University of Delhi

RC/2015/9435 31 August, 2015

The Principal,
Shivaji College
Ring Road, Raja Garden,
New Delhi-27

Subject: - **Innovation Projects 2015-16**

Dear Principal,

The University of Delhi is pleased to announce the third round of the undergraduate research initiative in colleges, Innovation Projects 2015-16. You will be glad to know that the following project submitted by your college has been selected for award

Project Code: SHC 311
Project Title: Lifestyle Disorders: Etiology, Awareness And Management

The distribution of grant under different budget heads as below:

Sr. No.	Budget Head	Amount
1.	Equipment/Consumables	Rs 2,25,000/-
2.	Stipends	Rs. 1,20,000/- (1000x10x12)
3.	Travel	Rs 55,000/-
4.	Honorarium	Rs 25,000/-
5.	Stationery/Printing	Rs 20,000/
6.	Contingency	Rs 55,000/-
	Total	Rs 500,000/-
Rs 5 lakhs (Rupees five lakhs only)		
Amount to be released in first phase by Finance Branch- Rs 3,50,000/		

Budget head No. 1 and half of the remaining grant will be released as the first instalment. The second and final instalment will be released after submission of half-yearly report (by 15 February 2016), satisfactory review and recommendation of release of the second instalment.
Please refer to the detailed guidelines for implementation of the project. Any queries may be addressed to- innovationprojects1516@gmail.com.

With best wishes,

Yours sincerely,

Prof. Malashri Lal

Final Report

1. Project Title: Lifestyle Disorders: Etiology, Awareness & Management

2. Project Code: SHC 311

3. Abstract

Obesity is gradually becoming a global epidemic with more than 13% of the world's adult population classified as obese. The Indian youth today is much more prone to cardiovascular diseases, respiratory problems and obesity related disorders. All these alarming conditions are a direct consequence of unhealthy eating habits, lack of physical activity, stressful life, alcohol and drug abuse, smoking etc. It is the need of the hour to educate our young population about these evils of the prevalent lifestyle disorders and warn them to avoid these problems coming their way. Health camps were conducted at Shivaji College, University of Delhi, comprising of more than 1000 students and adult population (teaching & non-teaching staff) to measure their body parameters indicative of general health. Their BMI, total body fat, visceral fat, subcutaneous fat, skeletal muscle content, lipid content, spirometric ratios indicative of lung capacities, oxygen saturation of blood, cardiorespiratory fitness values were recorded and analyzed. Questionnaires were designed as well to record their daily eating habits, sleep patterns, substance abuse as well as family health history. These health camps were extremely well received by the college students and staff both. Their results were analyzed and awareness desks were conducted at which they were informed in detail about their body parameters. The participants were forewarned about any ailments and also suggested remedial measures that could help in improving their health condition.

4. Introduction

The World Health Organization (WHO) defines health as a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity. The advent of urbanization and advanced technology has brought with it a host of disorders, which poses a serious threat to the well-being of human beings. The problem is particularly pertinent to the youth as a radical shift in their lifestyle has been observed. The consumption of unhealthy food and addictive stimulants, lower levels of physical activity and abnormal sleep cycles are responsible for jeopardizing the future of mankind.

One of the major outcomes of this shift in lifestyle has been an unprecedented rise in obesity. It has been declared to be a global epidemic by WHO (1997), with worldwide projections of more than one billion overweight individuals across the world by 2030 (WHO, 2010). In 2014, more than 1.9 billion adults, 18 years and older, were overweight. Of these over 600 million were obese. Obesity in childhood and adolescence, is a strong indicator of adult obesity (Whitaker et al., 1997). Obesity is responsible for a host of other diseases like diabetes mellitus, coronary heart diseases, hypertension and certain types of cancer (WHO, 2005). Another disease which has been associated partially due to lifestyle choices is Chronic Obstructive Pulmonary Disease (COPD). It is a lung ailment that is characterized by a persistent blockage of the airflow from the lungs and interferes with normal breathing. More than 3 million

people have been reported to have died of COPD in 2012. WHO estimates COPD to become the third leading cause of death worldwide by 2030. The primary cause of COPD has been found to be tobacco smoke (including second-hand or passive exposure). Other risk factors include outdoor and indoor air pollution, occupational hazards and childhood respiratory infection.

It is heartening to know that these debilitating diseases, can be diagnosed utilizing simple measurements at an early stage, and treated or managed accordingly. While obesity and its comorbidities are preventable to a large extent, COPD can be well managed if diagnosed at an early stage. Young adults and adolescents are the best point of intervention for health assessment and spreading awareness, as it would effectively nip the problem at its inception. This study has been carried out with this very objective in mind. Our study population mainly consisted of undergraduate students of Shivaji College, University of Delhi. The teaching and non-teaching staff of the college was also surveyed to obtain a comparison between the two age-groups. It was attempted to survey the chosen subject population for various health parameters, and bring about a consciousness of their health status and the measures that can be adopted for good health.

Towards the assessment of obesity, the most significant anthropometric marker used is the Body Mass Index [BMI]: the ratio of body weight measured in kilograms, divided by the square of the height measured in meters. This was collated with measurements of the Waist Hip Ratio (WHR) and a correlation established in the given population. Other body composition parameter measurements like visceral fat were also utilized, as they are also good indicators of predisposition of an individual to various disorders like coronary heart disease, diabetes mellitus, pulmonary problems and dyslipidemia. The measurement of heart health was also carried out using a pulse oximeter, which gives us information regarding the saturation level of the arterial blood as well as the amount of work done by the heart in order to maintain this saturation. The assessment of pulmonary functions and diagnosis of respiratory diseases, if any, was attempted by employing a spirometer. The overall health of the subjects was evaluated by the Harvard Step Test method. Through this project, we made an attempt to determine the physical constitution of the youth who participated in our study and make them aware of the various salubrious steps that can be followed by them for a healthier future.

5. Objectives

Our project focused on obtaining data about lifestyle habits and choices made by individuals belonging to varied age groups that effect their overall health and may lead to alarming diseases in their future. The idea behind this survey and data collection was also to make aware the undergraduate students of our college to various unhealthy habits they have that may have alarming consequences. Several health camps were conducted throughout the year long project and after carrying out tests, their results were discussed there and then making them aware of any future issues. The students were responsible for conducting these camps as well as counsel any participant as and when required.

The following objectives were covered in the project:

I. Survey of the target groups using **questionnaires** (history of disease, smoking & alcohol consumption).
II. Awareness through organizing **Health Camps**.
III. The measurement of **body parameters such as:** Height, Weight, BMI, waist hip ratio, Blood Pressure, Pulse Rate, Total Body Fat (including visceral fat,

subcutaneous fat, skeletal muscle content), Oxygen Saturation of Blood, Harvard Step Test and Lung Capacity by spirometry.

IV. **Blood Investigations (**Hemoglobin, Glucose, Cholesterol and Calcium test).

V. To **establish the relationship** that life style diseases are associated with factors like age, body mass index, stress, family history of the disease and lack of physical activity etc.

VI. To **counsel** these individuals under study and make them more aware of the lifestyle choices that they make and their consequences.

6. Methodology

Our project focused on collecting data regarding various lifestyle habits and patterns and correlating anthropogenic parameters with them. Our project was divided into three phases: A, B and C for conducting the various tests over the year long duration of the project.

PHASE A

Data Sampling

The study was conducted at Shivaji College, a constituent college of the University of Delhi, accredited with grade A by NAAC. A total of 371 students, of the age group 17-21, were included in this study. Data was obtained by requesting participants to fill a detailed questionnaire, which included general information, specific anthropometric measurements, socio-demographic profile, dietary pattern, history of diseases like diabetes, cardiovascular diseases, hypertension etc.

Anthropometric Measurements

For the calculation of BMI as weight (kg)/square of height (m^2), height and weight of the participants were measured. The height of the individuals was measured using height measuring tape and weight was measured on Equinox digital weighing scale EB 9300. Weight was measured after removal of shoes while wearing light clothing. Height was measured without shoes in the standing position with the shoulders in relaxed position and arms hanging freely. Based on their BMI, the participants were classified as underweight, normal weight, overweight and obese [Table I].

Table I. Standard Values of Anthropometric Measurements Used in the Study

Parameters	**Low**	**Normal**	**High**	**Very High**
BMI (kg/m^2)	**Underweight**	**Normal weight**	**Overweight**	**Obese**
All individuals	<18.5	18.5-24.99	≥25	≥30
Total Body Fat (TBF %)				
Male	< 10.0	10.0-19.99	20.0-24.99	≥25
Female	<20.0	20.0-29.99	30.0-34.99	≥35
Skeletal Muscle				
Male	<33.3	33.3-39.3	39.4-44.0	>44.1
Female	<24.3	24.3-30.3	30.4-35.3	>35.4
Visceral Fat (cm^2)				
All individuals	0.5-9.5	10-14.5	15.0-30.0	

For obtaining the waist-hip ratio, the waist circumference measurement was taken at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest. The hip circumference measurement was taken around the widest

portion of the buttocks, as per WHO recommendations. Care was taken that both waist and hip measurement was taken with the tape wrapped snugly around the body, but not pulled so tight that it is constricting.

PHASE B

Data Sampling

The study was conducted at Shivaji College, a constituent college of the University of Delhi, New Delhi, India. A total of 140 students, of the age group 17-21 years, were included in this study. A health camp was organized by members of innovation project SHC-311 within the college premises and data was obtained by recording various body parameters of participants. Before proceeding to recording the body parameters, care was taken to record the personal detail such as age, gender, height and weight of each participant.

Anthropometric Measurements

For the calculation of BMI as weight (kg)/square of height (m2), height and weight of the participants were measured. Based on their BMI, the participants were classified as underweight, normal weight, overweight and obese [Refer to Table I].

Measurement of body fat (total body fat, visceral fat, subcutaneous fat and skeletal muscle) was done using the instrument Omron Karada Scan Body Composition Monitor (HBF-375, Omron Health Care Co., Kyoto, Japan). The instrument works on the principle of biological impedance, which is a successful method for evaluating body composition. It is relatively simple, quick, non- invasive and does not require exposure to radioactivity or submersion in water. Hence, it is being used widely in various studies involving children as well as adults for assessment of body composition by a number of healthcare professionals and researchers worldwide. Standard values are shown in Table I.

Body tissues containing more water conduct electricity easily whereas fat tissue is a poor conductor. This feature is used to calculate body fat content. For measurement of body fat, it was imperative to begin with entering personal details of each participant such as age, gender and height. The subjects stood on footplate barefoot and grasped the two handgrips with arms. The posture of the individual was such that arms were straightened and an angle of 90° was maintained between arms and body. Precautions were taken to avoid errors such as shaking of the body, extremely bent arms, incorrectly positioned feet and incomplete contact of palms/soles with the electrodes.

Lipid Analysis

Lipid fraction of the human body include three significant components: cholesterol, triglycerides and lipoproteins. Cholesterol is the fundamental element of cell membranes and is a precursor for various steroid hormones. Triglycerides (fatty acid esters of glycerol) represent the main lipid component of fat deposits of animals. Both cholesterol and triglycerides being insoluble in water need to be transported in plasma with lipoprotein particles. Lipoproteins are differentiated according to sizes, mobility and relative contents of fats into: very-low-density lipoproteins (VLDL), low-density lipoproteins (LDL), inter-mediate density lipoproteins (IDL) and high density lipoproteins (HDL). Their levels need to be significantly maintained and hence a screening of 214 students (68 males & 146 females) and 38 adults (20 males & 18 females) was done. Measurement of these parameters was done by withdrawing blood samples from the participants and following standard protocols for quantitative determination using kits. All lipids were measured using kits manufactured by Span Diagnostics Ltd. Standard values of lipid profiles examined are shown in Table II.

Table II: Standard Values of Lipids & Calcium tested in the Study

Parameter	Normal or desirable	Borderline High	High
Cholesterol	<200 mg/dl	200-239 mg/dl	>240 mg/dl
Triglycerides	<150 mg/dl	150-199 mg/dl	>200 mg/dl
HDL cholesterol	>59 mg/dl Normal	45-59 mg/dl Desirable	<40 mg/dl Increased Risk
LDL cholesterol	<100 mg/dl Optimal	100-129 mg/dl Desirable 130-159 mg/dl Borderline High	>159 mg/dl high
VLDL cholesterol	<32 mg/dl		
Calcium	Hypocalcaemic <8.7 mg/dl	Normal 8.7 – 11mg/dl	Hypercalcemic >11 mg/dl

Risk	Ratio of Total Cholesterol to HDL	
	Men	**Women**
Very Low	<3.4	<3.3
Low risk	4.0	3.8
Average risk	5.0	4.5
Moderate risk	9.5	7.0
High risk	>23	>11

Risk	Ratio of LDL to HDL	
	Men	**Women**
Very Low	1	1.5
Average risk	3.6	3.2
Moderate risk	6.3	5.0
High risk	8	6.1

Calcium

Calcium is found mainly in bones of the body. Concentration of calcium, both total and free, depends on age, sex, physiological state (eg, pregnancy), and even season (owing to the seasonal variation of vitamin D, which is directly involved in the regulation of calcium concentration). Normal reference values are given in Table II. Calcium tests were done for 214 students (68 males & 146 females) and 38 adults (20 males & 18 females) using standard protocol of Coral Clinical Systems Kit.

Statistical Analysis

The subjects were grouped according to their anthropometric measurements and body composition parameters. Males and females were also grouped when the parameters showed a gender bias. The present study consisted of a single population consisting cross section of the age group 17-21 years. Basic descriptive statistics for subject data were expressed as mean ± standard deviation. Pearson's correlation coefficients (r) were calculated to assess the link and the degree of relation between BMI and selected body composition parameters. Statistical analysis was carried out using the SPSS version 16.0 software for Windows.

PHASE C

A health camp was organised in the college premises during the last two weeks of September to analyse the final remaining objectives of our project. During this phase we

also celebrated “World Heart Day” on September 29, 2016. The following tests were performed during this camp:

Basic questionnaires were designed to access personal details, family health history, residential area, sleeping habits, ailments if any and smoking/alcohol abuse in any participant. Height, weight, waist hip ratio, waist circumference were measured for all participant prior to the tests.

Spirometry

‘Measurement of breath’ or Spirometry is a routine lung function test being used worldwide for airway obstruction. It is a simple test that helps in determining prevalence of asthma as well as adult chronic obstructive pulmonary disease (COPD) in populations. COPD is a serious health problem and maybe irreversible if not detected early. A spirometer is a device that measures amount of air exhaled at various time intervals (eg: 1 sec, 6 sec) and the rate of exhalation. The spirometer was used to measure FEV1 (Forced expiration volume in 1sec), FEV6 (Forced expiration volume in 6sec) and the ratio of the two. A normal healthy person with no obstruction is expected to have a ratio of FEV1/FEV6 > 73% and value of FEV6>82% [Table III]. Results below this value indicate prevalence of COPD and must be severely investigated. Spirometry was performed using Piko-6 Spirometer. Subjects were provided with fresh mouthpieces for every measurement and it was ensured that maximal FEV1 and FEV6 efforts were obtained. In case of abnormal readings, the procedure were repeated. Lung capacities vary with age, gender, ethnicity, habits like smoking etc. The test was carried out for subjects belonging to a heterogeneous age groups from 16-65. 438 students (274 males & 164 females) were examined for spirometric ratio of FEV1/FEV6 and value of FEV6. As well as 68 adults were examined for the same. Analysis for relationship of height with these values was done and data was divided for students < 160 cm (159 subjects) and > 160 cm (278 subjects).

Table III: Standard Values for Spirometry & SpO_2

FEV1/FEV6 Ratio		
Category	**Values**	**Risk Levels**
I	< 0.73	Obstructive spirometric pattern; indicating risk of COPD
II	>0.73	Normal
FEV6		
Category	**Values**	**Risk Levels**
I	< 0.82	Restrictive spirometric pattern; indicating risk of COPD
II	>0.82	Normal
SpO_2		
Category	**Values**	**Risk Levels**
I	< 90	Medical Emergency
II	90-94.99	Hypoxia
III	95-100	Normal

Pulse Oximetry

This technique is an avidly used method prior to anaesthesia in operating rooms to determine oxygen saturation of blood. Blood cells contain haemoglobin (Hb) which in turn contains four oxygen molecules. If all binding sites on Hb are occupied by oxygen, it is said to be 100% saturated. During anesthesia the oxygen saturation should always be 95 - 100% [Table III]. If the oxygen saturation is 94% or lower, the patient is hypoxic and needs

to be treated quickly. A saturation of less than 90% is a clinical emergency. The oximeter measures oxygen saturation peripherally on ear, toe, finger it is called peripheral oxygen saturation (SpO_2). Percentage oxygen saturation was recorded for 69 adult and 440 student subjects using an instrument called a pulse oximeter. The instrument has a probe that measures both the pulse rate as well as the oxygen saturation of blood while it is placed on the finger or toe of the subject. Any individual with nail varnish was made to remove it for accurate reading. The finger/toe was inserted for several seconds till a stable reading for both values is displayed.

Harvard Step Test

Aerobic exercise is imperative to carry out activities of daily living and maintaining a healthy lifestyle. The aerobic capacity of an individual can be tested by measuring the ability to do exercise specifically by measuring the amount of oxygen required (VO_2). Harvard Step Test is the best known method for indirect measurement of VO_2. The Harvard Step Test was first developed by Brouha, Graybriel and Heath in 1943 (Brouha, Graybiel & Heath, 1943, found in Maud & Foster, 1995). It measures the cardiorespiratory fitness of a subject prior and post exercise. The subject is subjected to a short exercise and his/her blood pressures as well as heart rates are measured prior to and post the activity.

Cardiorespiratory fitness of 305 student subjects (191 males & 114 females) was determined by using Harvard Step test. The participants were clearly informed about the potential risks and benefits of the test and their consent was taken for the same. Lifestyle habits and any history of disease was taken into consideration prior to the test. The blood pressure (systolic & diastolic) along with the heart rate was measured prior to the exercise. The subjects were instructed to step up and down a 33cm high bench for 3 minutes with a rate of 24 steps/ minute. Post this brief exercise, 1 minute rest period was observed and the blood pressure as well as pulse was measured again. The students were also grouped according to their BMI and relationships were studied between their BMI and cardiorespiratory fitness. The pulse rates post exercise were grouped according to seven categories as shown in Table IV.

Table IV: Groupings of subject with respect to pulse measured post exercise

Categories of Pulse Return	Males	Females
Excellent	50-76	52-81
Good	79-84	85-93
Above average	88-93	96-102
Average	95-100	104-110
Below Average	102-107	113-120
Poor	111-119	122-131
Very poor	124-157	135-169

Statistical Analysis

The subjects were grouped according to their anthropometric measurements and body composition parameters. Males and females were also grouped when the parameters showed a gender bias. **The present study consisted of population consisting cross section of the age group 17-21 years and adult population of the age more than 23**. Basic descriptive statistics for subject data were expressed as mean ± standard deviation. Statistical analysis was carried out using the SPSS version 16.0 software for Windows.

7. Results

The results of our project have also been divided phase wise as different parameters were analyzed in each phase and hence various conclusions about the health status of our population was reached.

PHASE A

Data collected from the 371 participants were analysed for the health related criteria using anthropometric measures [Table V]. The data constitutes a majority of females which form about 58.5% of the total data. Males form the rest of 41.5%. The BMI was calculated according to the WHO definition using weight in kilograms and height in meters. The average BMI for the entire sample is 20.70 units.

Table V: Descriptive characteristics of the sample*

Variables	Males n=154	Females n=217	All individuals n=371
Age (y)	18.46 ~ 0.98	18.61 ~ 1.79	18.55 ~1.51
Weight (Kg)	60.68 ~10.83	51.26 ~ 10.08	55.17~11.34
Height (m)	1.70 ~ 0.065	1.58 ~ 0.07	1.63 ~0.09
Waist Circumference (cm)	30.51~ 3.20	28.36 ~ 2.96	29.25 ~3.24
Hip circumference (cm)	34.92 ~ 3.52	34.65 ~ 3.43	34.76 ~ 3.47
WHR	0.88 ~0.91	0.82 ~ 0.08	0.85 ~ 0.09
BMI (Kg/m^2)	21.01~3.45	20.48 ~3.69	20.70 ~3.59

*x ~ S.D.

The same when calculated for males and females separately was found to be 21.01 and 20.48 respectively. When the entire sample is classified according to the BMI criterion [Table VI], we find that approximately 26.95% of the individuals are underweight. The normal category individuals constitute about 61.99 % of the observations. The overweight and obese individuals form about 7.82 % and 3.23 % respectively.

Table VI: Prevalence of obesity as per Body Mass Index calculations

Obesity Category	**BMI**
Under weight	100 (26.95%)
Normal	230 (61.99%)
Over weight	29 (7.82%)
Obese	12 (3.23%)

The correlation was also calculated between the BMI and the waist-hip ratio. This value is -0.012 indicating that individuals with higher BMI have lower waist to hip ratio. This correlation was calculated for the BMI classifications and the results are reported in Table VII.

Table VII: Correlation between BMI and WC and WHR for different obesity categories

Obesity Category	**Correlation between BMI & WC**	**Correlation between BMI & WHR**
Under weight	0.027	-0.067
Normal	0.319*	-0.081
Over weight	0.212	-0.208
Obese	0.489	-0.360

* statistically significant at the level 0.01 (two tailed)

Table VIII: Correlation between BMI and WC and WHR for males and females

Gender	Correlation between BMI & WC	Correlation between BMI & WHR
Male	0.659*	0.018
Female	0.653*	0.120

* statistically significant at the level 0.01 (two tailed)

The relationship between BMI and WC of males and females was also studied. It is observed that out of 217 females 7 females have WC more than 35. It was further observed that these females have BMI more than 25. Moreover, out of 217 females 20 females have BMI more than 25. Out of these 20 females 12 females have WC less than 35. Out of 154 males, 1 male has WC more than 40 whose BMI is also more than 25. Out of these 154 males, 20 males have BMI more than 25 but their WC is less than 40. Results are reported in Table VIII and have been plotted as well [Figures I,II].

The overall correlation between the BMI and the waist circumference is 0.640 which is highly significant [at the level 0.01 (two tailed)]. The correlation indicates that the higher BMI is associated with a larger waist circumference and that the degree of this association is about 0.64. The overall correlation between the BMI and the waist/hip ratio is 0.095 which is not statistically significant. The correlation coefficient was also calculated for all the BMI classifications and the results are displayed in Table VII.

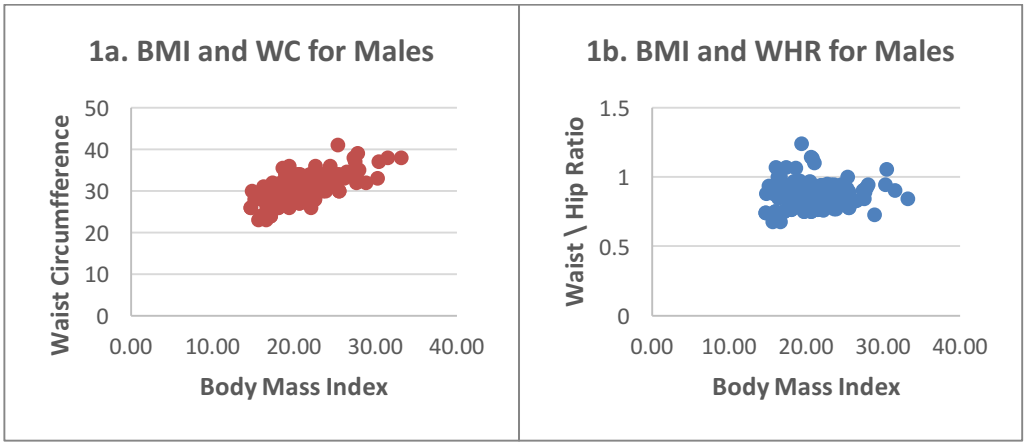

Figure I: (a) Plot between BMI and WC for males; (b) Plot between BMI and WHR for males.

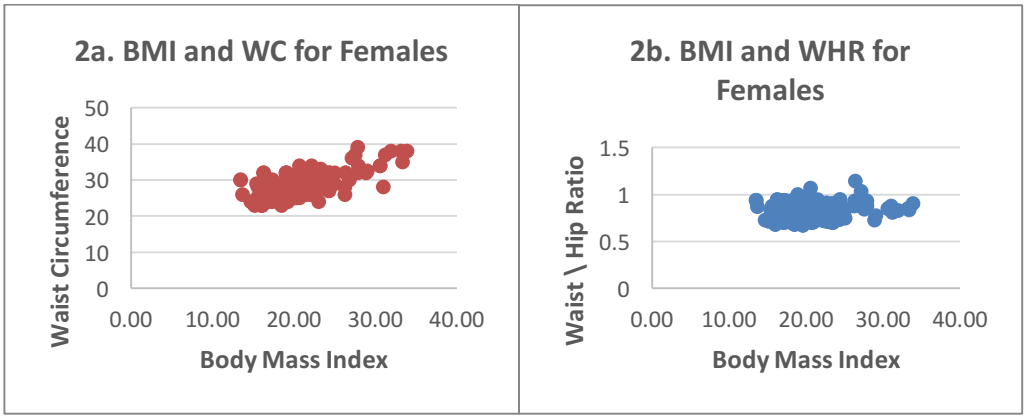

Figure II: (a) Plot between BMI and WC for females; (b) Plot between BMI and WHR for females.

Relationship between BMI and Diet habits (Vegetarians and Non-vegetarians):

It is generally accepted that the non-vegetarians have higher BMI on average due to their dietary habits and lifestyles. To check for this in our data, we collected information on the dietary habits of the individuals in the survey. The individuals answered the simple question about whether they are vegetarians or non-vegetarians. The collected data reveals that out of the total 371 individuals, about 123 (33.15%) reported to be non-vegetarians. The rest of the observations were included under vegetarians which constitute the rest of 66.85% of the data. The average BMI were recorded to be 20.30 and 21.50 for vegetarians and non-vegetarians respectively. A simple t-test reveals that there is no significant difference between the average BMI for these two diet groups thus refuting the popular notion.

PHASE B

The first Health camp was conducted on September 28, 2015.

A. Assessment of body parameters for determining prevalence of obesity

The data collected from the 140 undergraduate participants (age ranging from 17-21) were analyzed for their health status using anthropometric measures. The participants were primarily females with as many as 57.1% female subjects. The participants were analyzed for various parameters of body composition like Quetelet's Index (BMI), Total Body Fat percentage, Visceral Adipose Tissue (VAT), Subcutaneous Adipose Tissue (SAT), Skeletal Muscles (SMs) were studied The representative data was plotted on a scatter plot of 5x5 grids constituting of all the parameters studied in the population (Figure III). The population was distributed as *low*, *normal*, *high* and *very high* groups on the basis of their values for a particular body parameter.

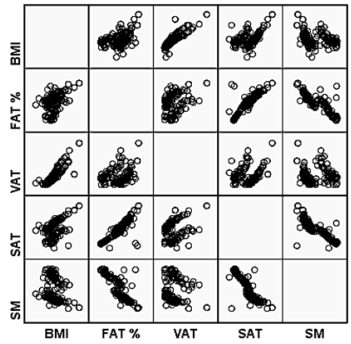

Figure III: Distribution of body parameters from collected data. All the parameters considered for analysis are shown in a scatter plot in a representation of the recorded data obtained from the current study.

A total of 140 individuals were investigated as a part of the study and mean values of parameters used in our study are mentioned in Table IX; 57.1 % of the participants were females (80 females and 60 males). The study sample represented a wide range of BMI values (11-35 kg/m2). The range of fat percentage extended from 6.9-40.4. The visceral fat was comparatively restricted in extend and ranged from 0.5-14.5 cm2. The subcutaneous fat represented a wide range of values (1.40-39.40 cm2). The skeletal musculature in comparison had a narrow range of values (22.1- 40).

Table IX. Descriptive Statistics of the Anthropogenic Measurements and body parameters

Parameter	Mean ± S.D.	
	Males	Females
BMI (kg/m^2)	20.86 ± 2.99	21.48 ± 4.64
Fat %	15.66 ± 6.89	28.14 ± 5.22
VAT (cm^2)	4.13 ± 2.62	3.24 ± 2.78
SAT (cm^2)	10.58 ± 4.44	23.56 ± 5.75
SM	36.56 ± 2.36	26.97 ± 2

B. Body Mass Index (BMI)

Our data indicates that 60.7 % of the subjects screened were found to lie in the normal range, 24.3 % were underweight, and 12.1% subjects were overweight, while 2.9% was obese (Figure IVa). The pooled data indicate that among the male participants 10% were overweight/obese (Figure IVb), while among the female participants, 18.8% were overweight/obese (Figure IVc).

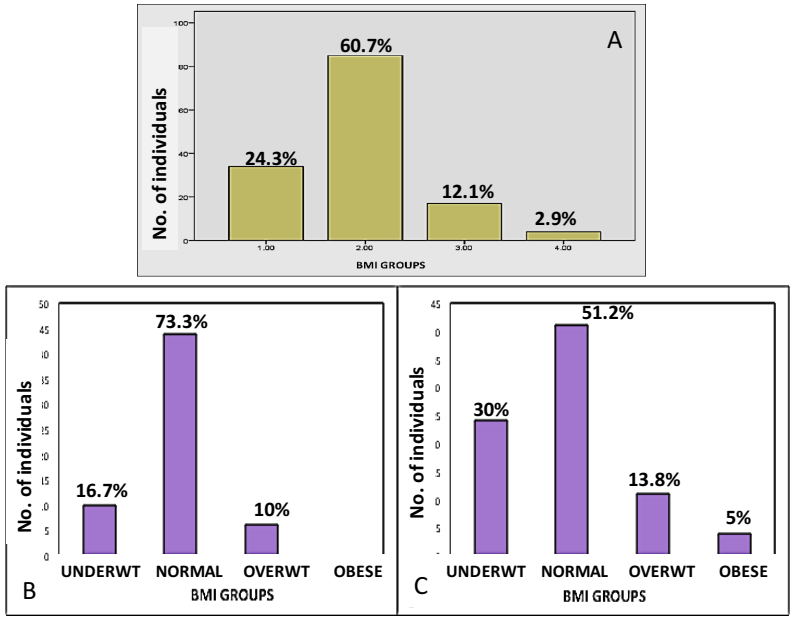

Figure IV: Graphical representation of the distribution of (a) all individuals (b) males and (c) and females in the four pre-defined BMI groups

C. Total Body Fat %

The normal range of TBF % has been shown to differ in a gender-biased manner. The majority of male participants were found to range between low, normal and high levels of body fat (30% with low levels and 40% with normal levels and 23% with high levels; Figure V a). The female participants were found to predominantly belong to the normal, high and very high range of total body fat percentage (58.8% normal, 27.5% high and 8.8% very high; Figure V b).

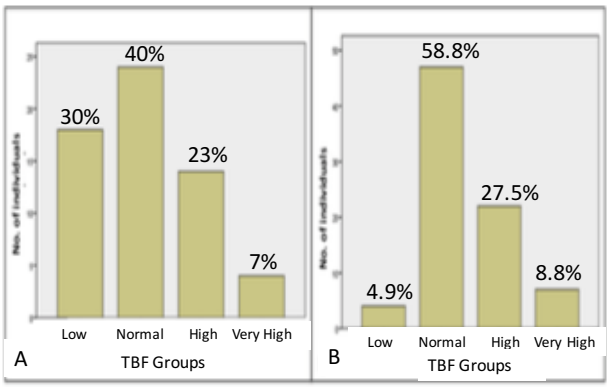

Figure V: Distribution of Participants Based on Total Body Fat (TBF) %. a) Distribution of Male subjects into low, normal, high and very high TBF % groups. b) Distribution of female subjects into low, normal, high and very high TBF % groups.

D. Visceral Adipose Tissue

The VAT of individuals has shown to have no gender bias. The current study shows that 97% of the subjects have low visceral fat, and the rest have a normal VAT levels (Figure VI). No individuals were shown to have a VAT composition in the *high* category.

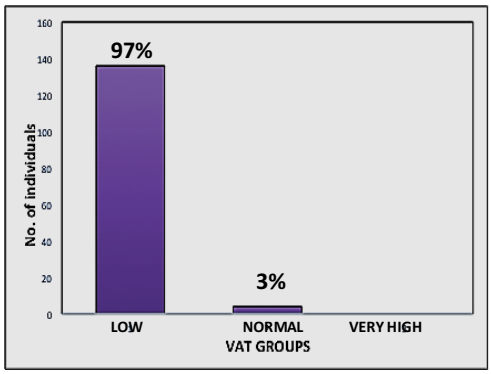

Figure VI: Distribution of individuals in groups with respect to their visceral adipose tissue content.

E. Skeletal Muscle

The male and female participants of the study were grouped into four sub-groups based on their levels of skeletal fat (refer to Table I). Amongst the female participants, 85% were found to have normal skeletal musculature, and 7.5% with high or very high skeletal musculature. The male participants had 76.6% individuals with normal skeletal musculature and 11.7% with high or very high skeletal musculature (Figures VII a & b).

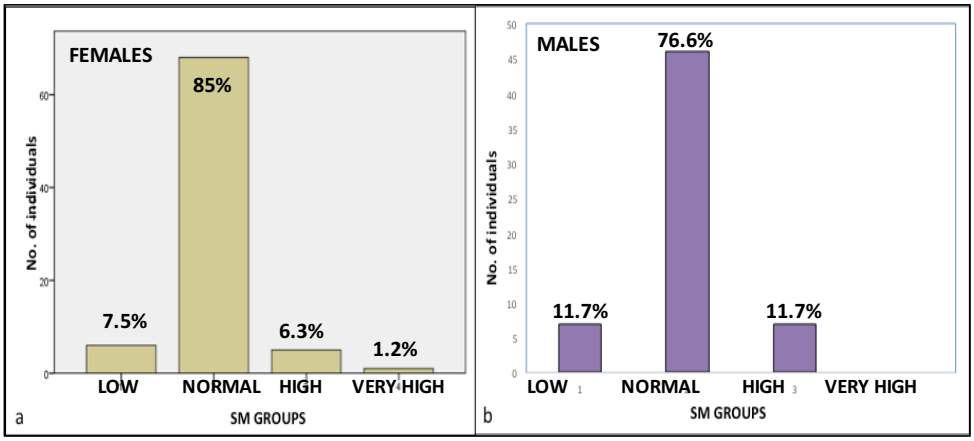

Figure VII: Distribution of individuals (a) Females and (b) Males in groups with respect to their skeletal muscle content {Group 1: Low; Group 2: Normal; Group 3: High; Group 4: Very high}.

F. Analysis of association between various body parameters

One of the main objectives of this study is to analyze the relationship of BMI and the various body parameters in the given population of young adults of Indian ethnicity and moderately high physical activity. Both BMI and body composition measurements have been shown to be useful indicators of obesity. A correlation between these parameters was attempted as a part of this study. Correlation between BMI and VAT/SAT/TBF% and SM was investigated in order to come to a conclusion. A relationship between VAT and TBF% was also attempted in order delineate any correlation between them.

The participants were divided into subgroups based on their BMI values. Further, their relationship with the above mentioned body parameters were tested by plotting their mean values against BMI values (Figure VIII). All the body composition parameters (TBF%, VAT and SAT) with the exception of skeletal musculature appear to increase with increase in BMI ratios.

G. Correlation of the BMI-body composition parameters relationship

Our study shows that there was a strong and significant positive correlation between BMI and TBF% ($r = 0.80$, $p < 0.01$ in females; $r = 0.50$, $p < 0.01$ in males). A similar strong and significant positive correlation is observed between BMI and SAT ($r = 0.75$, $p < 0.01$ in females; $r = 0.61$, $p < 0.01$ in males). A negative and significant correlation was found between BMI and SM ($r = -0.54$, $p < 0.01$ in females; $r = -0.70$, $p < 0.01$ in males). The strongest and significant correlation was observed between BMI ratios and VATs ($r = 0.99$, $p < 0.01$ in males and $r = 0.87$, $p < 0.01$ in females). It was found that there is a positive and significant correlation between the parameters VAT and TBF%, ($r = 0.54$, $p < 0.01$, for males; $r = 0.75$, $p < 0.01$) for females (Table X).

H. Relationship between BMI-body composition parameters

The association between BMI and TBF% was also analyzed in a scatter plot and it not only showed an increasing trend for both males and females, but also a definite difference in pattern of distribution based on their respective BMI ratios and TBF% (Figure IX). The association between BMI and SAT was also analyzed in a scatter plot and it showed an increasing trend for both males and females, as well as a definite difference in pattern of distribution based on their respective BMI ratios and SAT.

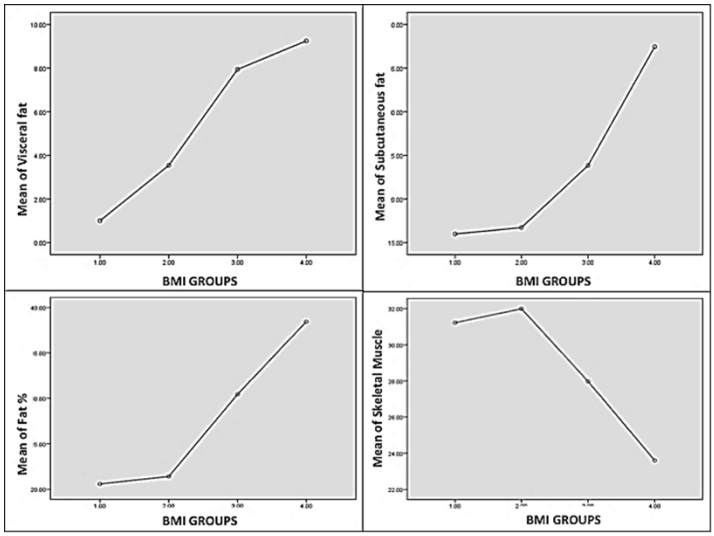

Figure VIII: Plots between BMI groups with mean of Visceral fat, Subcutaneous fat, Fat % and skeletal muscle (Categories of BMI: 1- underweight, 2-normal weight, 3-overweight, 4- obese).

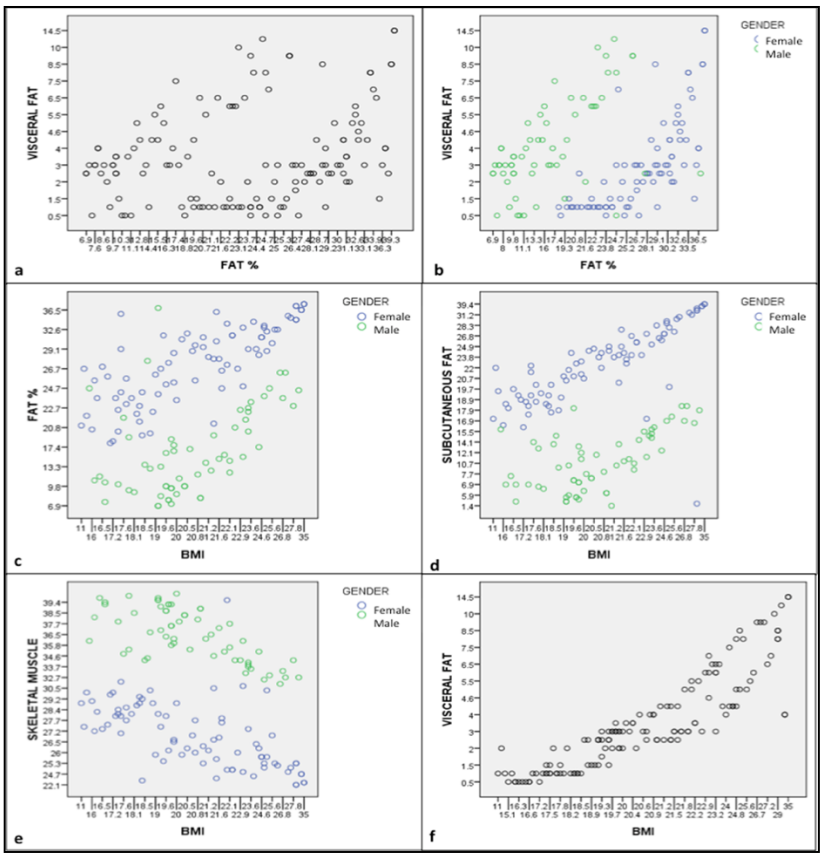

Figure IX: BMI and relationship with body composition parameters viz. (a-b) scatter plot between visceral fat and total body fat (all individuals, subgroups of males and females); c) Scatter plot between total body fat and BMI (subgroups of males and females); d) Scatter plot between subcutaneous fat and BMI (subgroups of males and females); (e) Scatter plot between skeletal muscle and BMI (subgroups of males and females); f) Scatter plot between visceral fat and BMI.

The association between BMI and SAT was further analyzed in a scatter plot and it appears to be the only body parameter that has a decreasing trend with respect to each other, for

both male and female participants (Figure IX). The association between BMI and VATs was further analyzed in a scatter plot and it showed an increasing trend for all participants, however based on the values of BMI ratios and VAT levels recorded a distinctive difference in the pattern of distribution based on their respective genders (Figure IX). Total body fat comprises of visceral fat and subcutaneous fat.

It was found that there is a strong and significant correlation between the two parameters, ($r = 0.54$, $p< 0.01$, for males; $r = 0.75$, $p< 0.01$) for females; Figure IX). When the entire population was assessed for correlation between the parameters, a lower correlation coefficient was observed (3.21).

Table X: Correlation between BMI and various body composition parameters

Parameter	Male	Female	Whole
BMI vs TBF%	0.50**	0.80**	NA
BMI vs SAT	0.61**	0.75**	NA
BMI vs SM	-0.70**	-0.54**	NA
BMI vs VAT	0.99**	0.87**	0.87**
VAT vs TBF	0.54**	0.75**	0.32**

** Correlation is significant at the 0.01 level (2-tailed).

I. Lipid Analysis

Lipid analysis was done to measure cholesterol, HDL, LDL, VLDL and triglycerides in blood samples of student as well as adult population. A total of 214 students and 38 adults were tested for lipids. Cholesterol levels were found to be in the normal category for the predominant population for both adults and students, however, adults had a 10.5% population with borderline high levels [Figure X]. Refer to Table II for standard values.

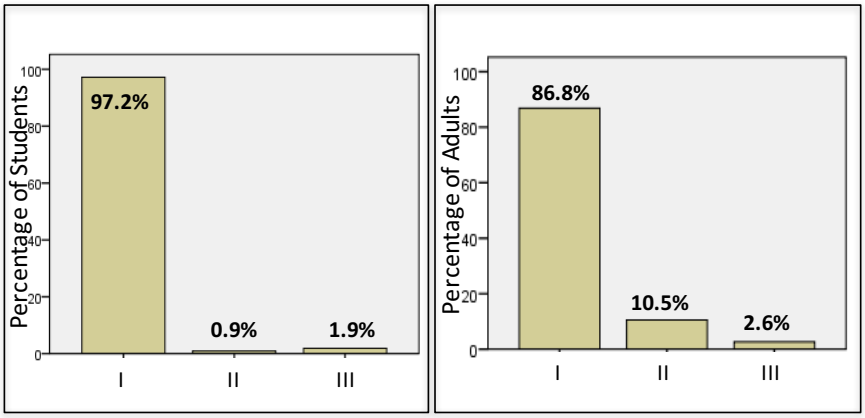

Figure X: Distribution of cholesterol levels in students (left) and adults (right). Categories are: I-normal, II-borderline high and III-high.

Triglycerides were found to be alarmingly high [Figure XI] in the adult population which means that they are prone to cardiovascular abnormalities.

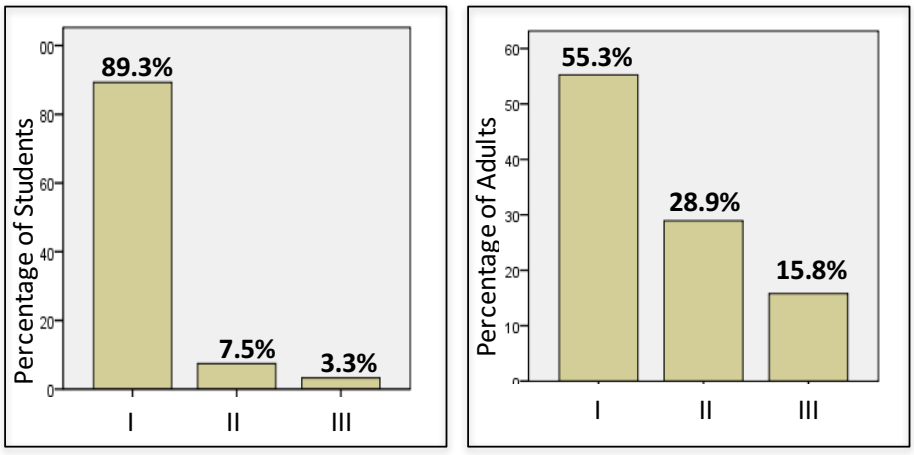

Figure XI: Distribution of triglyceride levels in students (left) and adults (right). Categories are: I-normal, II-borderline high and III-high.

HDL or high density lipoprotein also called the good lipid as it scavenges the harmful lipids from the arterial walls. Normal values of HDL were found in the student population but comparatively lesser levels were found in 15.8% of the adults [Figure XII]. Refer to Table II for standard values. LDL or low density lipoprotein are also called the 'bad lipids'. Predominant student population had optimal LDL values (71%), but the levels were seen worsening in the adult population [Figure XIII].

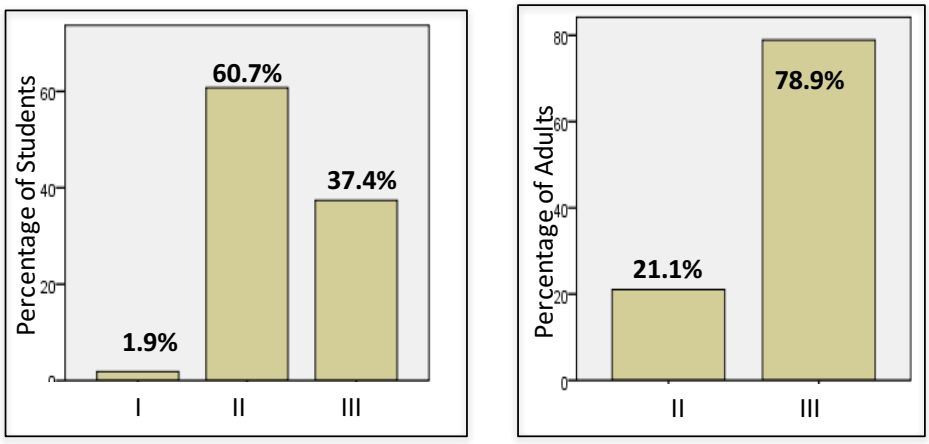

Figure XII: Distribution of HDL levels in students (left) and adults (right). Categories in Table II.

High LDL levels are precedent to blockage of arteries as they get deposited on the walls and lead to increase in arterial pressure. Refer to Table II for standard values. VLDL levels were also found to be high in the adult population [Figure XIV]. Both LDL and VLDL levels are alarm bells for heart related abnormalities.

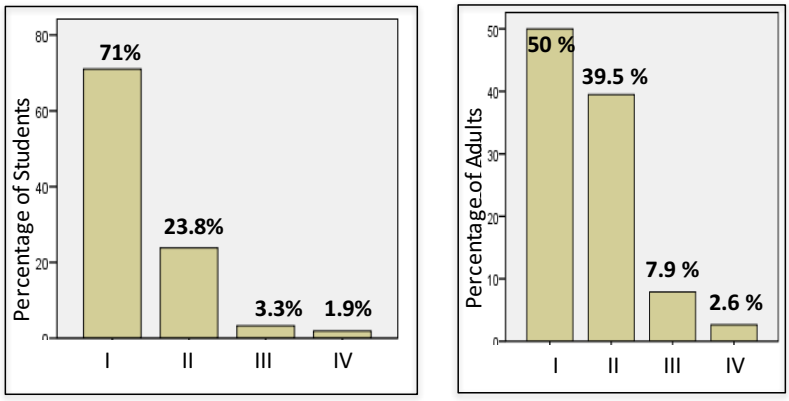

Figure XIII: Distribution of LDL levels in students (left) and adults (right). Categories are: I-Optimal, II- desirable, III-borderline high and IV-high.

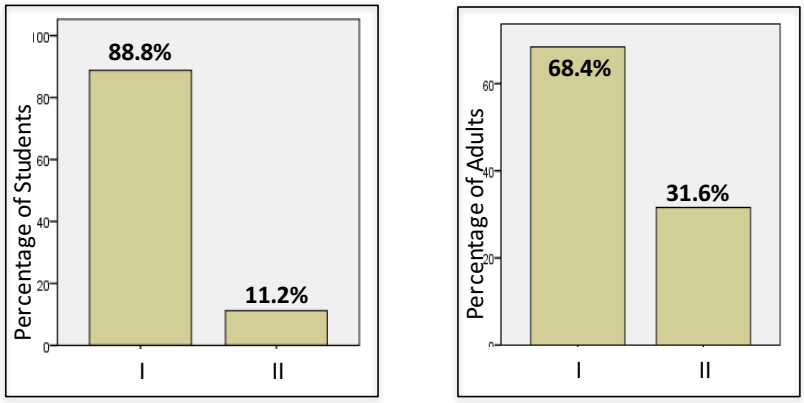

Figure XIV: Distribution of VLDL levels in students (left) and adults (right). Categories are: I-Optimal, II - High.

Ratios indicating Cardiovascular Risk of a Subject:

a. **Total Cholesterol/HDL ratio**

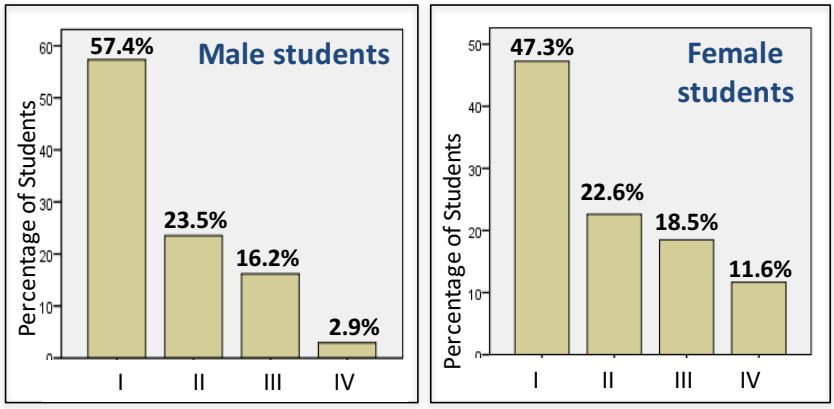

Figure XV: Gender wise Comparison of Total cholesterol/HDL ratios in students. Categories are: I-Very low risk, II – Low risk, III-Average risk, IV-Moderate risk and V-high risk.

Five categories of Total cholesterol/HDL ratio have been ascertained [Table II]. Our population had no participants that were delineated into the high risk category. Gender

wise comparison showed a steady trend in students as well as adults with most females in the moderate risk category [Figure XV & XVI].

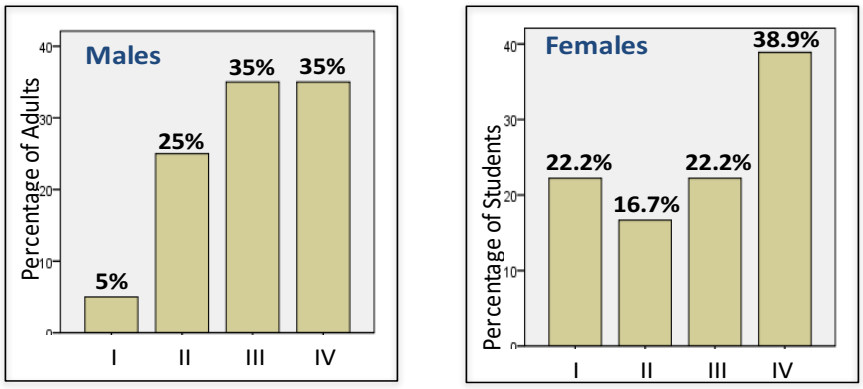

Figure XVI: Gender wise Comparison of Total cholesterol/HDL ratios in adults. Categories are: I-Very low risk, II – Low risk, III-Average risk, IV-Moderate risk and V-high risk.

b. LDL/HDL Ratio

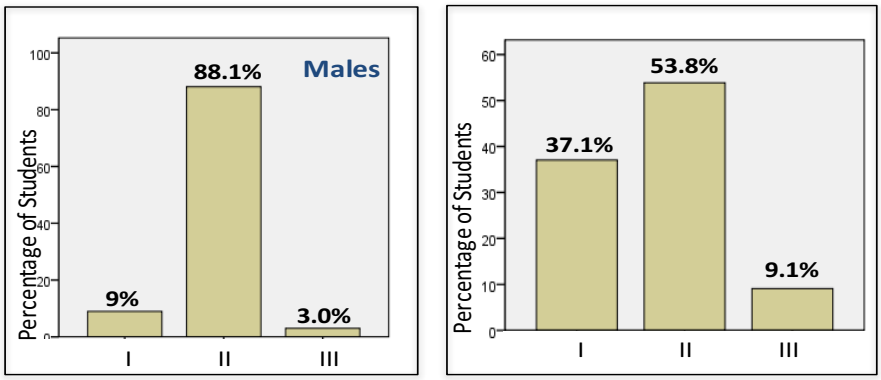

Figure XVII: Gender wise Comparison of LDL/HDL ratios in students. Categories are: I-Very low risk, II – Average risk, III-Moderate risk and IV-high risk.

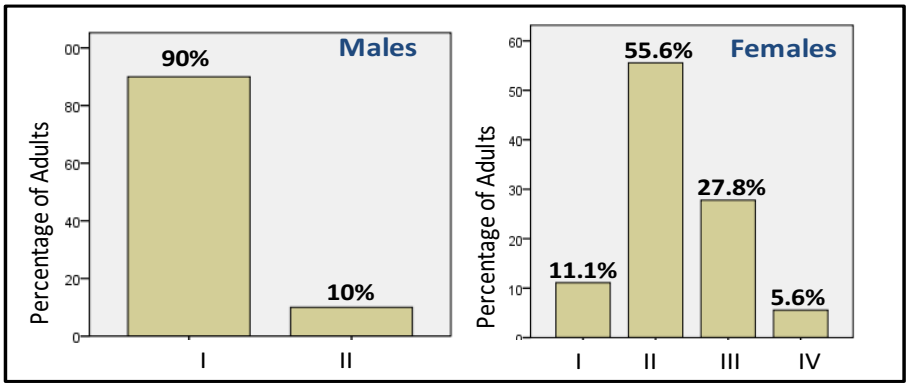

Figure XVIII: Gender wise Comparison of LDL/HDL ratios in adults. Categories are: I-Very low risk, II – Average risk, III-Moderate risk and IV-high risk.

LDL/HDL ratios also showed a similar trend as the earlier ratios with female students and adults threatened with moderate risk levels of LDL [Figure XVII & XVIII].

J. Calcium Levels

Calcium levels were also measured in all participants. 37.5% of students were hypo calcaemic, 56.1% in normal range and 6% hyper. A gender wise comparison showed an unexpected deficiency of calcium in male students compared to females [Figure XIX].

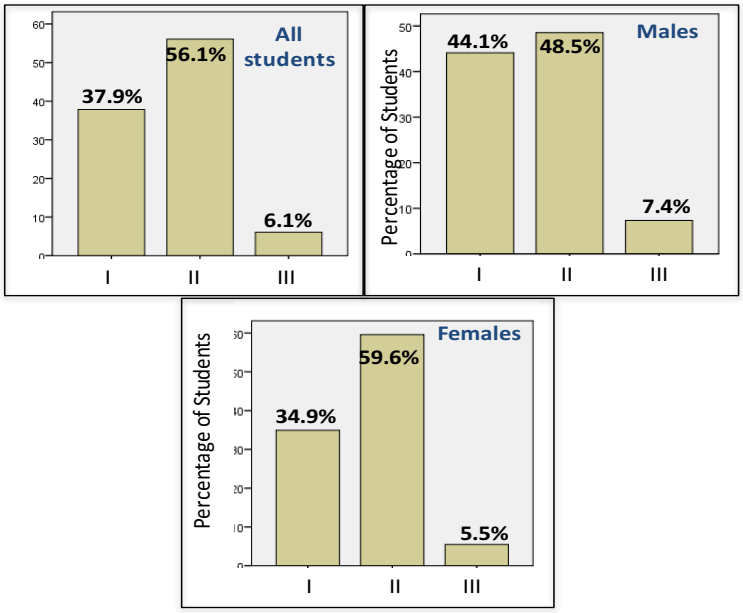

Figure XIX: Comparison of calcium levels in all students. Categories are: I-Hypo calcaemic, II – Normal, III-Hypercalcaemic

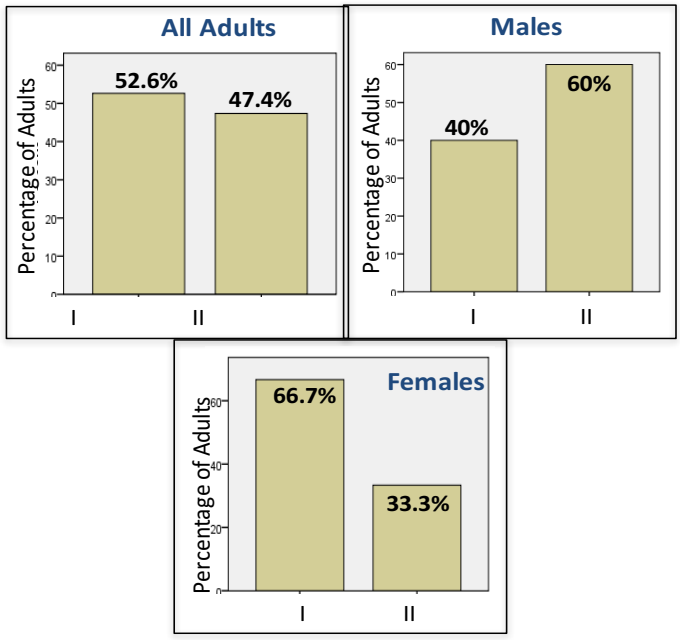

Figure XX: Comparison of calcium levels in all adults. Categories are: I-Hypo calcaemic, II – Normal, III-Hypercalcaemic

Adult population on the other hand showed that majority females were having calcium

levels lower than normal [Figure XX]. Prior to these check-ups, questionnaires regarding exposure of these participants to sunlight was also assessed. It was found that this exposure was not adequate hence affecting the calcium levels in their blood tests.

PHASE C

The final health camp was conducted during the last two weeks of September, 2016. Apart from the general anthropometric measurements, another questionnaire was filled regarding eating habits, sleep patterns, smoke/alcohol abuse and history of any respiratory ailments. It was deciphered that general lifestyle patterns could be correlated with any prevailing disorders of the population under scrutiny.

A. Oxygen saturation of blood

Peripheral oxygen saturation (SpO2) of blood was measured in a non-invasive method and unexpectedly it was found that students were present in the category of medical emergency [6.4%]. No adults were found in this category. Hypoxic individuals belong to category II and were 7.5% students and 8.7% adults. The rest were a predominant category of normal oxygen saturation.

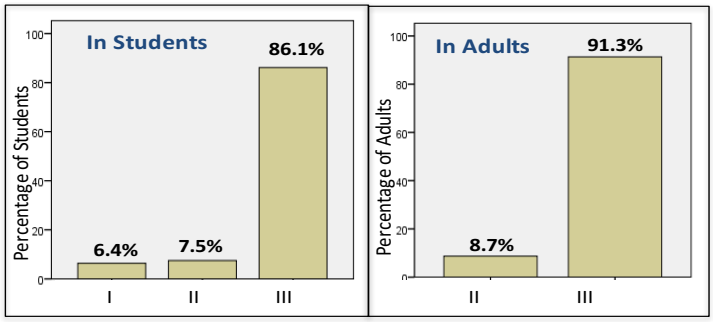

Figure XXI: Comparison of SpO_2 levels in all students and adults. Categories are mentioned in Table III.

B. Spirometric Values of Lung Capacities

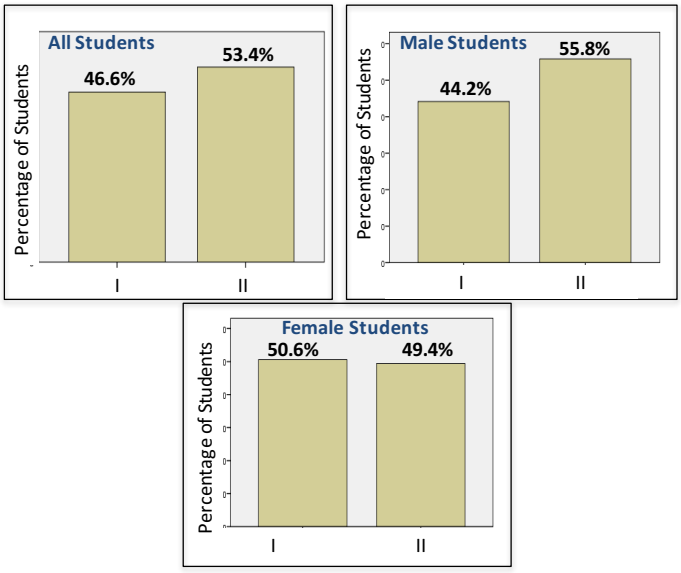

Figure XXII: Values of FEV1/FEV6 ratio for all students and gender based comparison.

Two lung capacities were measured to hint at any prevalence of obstructive/ restrictive pattern of breathing using spirometry. Figure XXII shows percentage of individuals belonging to category I - <0.73 of FEV1/FEV6 ratio and having obstructive pattern [46.6%]. Another value that was compared was FEV6; forceful expiration in 6 seconds by an individual and with a value <0.82 hinting at restrictive breathing pattern and hence prevalence of COPD. Figure XXIII shows percentages of students belonging to both categories. A gender based comparison of both values shows that males have better lung capacities compared to females.

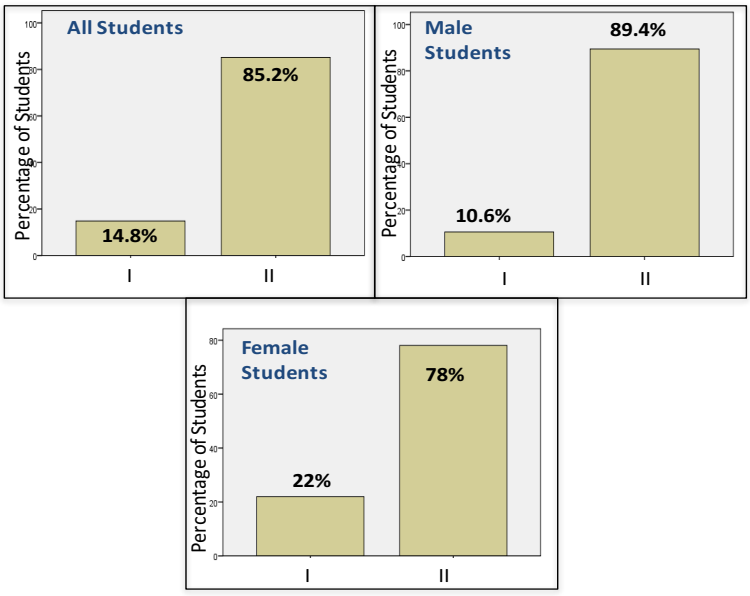

Figure XXIII: Values of FEV6 for all students and gender based comparison. Categories are mentioned in Table III.

Lung capacities were also measured with respect to height of students. Students were divided into two categories: > 160 cm and <160 cm. It was seen that with increasing height the lung capacities also increased and hence there is a direct relationship between the two. This pattern was shown for both spirometric values: FEV1/FEV6 and FEV6 [Figures XXIV & XXV].

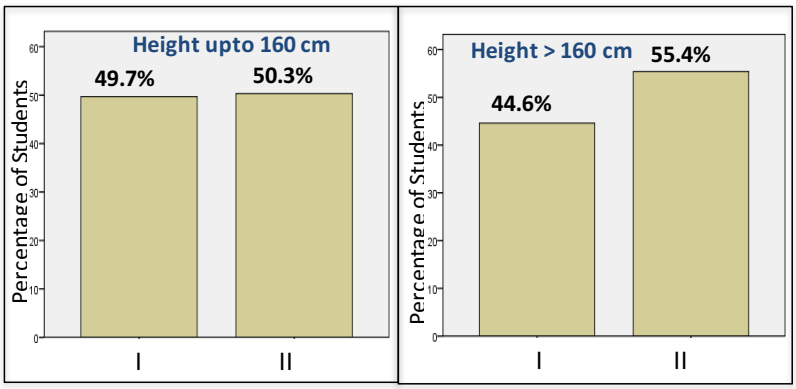

Figure XXIV: Values of FEV1/FEV6 in students for height < 160 cm & >160 cm. Categories are mentioned in Table III.

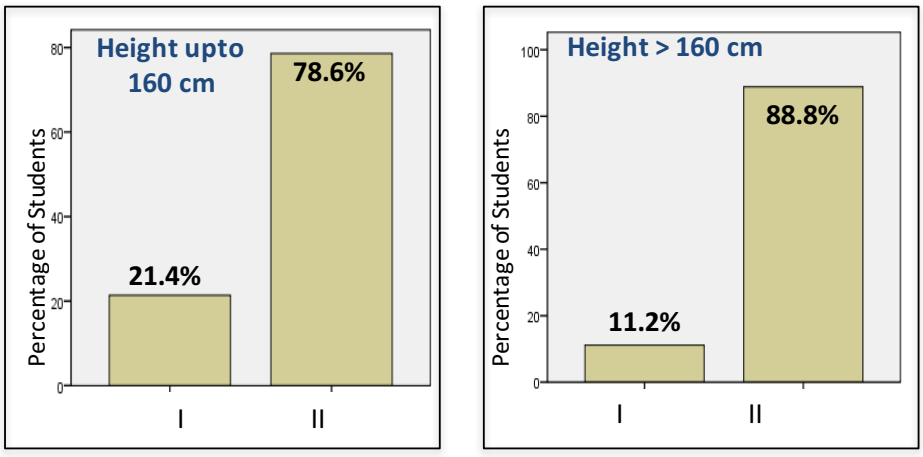

Figure XXV: Values of FEV6 in students for height < 160 cm & >160 cm. Categories are mentioned in Table III.

Adults were also examined for the spirometric capacities and it was seen that most were in the healthy part of the population [Figure XXVI].

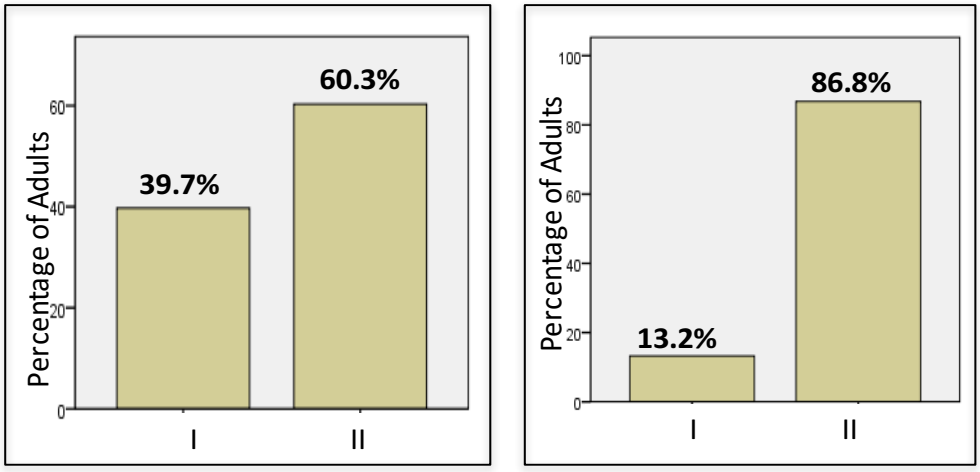

Figure XXVI: Values of FEV1/FEV6 ratio (left) for all adults. Categories are mentioned in Table III.

C. Harvard Step Test

Cardiorespiratory fitness of the student population was assessed using the traditional Harvard Step Test. On basis of the recovery of pulse rate post exercise the students were grouped into seven categories [Table IV]. Gender wise comparisons were done and it was seen that males had better recovery rates compared to females [Figure XXVII]. The student population was also divided on basis of their BMI values. BMI values were correlated with their pulse recovery rates and it was seen that the obese population had least pulse recovery rates especially the females [Figure XXVIII, XXIX].

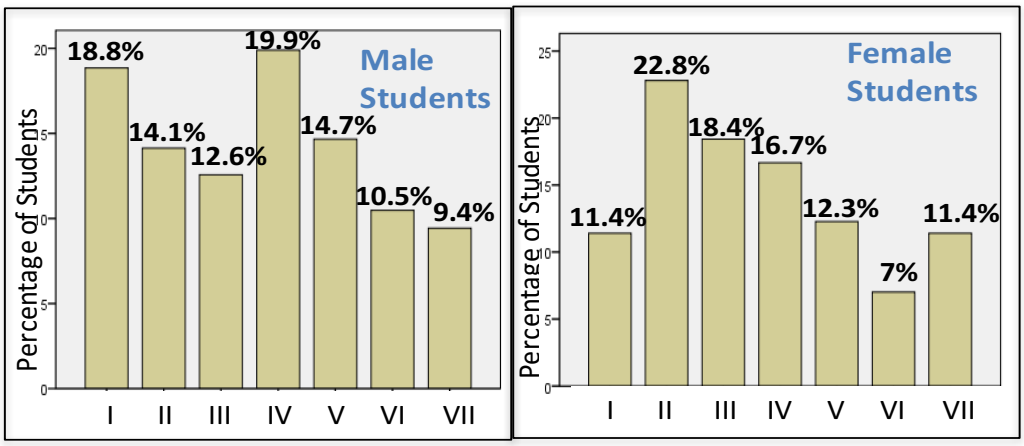

Figure XXVII: Gender wise comparison of students with respect to recovery rate of pulse measured post exercise. Categories as mentioned in Table IV.

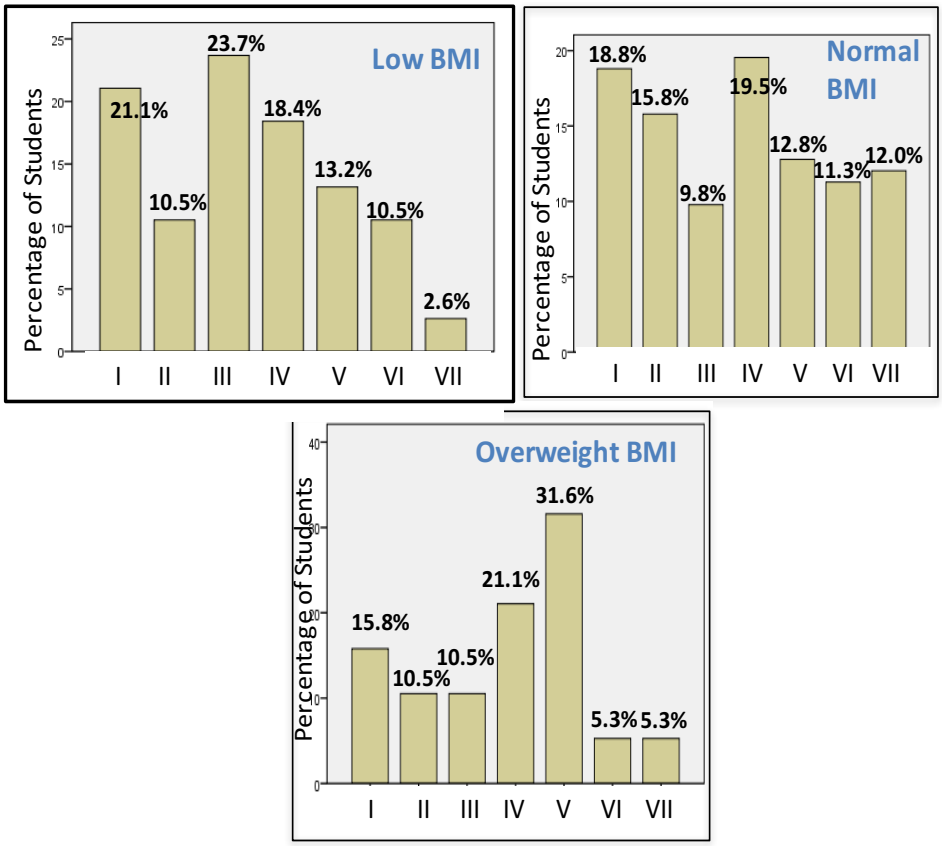

Figure XXVIII: BMI wise comparison of male students with respect to recovery rate of pulse measured post exercise. Categories as mentioned in Table IV.

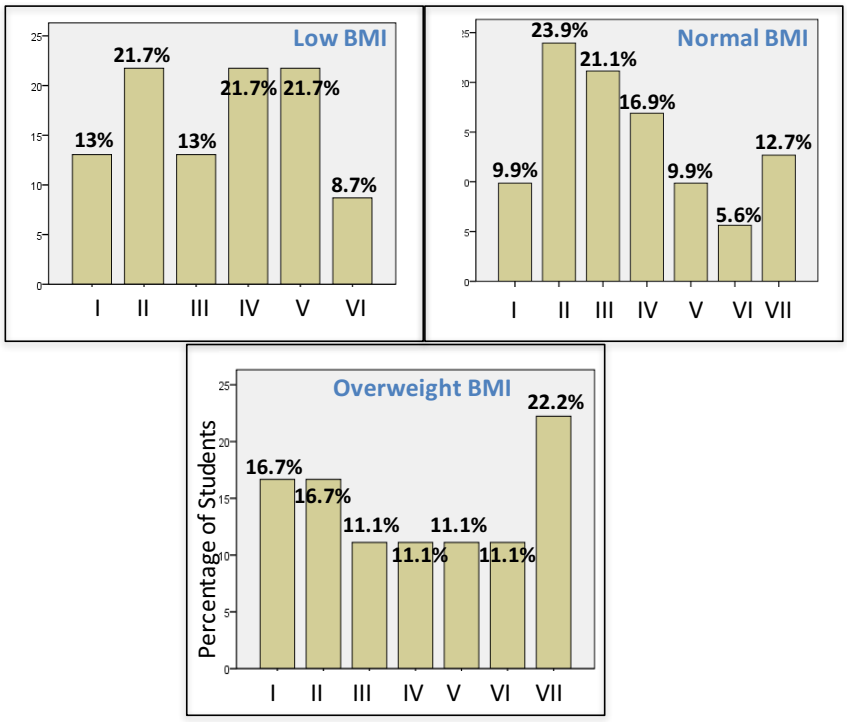

Figure XXIX: BMI wise comparison of female students with respect to recovery rate of pulse measured post exercise. Categories as mentioned in Table IV

DISCUSSION

PHASE A

Our study delineates that BMI and WC measurements are significantly correlated and give meaningful interpretations in study of subjects in the age group 17- 21. BMI only serves as an initial screening for overweight and obese individuals, and other measurements such as WC are significant indicators of overall health. However, WHR did not give significant results in our study and we can hypothesize that for this age group (17-21) it is not as useful as WC. Our findings are in agreement with Janssen *et al*. as well as Hurt *et al*., who have stressed over the need to combine BMI and WC as parameters for highlighting obesity related health risks. A number of students were found to have high BMI and WC values. No substantial difference was noted for BMI of vegetarians vs non-vegetarians. Lifestyle patterns and dietary intake have profound effect on overall health of individuals. Lack of exercise, intake of food high in sugar and fat content as well as stress levels lead to obesity. Our aim of the study is also to spread awareness amongst the youth regarding their lifestyle habits that are making way for health challenges in the future.

On the basis of area of fat distribution, obesity can be classified into android and gynecoid obesity. In android obesity, fat is localized around the waist and in the upper body (apple shaped). It is more frequently seen in men and has a poorer prognosis for morbidity and mortality than the gynecoid type. In gynecoid obesity, fat is located in the lower half of the body (pear shaped) and is more frequently seen in women.

Energy input must equal the energy output to maintain the energy balance. Obesity occurs when extra kilocalories are consumed than that required by the body. During the early stages of being overweight, the existing fat cells become larger, and upon further consumption of excess calories, the body starts making more adipocyte to store the fat. Once new fat cells have been created, they do not disappear with weight loss, they are

ready to be refilled for future weight gain. In certain cases, obesity has been linked to resistance to leptin – a hormone which is responsible for body weight regulation. However, more commonly, obesity occurs as a result of bad life style choices, no exercise, consumption of junk food, endocrine disorders. Stress, anxiety and depression have also shown to alter feeding behaviors due to emotional eating, rather than actual need of food. Maintaining a low calorie diet in isolation is not enough for long term maintenance of weight, hence physical exercises are essential for energy expenditure of the body. Exercise reduces the percentage of fat in the body and increases the percentage of muscle mass and lean tissue. Aerobic exercise programs have been shown to significantly reduce the risk of android obesity. Converse to obesity, underweight individuals have the ailment of nutritional deficiency. A balanced diet with appropriate nutrient intake is imperative for a healthy life.

PHASE B

The study comprised of young individuals with ages ranging between 17-21, and a higher proportion of female participants as compared to males. The assessment of their health status was carried out by analysing the data for the various body parameters including BMI, TBF%, VAT, SAT and SM. The population was primarily found to constitute of normal range BMI individuals, but substantial subjects were also found in the below normal and overweight category. When analysed on the basis of gender, it was found that though both participants had majority of normal BMI ratio values, in the case of females, higher number individuals existed at both extremities (more underweight as well as overweight/obese individuals as compared to their male counterparts). The assessment of the TBF% of the participants indicates that there was distinctive difference in distribution patterns between males and females. The number of males with very high TBF% was negligible as compared to the males with low or normal levels of TBF%. In stark contrast, the females had primarily individuals in normal, high and very high categories of TBF%. This indicates that the male participants had healthier fat composition as compared to the females. The presence of visceral adipose tissue has no gender bias and all participants of the study had either normal or low levels of VATs, thus no definite predisposition to diseases associated with high VAT. The skeletal musculature of both the male and female participants was found to be primarily normal, with a higher percentage of males having high musculature as compare to females, indicating more athletic activities carried out by the males.

This study was aimed at exploring if BMI as an anthropometric measurement is indicative of the status of the various other body composition parameters, in the currently selected population of Indian undergraduate students with moderate to high levels of physical activity. It was observed that the increase in BMI was correlative to the increase in the TBF%, the VAT and the SAT content. However, increase in BMI showed a concomitant decrease in skeletal musculature. This inverse pattern between BMI and SM is expected, as individuals with more skeletal musculature would ideally be carrying out more physical activity, and hence a lower chance of obesity as well as high BMI. The increase in TBF% and SAT were shown to exhibit a sudden linear spike in values with increase from normal BMI to higher BMI ratios. In the case of visceral fat, there is a gradual increase of VAT with increasing BMI. Skeletal muscles are to be highest in individuals with normal BMI, followed by a sharp decline with the increase of BMI. Further correlation studies were also carried out between the above mentioned parameters and a similar trend was observed, hence showing a strong, significant and positive association between BMI and the other body parameters. The association between TBF% and VAT was also found to be strongly positive and significant. BMI and SM were shown to have a strong and significant negative correlation as expected.

Our study thus shows that we have analysed a primarily healthy group of young adults, however a significant proportion of individuals were also identified with possible weight

related predicaments in the near future. The results of this study also indicate that though BMI can be used to correlate with most body parameters for a similar population to a significant extent, however the relationship is not linear throughout the spectra. Hence additional body composition parameters must be also taken into account when carrying out such studies.

In order to manage and prevent obesity, it is important to understand the mechanisms and modes by which obesity may occur. Based on the localization of excess fat, overweight and obese persons can be categorized under two groups: android and gynecoid. Obesity of the male type is android and is associated with excess adipose tissue distribution in the upper thoracic body and results in apple shape structure. Female type or gynecoid obesity is characterized by fat deposition in the lower body that is thighs and hips and leads to pear shaped body. Android type obesity predisposes to cardiovascular disorders, insulin resistance, strokes and high blood pressure.

The adipocytes or fat cells in the adipose tissue secrete hormones known as adipokines [Figure XXX]. The visceral fat that surrounds the abdomen releases adipokines like visfatin, which can lead to inflammation in visceral fat and is associated with increased cardiovascular diseases. Obesity suppresses the good adipokines, which help in maintaining body weight and also exert anti-inflammatory action. It also increases secretion of bad adipokine –resistin which can lead to insulin resistance and hence can lead to type-2 diabetes. It has also been reported that VATs may induce the more adipocytokines than the SATs. Hence, as VAT increases, diseases related to metabolism also increase, along with an increase in incidence and severity of excess subcutaneous fat.

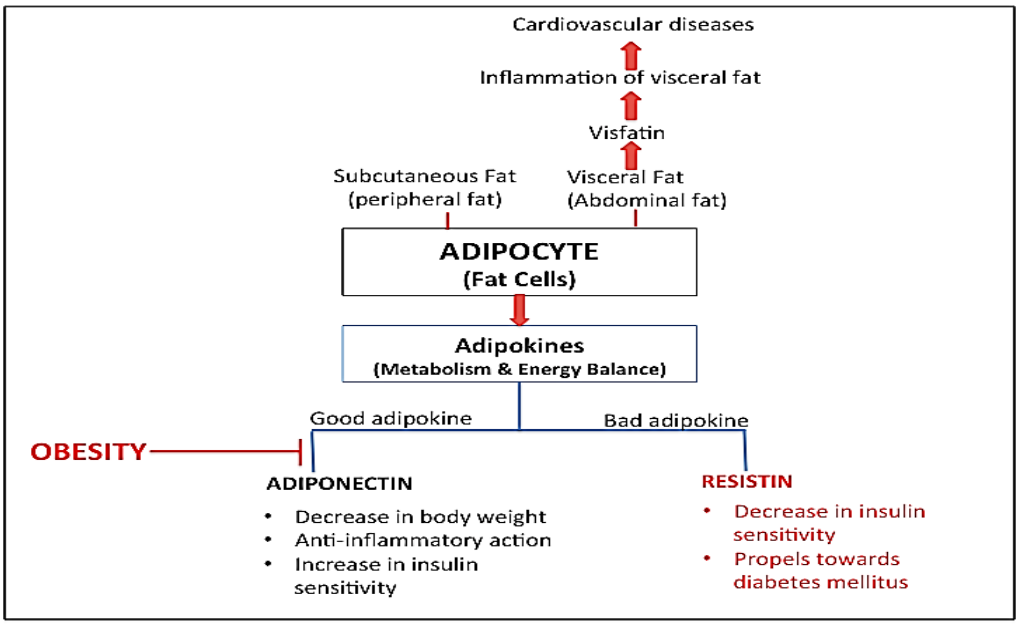

Figure XXX: Role of adipocytes/fat cells in producing good and bad adipokines. Obesity inhibits positive effects of adiponectin (good adipokine). Visceral fat cells produce visfatin that causes inflammation of visceral fat and leads to cardiovascular diseases.

The root cause of increasing obesity in the younger generation is due to major lifestyle changes that include sedentary habits, excessive use of technology and unhealthy diet intake. The traditional lifestyle which included physical activity on a day-to-day basis for carrying out meagre jobs has been given up. Body weight can be maintained by decreasing fat and increasing muscle mass. This can be done by decreasing the intake of unhealthy food and increasing the physical activity levels on a daily basis. One of the objectives of this study was also to spread awareness amongst the youth regarding their lifestyle habits

that are making way for health challenges in the future.

Liver is primarily responsible for synthesis of cholesterol apart from the dietary intake of this organic molecule. It is a part of the membranes of the cells and helps in transporting fats to various destinations in the body for energy, repair and storage value. High levels of cholesterol are known to get deposited in the blood vessels bringing about constriction of the same. Triglycerides on the other hand are the storage and transport system of lipids in our blood. High carbohydrate diets cannot be utilized by the body immediately and hence is converted to triglyceride and stored in adipose tissues of body. Elevated serum triglyceride levels can also result from stress, alcohol abuse and dietary indiscretion and the best methods advised to lower them are weight loss and medication.

Cholesterol and triglycerides attract clinical attention when they are present in abnormal concentration. Increased level (hyperlipidemia) or decreased level (hypolipidemia) occurs because of abnormalities in the synthesis, degradation and transport of their lipoprotein particles. Clinical manifestations of hyperlipidemia pose a great risk to cardiovascular diseases. The plasma level of total cholesterol, triglycerides, low density lipoproteins (LDL), high density lipoproteins (HDL) and very low density lipoproteins (VLDL) can be used to diagnose different lipoprotein disorders. HDL is often called the good lipid as it scavenges away the the cholesterol from the blood vessels to the liver for disposal. However, LDL is the bad lipid as it deposits the harmful fat in the vessel walls. VLDL carries fat from the liver to other parts of your body and post unloading of the fat it changes to LDL. Hence, high levels of LDL are also alarming.

High levels of triglycerides, LDL and VLDL were found in the adult population. Normal levels of triglycerides, HDL, LDL, VLDL were found in predominant students. Higher levels of HDL are healthier for a the body and these were optimal in a high percentage of student population but lesser for the adults. Increase in the level of Triglycerides increases the risk of heart disease because they can be transformed into LDL which are more atherogenic. Elevated cholesterol and LDL levels can cause atherosclerosis and also be one of the risk factors for cardiovascular disease. Lowering LDL values have been the primary goals for a medical professional dealing with a patient with cardiovascular disease as post its deposition it brings about narrowing of the blood vessels. Exercise, weight loss, healthier diets and estrogen are known to bring about increase in HDL or good lipid levels.

However, relying solely on this marker is not sufficient to assess the lipid panel and risk of coronary diseases. Hence two different ratios were calculated for this assessment.

Two ratios were also calculated as indicators of cardiovascular disease: Total cholesterol/HDL and LDL/HDL. Gender based comparison was done and females were found to be in a higher proportion in the moderate risk of cardiovascular disease category compared to the male students. No students were found to lie in the high risk category of disease. Similar gender bias was seen in the adult population under study and no adults were seen the high risk category.

At the health awareness desk, we advised the participants with high values of lipids to give way to healthier diets with increased fibre content, lesser fat content, polyunsaturated fat and regular exercise that helps in getting rids of excess fat stored in the adipose tissue.

Students and adults both were found to be in the hypo calcaemic category predominantly however in a gender based comparison, male students had lower levels compared to females. But as expected female adult subjects had much lower calcium levels compared to male subjects. Calcium is the most abundant mineral in the body majorly present in the bones, but small amount of Ca^{2+} which is present outside bones is involved in variety of essential processes like blood coagulation, contraction of muscles , functioning of enzymes and neuromuscular excitability. Low level of serum calcium stimulates the

formation of Vitamin D and Vitamin D synthesis requires sunlight. Vitamin D deficiency is highly prevalent in people where direct exposure to sunlight is less. It is called as sunshine vitamin as it is produced by the body in presence of sunlight. It is an essential factor and is required for calcium absorption and utilization of .It helps in regulation of calcium homeostasis. Together they prevent osteoporosis, hypertension, diabetes, cancer, allergies, depression and other bone related diseases. It is needed for bone growth and bone remodelling The most commonly recognised symptoms of Vitamin D deficiency are Rickets in young children and Osteomalacia in adults. Together with calcium, vitamin D also helps to protect older adults from osteoporosis.

PHASE C

Spirometry is a very easy, reliable tool in detecting abnormalities in lung function and their follow up. It has been used as a tool to screen for chronic obstructive pulmonary disease (COPD) at an early stage. COPD refers to a group of abnormalities that are characterized by development of airflow limitations which may or may not be fully reversible with medication. Spirometer is a device that measures efficiency of lungs by testing the amount of air exhaled by a subject as well as the rate of exhalation. A basic examination involves forceful exhalation by a subject as forcefully as possible after inhaling deeply. This effort is known as forceful expiratory manoeuvre. The most frequently studied capacity is 'Forced Vital Capacity of FVC' which is defined as maximum volume of air exhaled post a maximum effort of inspiration. We however have tested two lung capacities, namely forced expiratory volume in one second (FEV1) and forced expiratory volume in six seconds (FEV6) and their ratio. FEV1 and FEV6 are respectively the volumes of air exhaled in the first and sixth seconds of forceful expiratory manoeuvre. Studies have successfully showed that measurement of FVC is being increasingly replaced by FEV6 as the former requires forceful emptying out of lungs taking upto 60 seconds and can be completely exhausting for a subject. FEV6 is an appropriate surrogate for FVC as it is less physically demanding and reduces risk of syncope. Spirometric measurements are influenced highly by age, gender and ethnicity.

One of the most vital tests indispensable to health status of the body is the percentage oxygen saturation level of blood. It is represented in form of a percentage that refers to fraction of oxygen saturated hemoglobin relative to total hemoglobin content in blood. Values between 95-100% represent that the subject has adequate oxygen available in body to carry out vital functions. Lesser levels show hypoxia and need medical attention. Monitoring of SpO_2 levels is extremely important in cases of surgery as well. Lower levels are early warning signs that may show impending body problems. Our study showed that surprisingly more students were in the hypoxic category compared to adults. These students were contacted by our group and suggested to perform breathing exercises as well as get a thorough check up done.

Aerobic exercise is imperative for a healthy lifestyle this aerobic capacity can be measured by the amount of oxygen required (VO_2). Aerobic capacity measured reflects the ability of body organs to utilize oxygen via metabolic pathways and hence determining cardiorespiratory fitness of an individual. Measurement of max VO_2 can be done directly as well indirectly. The best way to measure VO_2 indirectly is performing the Harvard Step Test. Students of the undergraduate level were tested for their cardiorespiratory fitness using this method. The participant was declared fit when he/she could undergo vigorous exercise with good efficiency without experiencing fatigue and showing rapid recovery. The effort applied during exercise and fitness was estimated by measuring the heart rates pre and post exercise. The more rapidly the heart rate returns to normal post exercise, the fitter the individual is. On examining the students it was observed that gender wise, females showed better pulse return rates compared to males in our population. Also, the students on being examined for pulse rate as well as BMI showed clearly that there is an inverse

relationship between the two. The higher the BMI of an individual, the more abnormal is the return heart rate. The present study showed that pulse rate variability pre and post any stress was minimum among fit students and maximum among unfit students with a high BMI.

8. Innovations shown by the project

Our project was formulated keeping an aim of bringing about the Social Innovation of bringing about a slow and steady change in the lifestyle of the youth, based on scientific data collected from this study. The youth do not go for a health checkup, unless they are faced with a medical problem. This study was an attempt to make them aware of their health status *before* they may suffer from life style based disorders. The idea is to make them aware of the concept of "sustainable health" that not only focuses on their choices made today but on their outcomes that will affect their future generations.

Our health camps within the college premises were promising efforts made by our group to apprise the students of any alarming disease progressing in their life. The youth of today have a laid back lifestyle with no emphasis on exercise or any physical activity. Adding on to that are their unhealthy food habits which are high in fat and lipid content but lacking in nutrition. Our questionnaires also told us about the unhealthy sleeping patterns as well as smoking/alcohol abuse which could be directly involved in the health status of the students.

Our final initiative of the Health Awareness Desk gave us an excellent platform to interact with the students and advise them about any changes they need to make in their daily routines. As expected, they were mostly unaware about their health status and took our suggestions very seriously. Another effort taken up by our student group was reaching to the families of the students whose tests results were alarming and needed medical attention.

9. Conclusion and Future direction

We have been successful in generating awareness amongst our college population about their lifestyle habits. Unfortunately a number of parameters tested did not give good results for a number of students and they were counselled deeply to make changes in their lives.

We would like to extend these activities to a university level and involve more students as a part of our project in the future. We could set up more advanced health check-ups for University students at any event in the coming time and pre-empt them about any problems they may be predisposed to as a consequence of their lifestyle choices.

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11. Publication/s from the work [Copies attached with annexures]

- Darshan Malik, Jayita Thakur, Ankita Dua, Jeetendra Aggarwal and Shashi Nijhawan. **Irregularities of the Ovarian Cycle in Young Females: Etiology, Awareness and Management.** International Journal of Biotechnology and Biomedical Sciences. p-ISSN 2454-4582. 2016, Vol 2(1): 57-59

- Darshan Malik, Jayita Thakur, Ankita Dua, Jeetendra Aggarwal and Shashi Nijhawan. **Lifestyle Disorders: A Case Study of Quetlet's Index and WHR in Undergraduate Students.** Proceedings of International Conference on Public Health: Issues, Challenges, Opportunities, Prevention, Awareness 2016, pp 232-236 [**Awarded best paper presentation]**

- Darshan Malik, Jayita Thakur, Jeetendra Aggarwal, Ankita Dua, Shashi Nijhawan, Abhishek Kumar, Kamalpreet Kaur, Himanshi Aggarwal, Diksha Mehta, Hritika Verma, Subhasis, Sheetal Bhardwaj, Aakanksha Singh, Akshay GM and Mithilesh Yadav. **Assessment of correlation between Quetelet's Index and Body fat percentage in a group of Indian Undergraduate students.** The DU Journal of Undergraduate Research and Innovation, 2(1) pp56-69

12. Conference Presentation/s [Copies attached with annexures]

Title /Subject of Paper/Poster	Title/Subject of Conference/seminar/ Workshop	Organizing Institution	Conference/ Symposia/ Workshop (National/International)
Irregularities of the ovarian cycle in young females Etiology, awareness and management	Public Health: Issues, challenges, opportunities, prevention, awareness (Public Health 2016)	Daulat Ram College, University of Delhi	International Conference

	[15th-16th January, 2016]		
Infertility: Etiology & Management (Poster Presentation)	National Symposium on Reproductive Health in India: Concerns & Awareness [February 12th, 2016]	Deshbandhu College, University of Delhi	National Symposium
Burden of Type II Diabetes: A Lifestyle Disorder (Poster Presentation)	Lifestyle Disorders: Understanding the Molecular Mechanisms [28-29th January, 2016]	Shivaji College, University of Delhi	National Symposium
Type II diabetes: Catalyzed by bad lifestyle choices (Poster Presentation)	Man Made Diseases: An Urban Menace [11th-12th February, 2016]	Maitreyi College, University of Delhi, India	National Symposium
Analysis and Assessment of Body Fat Percentages and Quetelet's Index in Indian Undergraduate Students (Poster Presentation)	Innovation Conclave [25th-26th October, 2016]	Acharya Narendra Dev College, University of Delhi	Conclave

13. Patent/s and Technology Transfer (attach copies)

Not Applicable

14. Media Coverage (attach copies)

Not Applicable

15. Pictures related to the project


Shivaji College
NAAC ACCREDITED "A" GRADE
University of Delhi
Irregularities of the Ovarian Cycle in Young Females Etiology, Awareness and Management
Darshan Malik, Jayita Thakur, Jitendra Aggarwal, Ankita Dua, Shashi Nijhawan
Analysis and Assessment of Body Fat Percentages and Quetelet's Index in Indian Undergraduate Students

16. Annexures List:

ANNEXURE Ia	Questionnaire filled before Health Camp I
ANNEXURE Ib	Questionnaire filled before Health Camp I
ANNEXURE II	Questionnaire filled before Health Camp II
ANNEXURE III	Certificate awarded for "Best Oral Presentation"
ANNEXURE IV	Publication: Irregularities of the Ovarian Cycle in Young Females: Etiology, Awareness and Management
ANNEXURE V	Publication: Lifestyle Disorders: A Case Study of Quetlet's Index and WHR in Undergraduate Students
ANNEXURE VI	Publication: Assessment of correlation between Quetlet's Index and Body fat percentage in a group of Indian Undergraduate students.
ANNEXURE VII	Poster presented: Irregularities of the ovarian cycle in young females Etiology, awareness and management
ANNEXURE VIII	Poster presented: Infertility: Etiology & Management
ANNEXURE IX	Poster presented: Burden of Type II Diabetes: A Lifestyle Disorder
ANNEXURE X	Poster presented: Type II diabetes: Catalyzed by bad lifestyle choices
ANNEXURE XI	Poster presented: Analysis and Assessment of Body Fat Percentages and Quetlet's Index in Indian Undergraduate Students
ANNEXURE XII	Health Camp Organized on 28th September, 2015
ANNEXURE XIII	Health Camp Organized on World Health Day on 7th April, 2016
ANNEXURE XIV	Health Camp Organized on World Asthma Day – 3rd May, 2016
ANNEXURE XV	Health Camp Organized from 19th September, 2016 – 1st October, 2016
ANNEXURE XVI	Health Camp Organized on World Heart Day – 29th September, 2016
ANNEXURE XVII	Health Awareness Desk set up on 18th-19th October, 2016

Utilization Certificate

Innovation Project 2015-16
SHC – 311

Project Title Lifestyle Disorders Etiology, Awareness and Management

Audited Financial Statement under Innovation Project scheme

College: Shivaji College

Project Investigators: Dr. Darshan Malik, Dr. Jayita Thakur, Dr. Ankita Dua, Dr. Jitendra Aggarwal

Grant Sanctioned Rs	Rs. 5,00,000/- (Rupees Five Lacs Only)			
	Grant Received	**Grant Utilized**	**Unspent Grant**	
Equipments/Consumables	2,25,000/-	2,04,162/-	20,838/-	
Travel	55,000/-	26,070/-	28,930/-	
Stipend	1,20,000/-	1,20,000/-	NIL	
Honorarium	25,000/-	25,000/-	NIL	
Stationery	20,000/-	19,661/-	339/-	
Contingency	55,000/-	97,660/-	(42,660)	
Total	**5,00,000/-**	**4,92,553/-**	**7,447/-**	
Total amount utilized	Rs. 4,92,553/- (Rupees Four Lacs Ninety Two Thousand Five Hundred Fifty Three Only)			
Amount remaining Rs. (In figures and words)	Rs. 7,447/- (Rupees Seven Thousand Four Hundred Forty Seven Only)			

Certified that out of **Rs. 5,00,000/- (Rupees Five Lacs Only)** sanctioned to Innovation Project Code **SHC-311,** Rs. 4,92,553/- (Rupees Four Lacs Ninety Two Thousand Five Hundred Fifty Three Only) has been utilized during the period of the project. The remaining amount **Rs. 7,447/- (Rupees Seven Thousand Four Hundred Forty Seven Only)** and is being returned back to the University.

Note : Over expenditure under the head "Contingency has been met from unspent balance in Equipment and Travel with prior approval from the Innovation Desk

1st Project Investigator **2nd Project Investigator** **3rd Project Investigator**

4th Project Investigator

Principal

VIPUL DHAWAN & ASSOCIATES
M.No. 518146
NEW DELHI
Chartered Accountants