
75.6
40
40
22.2
17.8
64.4
71.1
26.7
31.1
High TC/HDL ratio
Impaired Glucose Tolerance
Abnormal HDL Cholesterol
High VLDL Cholesterol
Dyslipidemia
High Total Cholesterol
High LDL/HDL ratio
High LDL Cholesterol
High Triglycerides

Figure 4.12 Change in Percent Prevalence of Dyslipidemia, Lipid Fractions and Impaired Glucose Tolerance among Female Population Before & After Intervention (n=6)



| Table 4.48 Differences in the Mean Values of Lipid Fractions as well as Fasting Blood Sugar in the Study Population Before and After Intervention (n=51) Mean ± S.D. | | | | |
|---|---|---|---|---|
| | **Before Mean ± S.D.** | **After Mean ± S.D.** | **t value** | **p value** |
| | **(n=51)** | **(n=51)** | | |
| **Total Cholesterol (mg/dl)** | 180.9±45.9 | 179.7±45.0 | 0.416 | 0.679$^{NS}$ |
| **Triglycerides (mg/dl)** | 131.8±68.2 | 134.5±73.1 | -0.399 | 0.692 $^{NS}$ |
| **LDL Cholesterol (mg/dl)** | 110.6±37.2 | 115.3±33.2 | -1.639 | 0.107 $^{NS}$ |
| **VLDL Cholesterol (mg/dl)** | 26.37±13.6 | 26.9±14.6 | -0.385 | 0.702 $^{NS}$ |
| **HDL Cholesterol (mg/dl)** | 43.9±8.0 | 46.4±8.7 | -2.212 | 0.032* |
| **FBS (mg/dl)** | 90.1±16.9 | 83.3±10.5 | 3.994 | <0.001*** |
| *Level of significance:* * = $p < 0.05$ ** = $p < 0.01$ *** = $p < 0.001$ | | | | |

***Bottlenecks and facilitating factors in implementing a nutrition health promotion programme in a workplace setting***

One of the major facilitating factors which can be given credit for the successful completion of the present study and the positive result obtained in the form of healthier employees was the willingness of the industry management to assist the nutrition health promotion programme. As has been seen in earlier workplace health promotion researches, such health promotion initiatives are made possible only in the presence of a sensitized and motivated administration.

Another advantageous factor in this case, as is in case of any study conducted in a "setting" such as school/workplace was the availability of subjects on regular basis at the same premises. This made it convenient and feasible to address a large number of people at a common location and dispense nutrition and health information to a large audience effectively in short span of time.

One of the most important bottlenecks identified during the research study was the inability of subjects to participate in all the stages of the study. For example, many of the subjects who had consented to participate in the research study at baseline were unable to attend the nutrition health promotion programme sessions. The low turnout could be attributed to the inability of the employees to spare 30 minutes out of their regular working hours in spite of their willingness to attend the presentation sessions. Another reason for this was that the industry has a high turnover rate. Also, employees are regularly deputed outside the city for professional work and hence many of them became unavailable during subsequent phases of the research study after participating at baseline. Due to the long duration of the study period (20 months), loss of interest might also be one of the causes of the lower participation rate at end of the study period.

**SUMMARY**

- There was significant improvement in the average knowledge, perception and practice scores of the subjects after the intervention, as compared to baseline ($p<0.001$).
- As compared to baseline, a significantly higher number of subjects (67.5% v/s 90.4%) were able to answer both the 'attitude' questions correctly ($p<0.001$).
- There was rise in self-reported percent prevalence of all recommended healthy behaviors by study population after intervention period which was substantiated by the improvement in anthropometric and biochemical assessments.
- After intervention, highest percent reduction was seen in the prevalence of suboptimal blood pressure (74.5%), smoking (50%), abdominal obesity (33.3%), physical inactivity (21.5%), high WHR (10.3%), high BMI i.e. overweight and obesity (5.7%), inadequate fruit & vegetable intake (1.2%).
- Among all these, highest statistical difference was found in the form of reduction in percent prevalence of suboptimal blood pressure ($p<0.001$) from 56.6% to 14.5% as well as physical inactivity ($p<0.05$) from78.3% to 61.5%.
- As compared to baseline, there was a significant reduction in the mean hip circumference, SBP as well as DBP values of subjects ($p<0.001$).
- Percent prevalence of IGT and Dyslipidaemia reduced considerably - 55.5% and 11% respectively at the end of the intervention period.
- The mean HDL cholesterol level of subjects increased significantly ($p<0.05$) while mean fasting blood sugar levels of study population reduced significantly ($p<0.001$). Though not statistically significant, all other lipid profile parameters except LDL cholesterol showed reduction while mean LDL cholesterol showed slight increase.
- There was a 45% reduction in the 'at risk' population after the intervention period which was statistically significant at $p<0.01$.

**DISCUSSION**

The Ottawa charter of 1986 and Jakarta Declaration of 1997 (WHO 1986, WHO 1997) say that "The workplace and the health of the workers within it are inextricably linked. Ideally, workplaces should not only protect the safety and wellbeing of employees but also provide them opportunities for better long-term health and enhanced quality of life. Effective workplace programs, policies, and environments which are health-focused and worker-centred have the potential to significantly benefit employers, employees, their families, and communities." In addition to providing a very efficient platform for conducting health promotion activities, it has been proven to be an effective means of achieving greater health and awareness of lifestyle diseases among the vulnerable population (employees). Various successful workplace health promotion programmes are documented in literature that strongly advocate using this approach which not only improves the health profile and lifestyle practices of the employees, it also affords a chance to the administration to save on health care cost of employees in addition to enhancing employee productivity (Baicker et al 2010, Milani and Lavie 2009, Chapman 2005, Pelletier 2005, Aldana 2001).

In the present study, there was an overall positive change in the knowledge, attitude, practices, perceptions as well as diet and lifestyle pattern of the subjects at the end of the nutrition health promotion programme intervention period. There was marked improvement in the key diet & lifestyle habits of subjects such as increase in number of subjects who were physically active, those who avoided smoking and consumed adequate fruits and vegetables. The self-reported prevalence of various healthy behaviours was found to be on the rise and was complemented by side-by-side improvement in measureable health parameters such as BMI, WC, WHR, blood pressure, lipid profile as well as fasting blood sugar. While it is well known that healthy diet and lifestyle help in lowering and maintaining blood pressure, in the present study, the highly significant decline in prevalence of suboptimal blood pressure cannot be attributed solely to healthy diet and lifestyle changes. It can be hypothesized that as a result of the blood pressure measurements done as part of the study, subjects who were suffering from prehypertension and/or hypertension became aware of their condition and hence may have consulted a physician, thereby brining about effective management of their condition with pharmacological as well as non pharmacological means.

The combination of healthy diet and lifestyle modifications has been recommended by WHO as a highly effective measure to curb the rising prevalence of NCD risk factors among the population (WHO Ten facts on NCDs 2012). It is estimated that tobacco usage kills 5.4 million people a year. More than five million of those deaths are the result of direct tobacco use while more than 600

000 are the result of non-smokers being exposed to second-hand smoke (WHO Report on the Global Tobacco Epidemic 2013). Physical activity has been linked to cardiac protection (Rastogi et al 2004). Adequate fruit and vegetable intake has been associated with better glycaemia control as well as weight maintainance (Anderson et al 1995).

Considering the fact that, in the present study there was noticeable and significant improvement in the knowledge, attitude and perception scores of subjects after intervention period, it can be said that the clearly visible shift from unhealthy to health profile in study population was the direct result of improvement in knowledge, attitude & practices of subjects augmented by the healthier behaviours adopted by them. The subjects were sensitized to the ill-effects of the unhealthy habits being followed by them and it inevitably brought about a change in their knowledge, perceptions and in turn, practices. They were guided for the same by the health promotion programme sessions carried out and the information and motivation to continue healthy lifestyle was reinforced using passive intervention techniques such as point-of-decision prompts, posters, table mats carrying key messages. The significant reduction of 45% in 'at risk' population ($p<0.01$) after intervention clearly demonstrate the effectiveness of the nutrition health promotion programme in reducing risk factors of non communicable diseases in population and the potential it has to reduce health care costs of complications that arise due to uncontrolled risk factors in populations. Thus, the overall positive results of the present study are a testimony to the successful reception of the health promotion programme by the study subjects and willingness to adopt healthy changes in their lives, having understood the importance of the same. Past studies also show that improvement in KAP regarding various health issues goes hand in hand with improvement in practices of the same. A workplace tobacco cessation study conducted by Mishra et al in 2009 in an industry in Maharashtra reported a quit rate of 40% at the end of the study period along with considerable improvement in the KAP of subjects regarding the harmful effects of smoking.

There is paucity of literature regarding KAP interventions among industrial population with respect to non communicable diseases. Lot of studies however, have been conducted on industrial populations to assess the impact of interventions focussing on healthy diet, lifestyle & physical activity on the behaviour and health parameters (anthropometric, biophysical and biochemical parameters). The Chairman of Johnson & Johnson James Burke established 2 health related goals in the late 1970s: encourage employees to become the healthiest in the world and reduce the cost of health care for the firm. The company started a wide-ranging employee health promotion programmes including nutrition education, onsite fitness and other services. Between 1995 and 2010 the percentage of employees who smoked declined by more than two-thirds and

the number with high blood pressure or who were physically inactive declined by more than half (Berry and Mirabito 2011).

A worksite-based study evaluated clinical efficacy and cost-effectiveness of a 6-month health intervention using cardiac rehabilitation and exercise training. Employees (n=308) and spouses (n=31) were randomized to receive the intervention (n=185) v/s usual care (n=154). Significant improvements were demonstrated in quality-of-life scores (+10%, p = 0.001), behavioural symptoms (depression -33%, anxiety -32%, somatisation -33%, and hostility -47%, all p values <0.001), body fat (-9%, p = 0.001), high-density lipoprotein cholesterol (+13%, p = 0.0001), diastolic blood pressure (-2%, p = 0.01), health habits (-60%, p = 0.0001), and total health risk (-25%, p = 0.0001). Of employees categorized as high risk at baseline, 57% were converted to low-risk status. Average employee annual claim costs decreased 48% (p = 0.002) for the 12 months after the intervention, whereas control employees' costs remained unchanged (-16%, p = NS), thus creating a sixfold return on investment. In conclusion, worksite health intervention decreased total health risk and markedly decreased medical claim costs within 12 months (Milani and Lavie 2009). A 2010 meta-analysis of 15 WHP studies found that on average $3.37 in health care costs was saved for every dollar spent over 3 years (Baicker et al 2010). That finding echoes earlier analyses of peer-reviewed studies (Aldana 2001, Chapman 2005, Pelletier 2005).

In keeping with previous research, the present study provides credible proof of the fact that well-planned; need based health promotion Programme intervention implemented effectively in a workplace setting with the co-operation of the administrative staff yields beneficial results. It can thus be said that the “Nutrition Health Promotion Programme” carried out in the industry was successful to a great extent and succeeded in bringing about positive changes among the study subjects who participated in the study. Hence, it can be concluded that such workplace interventions have a potential to influence lifestyle practices of individuals and thus, this type of intervention can be successfully used to target vulnerable groups to sensitize and persuade individuals to lead healthier lives. At the same time, such kind of a health promotion activity is nearly impossible without the help and unfailing co-operation of the industry administration as well as the employees themselves. Hence, it is imperative that such programmes be made part of the documented policies of industries with special budget and time allocations for the same. However, such programmes have to be continuous in nature so that behaviour change can occur slowly but consistently with regular follow ups and reinforcements as it is well documented that behaviour change requires sustained efforts by nutrition health care providers as people move back and forth from pre contemplation phase to sustained action phase as is described in ten steps behaviour change transtheoritical model (Prochaska and DiClemente 1984). Thus a

continuous programme, follow-up and reinforcement is required to be put in place to ensure continuing adherence to healthy lifestyle by the subjects. The short term programme as in the present study was able to demonstrate the potential of such programmes in improving nutrition and health profile of subjects by increasing awareness and knowledge among them. It can thus be said that sustained and continues programmes have a greater potential to improve the practice behaviours further.

Also it is important to understand that the positive results showing the effectiveness of nutrition health promotion programme in those who completed the study may not represent the results of whole workplace nutrition health promotion programme as participation in the programme was voluntary and those who completed the study may already be self aware population as evident from the baseline knowledge levels of the subjects who completed the study, many studies in literature (Linnan et al 2001, Heany and English 1995, Glasgow et al 1993, Gebhardt and Crump 1990, Conrad 1987) have demonstrated that those who actually participate in such programmes are those who are self aware and conscious about their health status and are willing to take actions to improve their health status while those who do not participate are unaware and casual about their health status and may be at higher risk of developing complications of uncontrolled risk factors later in life.

All subjects who joined the study at its initiation were unable to participate in all the stages of the study due to various reasons. This is a limitation of the present study and the results thus obtained may not be true for the entire population because of the nature of the subjects who are likely to have participated in the study. On the other hand, a mandatory programme will include motivated as well as 'not so motivated' subjects who may or may not improve their healthy practices and may require greater and sustained efforts. This would give a more balanced result regarding reception and efficacy of the nutrition health promotion programme by all employees of the industry as a whole.

It is important that the administration of workplaces use various strategies like giving subsidy on health insurance or incentives for regular checkups of all staff irrespective of employee status contrary to current policies in industries to offer free health checkups to managerial staff only linked with participation in nutrition health promotion programme to encourage participation of the employees in such nutrition health promotion programmes. Also it is important that administration dedicates some time for employees in a month for attending nutrition health promotion programmes. In the absence of enabling policies at work place for nutrition health promotion programmes, it is difficult to achieve better results for the industry which will prove to be cost effective if participation rate is substantially improved.