

## RESULTS AND DISCUSSION

The findings of the present study on “**Effect of Functional Foods and Lifestyle Modification Strategies on Hypertensive Men and Women in Coimbatore, Tamil Nadu**” are discussed under the following headings:

- A. Demographic profile of the selected hypertensives**
- B. Dietary profile**
- C. Physical activity pattern**
- D. Lifestyle pattern**
- E. Emotional health**
- F. Medical History**
- G. Awareness on hypertension and hypotensive foods**
- H. Nutrition and health status of the selected hypertensives**
  - a. Blood pressure levels
  - b. Anthropometric measurements
  - c. Food and nutrient Intake of the selected hypertensives
- I. Impact of Dietary Intervention on the selected hypertensives**
  - a. Anthropometric Measurements
  - b. Blood Pressure
  - c. Biochemical parameters
- J. Impact of Lifestyle Intervention on the selected hypertensives**
  - a. Anthropometric Measurements
  - b. Blood Pressure
  - c. Biochemical parameters
- K. Statistical appraisal of the data**
  - a) Correlation analysis
- L. Comparison of intervention groups**
  - a. Anthropometric Measurements
  - b. Biochemical parameters
  - c. Blood pressure level

## A. Demographic profile of the selected hypertensives

Demographics are characteristics of a population such as race, ethnicity, gender, age, education, profession, occupation, income level, and marital status etc are being considered as demographics that are used in surveys.

The demographic profile of the selected hypertensive men and women from rural and urban areas are discussed below.

### a. Age

Table -X and Figure -5 present the age wise distribution of the selected hypertensives.

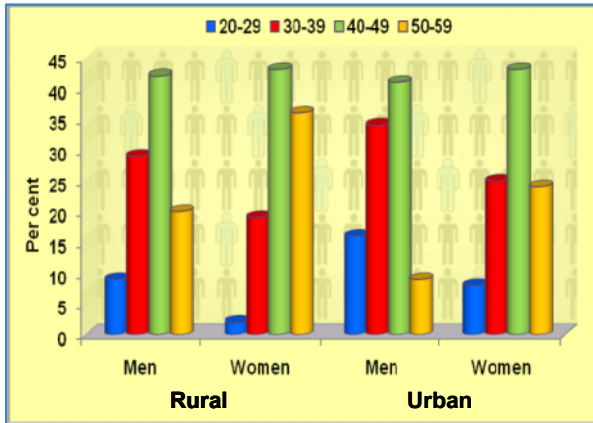
**TABLE - X AGE WISE DISTRIBUTION OF THE SELECTED HYPERTENSIVES**

Age (yrs)	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
20-29	11	9	3	2	14	5	20	16	10	8	30	12
30-39	37	29	24	19	61	24	43	34	32	25	75	29
40-49	53	42	55	43	108	42	53	41	56	43	109	42
50-59	26	20	47	36	73	29	12	9	31	24	43	17
Total	127	100	129	100	256	100	128	100	129	100	257	100

Table -X and Figure -5 clearly state that, the most (42 per cent) of the selected hypertensive men and women in both rural and urban areas were in the age group of 40-49 years. Similar trend was observed in the study by Ghosh *et al.*, (2013) in Bihar which showed maximum prevalence of hypertension in the age group of 40 -49 years.

This was followed by 30-39 years in rural (29 per cent) and urban (34 per cent) men and 50-59 years in rural women (36 per cent). Not much difference was noticed in urban women in 30-39 and 50-59 yrs. Among 20-29 years, the percentage of hypertensive men was greater than women.

The figure clearly depicted that men were happened to get hypertension at early age than women in both areas. It was illustrated that number of hypertensives in both rural and urban areas increased steadily with their age up to 40-49 years. But after 40-49 years, a slight decrease was noticed in 50-59 years in both areas.



**FIGURE-5 AGE WISE DISTRIBUTION OF THE SELECTED HYPERTENSIVES**

Panesar *et al.*, (2013) observed the hypertension prevalence of 5.7 per cent, 19.3 per cent, 31.9 per cent and 36.6 per cent in age groups 20-29, 30-39, 40-49 and 50-59 years, respectively. The present study results were also in line with the above results except in the age group of 50-59 years.

A study by Jeemon *et al.*, (2012), Ghosh *et al.*, (2013) and Meshram *et al.*, (2012) stated that as age advanced blood pressure also advanced 1.07 times and it was one of the independent risk factors of hypertension. Similar trend was also observed in the present research work.

**b. Family type**

Table -XI depicts the family type of the selected hypertensives

**TABLE –XI FAMILY TYPE**

Family Type	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Nuclear family</b>	89	70	93	72	182	71	111	87	107	83	218	85
<b>Joint family</b>	38	30	36	28	74	29	17	13	22	17	39	15
<b>Total</b>	127	100	129	100	256	100	128	100	129	100	257	100

Ministry of Statistics and Programme Implementation (2011) stated that the traditional Indian society and the age-old joint family system had been instrumental in safeguarding the social and economic security of the people in the country. However, with the rapid changes in the social scenario stimulated the prevalence of nuclear family set-ups in India in recent years and it was also reflected in the present study. Greatest percent of the selected rural hypertensive men (70 per cent) and women (72 per cent) and urban hypertensive men (87 per cent) and women (83 per cent) followed nuclear family system.

Joint family system still existed in more rural areas when compared to urban areas. Joint family system was practiced in more than one quarter of rural hypertensives where as only 13 per cent of urban men and 17 per cent of urban women followed the joint family systems.

**c. Religion**

Table -XII illustrates the religion of the selected hypertensives.

**TABLE -XII RELIGION**

Religion	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Hindu	98	77	99	77	197	77	95	74	96	74	191	74
Christian	29	23	22	17	51	20	25	20	19	15	44	17
Muslim	Nil	Nil	8	6	8	3	8	6	14	11	22	9
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

According to figures of the religion census of 2011 of India, Hindus comprised greatest per cent of the total population (Ghosh, 2014) and likewise the present study also had similar religious distribution with more per cent (74-77) of Hindus and 6-17 per cent of minorities. Among the minority communities 17 – 23 per cent were Christians and less than 12 per cent were Muslims in both rural and urban.

**d. Marital status**

Table -XIII states the marital status of the selected hypertensives

**TABLE -XIII MARITAL STATUS**

Marital status	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Married	106	83	110	85	216	84	112	88	115	89	227	88
Unmarried	19	15	3	2	22	9	13	10	2	2	15	6
Widow/ Wdower	2	2	11	9	13	5	3	2	9	7	11	5
Divorcee	Nil	Nil	5	4	5	2	Nil	Nil	3	2	3	1
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

Among the selected rural hypertensives, majority (83- 85 per cent) were married and the unmarried were found to be 15 per cent in men and two per cent in women. About two per cent of men and nine per cent of women lost their spouse and four per cent of women were divorcees.

In selected urban hypertensives, married men and women were 88 per cent and 89 per cent respectively and the unmarried men and women were 10 per cent and two per cent. Two per cent of men and seven per cent of women were widow/widower and two per cent of women were legally separated from their husbands.

Table -XIII stated that among the selected hypertensives, percentage of unmarried, widow/widower, divorcee in rural areas was found to be more in comparison with urban areas. Panesar *et al.*, (2013) opined that being married or a widow/widower was also one of the significant risk factor for hypertension. The present study also agreed the above statement.

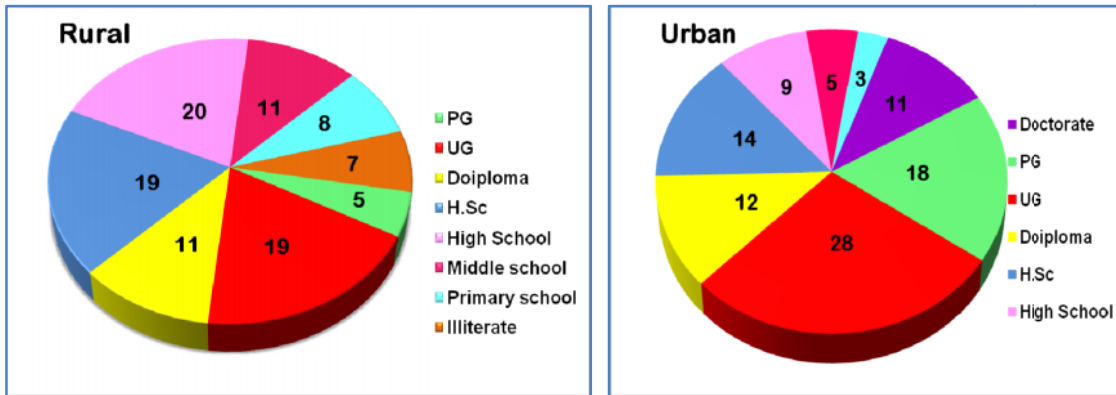
**e. Educational qualification**

Table -XIV and Figure -6 illustrate the educational qualification of the selected hypertensives

**TABLE –XIV EDUCATIONAL QUALIFICATION**

Educational Qualification	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Doctorate	Nil	Nil	Nil	Nil	Nil	Nil	10	8	17	13	27	11
Post Graduation	3	2	11	9	14	5	25	20	22	17	47	18
Graduation	20	16	29	22	49	19	45	35	27	21	72	28
Diploma	17	13	11	9	28	11	22	17	9	7	31	12
Higher Sec.	25	20	23	18	48	19	13	10	22	17	35	14
High School	32	25	18	14	50	20	13	10	11	9	24	9
Middle School	15	12	13	10	28	11	Nil	Nil	13	10	13	5
Primary School	8	6	12	9	20	8	Nil	Nil	8	6	8	3
Illiterate	7	6	12	9	19	7	Nil	Nil	Nil	Nil	Nil	Nil
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

Increasing research indicated that the incidence and prevalence of hypertension was highly associated with social class as best measured by education and occupation (Wang *et al.*, 2009).



**FIGURE - 6 EDUCATIONAL QUALIFICATION**

The above Table -XIV clearly stated that most of the selected subjects in both rural and urban were literates and only six per cent of rural men and nine per cent of rural women were found to be illiterates. Among rural, greatest part had completed only school education whereas majority of the urban were found to have higher education.

Among rural men, 16 per cent were graduates and only two per cent were post graduates, in rural women 22 per cent were graduates and less than 10 per cent were diploma holders and post graduates. In rural areas compared to hypertensive men, more women hypertensives completed higher education.

In urban areas, greatest percent of men (35 per cent) were graduates succeeded by post graduates (20 per cent) and diploma holders (17 per cent) and about eight per cent were awarded with doctorate. Nearly one fourth of the selected women in urban areas were graduates, 17 per cent were post graduates and 13 per cent were completed doctorate.

Greatest percent of rural men and women were not crossed their school education when compared to urban men and women. Willer *et al.*, (2012) found in his study that both men and women with lower educational levels were associated with unfavourable health behaviours, overweight, hypertension and higher

cardiovascular risk. The present study results differed from the above observation. It showed that hypertension was similarly prevalent in both sexes irrespective of their educational level.

According to Samal (2007) educational level was significantly associated with knowledge of increased risk, possible consequences of hypertension, and knowledge about non medication treatment options. As given by Samal, the educational level might have influence on knowledge on treatment and further complications but not in the prevalence of hypertension as per the present study outcomes.

**f. Occupational status**

Table -XV presents the occupational status of the selected hypertensives

**TABLE –XV OCCUPATIONAL STATUS**

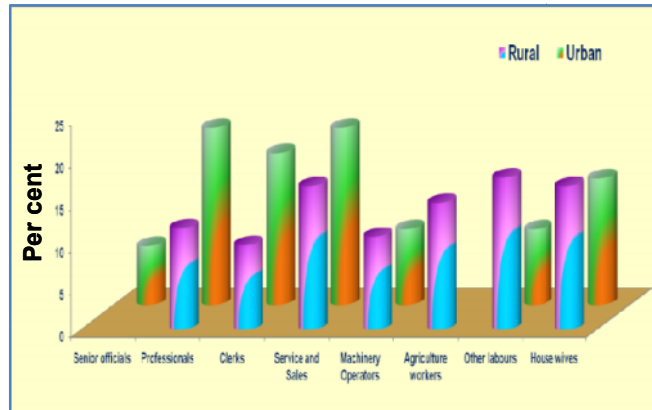
Occupation	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Senior officials	Nil	Nil	Nil	Nil	Nil	NIL	12	9	5	4	17	7
Professionals	10	8	21	16	31	12	28	22	27	21	55	21
Clerks	16	13	10	8	26	10	17	13	29	23	46	18
Service and sales	28	22	15	12	43	17	32	25	21	16	53	21
Machinery operators	29	23	Nil	Nil	29	11	23	18	Nil	Nil	23	9
Agriculture workers	17	13	21	16	38	15	Nil	Nil	Nil	Nil	Nil	Nil
Other labours	27	21	18	14	45	18	16	13	8	6	24	9
House wife	Nil	Nil	44	34	44	17	Nil	Nil	39	30	39	15
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

In modern society occupational stress or job strain, resulting from a lack of balance between job demands and job control, was considered one of the frequent factors in the etiology of hypertension. (Rosenthal and Alter, 2011).

Table -XV and Figure -7 clearly showed that 23 per cent of selected hypertensive rural men were working as a machinery operators followed by service and sales (22 per cent) which demanded more working hours. This result was in accord with Gangwisch (2006) statement *that* long work hours might increase the risk of development of hypertension through several pathways.

Almost 21 per cent of hypertensive men were other skilled labours, 13 per cent were engaged in agriculture and clerical work and only eight per cent were professionals. It agreed the results given by Wiernik *et al.*, (2014) that perceived stress was negatively associated with high blood pressure among participants of high occupational status, but positively associated among those of low occupational status and among the unemployed.

According to a study by Parveen (2009), married working women would have higher work related stress due to traditional trends, demands of society and more roles and responsibilities assigned to them as a mother, wife and home makers, as compared to unmarried women. This was again pinpointed by the present study by observing greatest per cent of the rural hypertensive women were working women and only 34 per cent were house wives. Among working women 16 per cent were professionals and skilled agriculture workers.



**FIGURE -7 OCCUPATIONAL STATUS**

According to many studies stress was just part of the job when it came to sales. The sales jobs were considered one of the most stressful professional jobs. It was true with respect to urban men in whom maximum per cent (25 per cent) of hypertensives were in sales and service followed by professionals (22 per cent) and plant and machinery operators (18 per cent). Thirteen per cent were in clerical job and nine per cent were senior officials and 13 per cent were other skilled labours.

About three fourth of hypertensive women in urban areas were working women and among them highest per cent (23 per cent) of women were in clerical job followed by professionals (21 per cent). This was similar to the results given by Yang *et al.*, (2006), which stated that clerical workers and professionals had a higher prevalence of hypertension. The pattern of high prevalence in clerical work

was consistent with research on job strain, in which low control over work tasks was a risk factor for hypertension.

On the whole, the professionals and service and sales personnel were more among the selected urban hypertensives where as other skilled labours, service and sales, house wives were in greater percent among rural. It can be stated that occupational stress might be one of the reason for hypertension but the influence varied with different individuals.

**g. Income level**

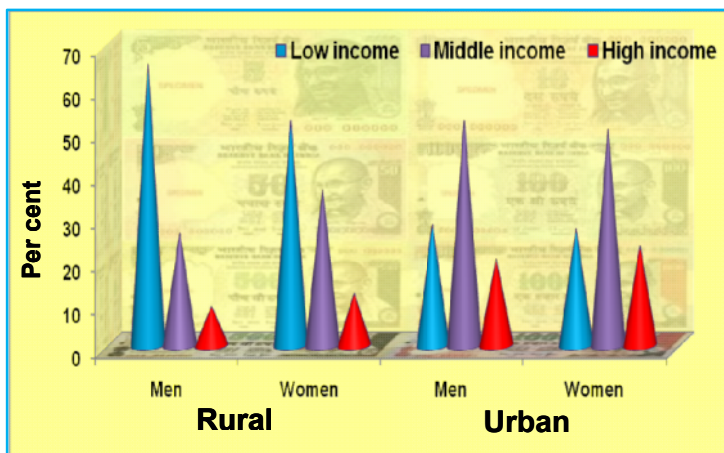
Table-XVI and Figure -8 reveal the income level of the selected hypertensives

**TABLE -XVI INCOME LEVEL**

Income Level*	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Low income	83	65	67	52	150	58	36	28	35	27	71	28
Middle income	33	26	46	36	79	31	67	52	64	50	131	51
High income	11	9	16	12	27	11	25	20	30	23	55	21
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

\*XII five year plan (2012-17)

Table -VII and Figure -8 depict that about 58 per cent and 28 per cent of the selected hypertensives in rural and urban areas belonged to low income group.



**FIGURE - 8 INCOME LEVEL**

In rural areas more than one half of the men (65 per cent) and women (52 per cent) belonged to low income group and in urban one half of the men (52 per cent) and women (50 per cent) belonged to middle

income group. About nine to twelve per cent of rural belonged to high income group while it was found to be nearly one fourth in their counterparts in urban.

On the whole greatest percent of rural hypertensives belonged to low income group but in urban it was middle income group.

This was in concordant with the results given by researchers at Duke University Medical Center. They observed alarming data regarding high rates of high blood pressure in young adults and suggested that those with less education and lower income were at greatest risk. In the latest study, researchers found that lower household income was most strongly associated with elevated blood pressure (Duke medicine, 2011).

## **B. Dietary profile**

### **a. Dietary habits**

Table -XVII shows the dietary habit of selected hypertensives.

**TABLE -XVII DIETARY HABITS**

Food habits	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Vegetarian</b>	18	14	19	15	<b>37</b>	<b>15</b>	17	13	21	16	<b>38</b>	<b>15</b>
<b>Non-vegetarian</b>	94	74	96	74	<b>190</b>	<b>74</b>	100	78	102	79	<b>202</b>	<b>79</b>
<b>Ova vegetarian</b>	15	12	14	11	<b>29</b>	<b>11</b>	11	9	6	5	<b>17</b>	<b>6</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

The EPIC-Oxford study found that non–meat eaters had a lower prevalence of hypertension and lower systolic and diastolic blood pressures than meat eaters. The study found that both red and processed meat intakes were associated with modest increases in total mortality, cancer mortality, and CVD mortality (Marsh *et al.*, 2012).

From the above Table-XVII, it was clear that the present study results were on par with the above statements. Majority of the selected rural hypertensives (74 per cent of men and women) and urban hypertensives (78 per cent men and 79 per

cent women) followed non vegetarian diet where as less than 17 per cent followed vegetarian diet. Only five to twelve per cent were found to be ova vegetarians. The dietary habit was found to be similar in both rural and urban areas.

**b. Meal pattern**

Table -XVIII displays the meal pattern of the selected hypertensives.

**TABLE -XVIII MEAL PATTERN**

Meal pattern	Rural			Urban		
	Men	Women	Total	Men	Women	Total
	%	%	%	%	%	%
<b>3 meals with snacks</b>	56	50	<b>53</b>	65	57	<b>61</b>
<b>3 meals without snacks</b>	18	18	<b>18</b>	12	15	<b>13</b>
<b>&lt;3 meals with snacks</b>	18	16	<b>17</b>	17	16	<b>17</b>
<b>Irregular eating pattern</b>	8	16	<b>12</b>	6	12	<b>9</b>

Meal pattern was the clear marker of diet quality and nutrient intake. The Table-XVIII stated that more than 50 per cent of the selected subjects were having three meals with snacks every day. The percentage was 56 per cent, 50 per cent, 65 per cent and 57 per cent in rural and urban men and women respectively. The present study agreed the results stated by Omidvar and Begum (2014) which observed that the frequency of regular consumption of three meals was high among south Indians.

Three meals without snacks intake was similar (18 per cent) in both rural men and women and it was found to be less in urban men (12 per cent) and women (15 per cent). Less than 3 meals with snacks consumption was noticed in 18 per cent of rural men, 17 per cent of urban men and equal per cent (16 per cent) of women in both rural and urban. It might be due to their nature of work. The results were on par with the study in four cities of India which stated that more than a quarter (27 per cent) people skip breakfast, 9 per cent skip lunch and as little as 5 per cent claim to skip dinner (Malathi and Kamath, 2013).

Irregular eating pattern was noticed more among rural women (16 per cent) followed by urban women (12 per cent). It was quite low in both rural men (eight per cent) and urban men (six per cent). This result was similar to the result given by Tharani and Amirthaveni (2014) which stated that about 8.1 and 13 per cent of male and female respectively had irregular eating pattern due to heavy work load and were not time conscious with regard to the food intake.

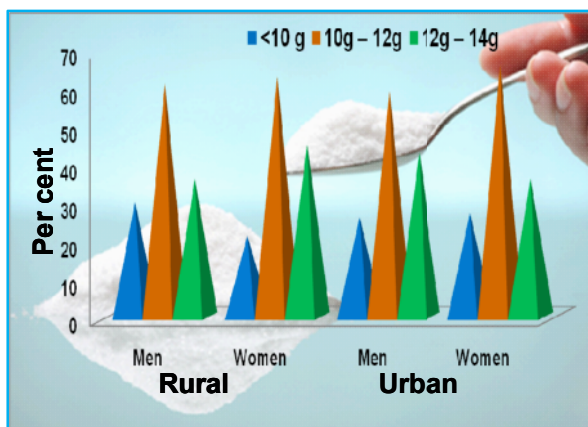
Over all, irregular eating pattern was seen more in rural areas (12 per cent) and three meals with snacks was observed higher in urban areas (61 per cent) than their counter parts.

**c. Salt intake**

Table -XIX and Figure -9 elucidate the salt intake of the selected hypertensives

**TABLE -XIX SALT INTAKE PATTERN**

Salt intake/day	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<10 g	30	24	21	16	51	20	26	20	27	21	53	21
10g – 12g	61	48	63	49	124	48	59	46	66	51	125	48
12g – 14g	36	28	45	35	81	32	43	34	36	28	79	31
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>



**FIGURE -9 SALT INTAKE PATTERN**

World Wide, excess dietary salt intake was responsible for 17 per cent - 30 per cent of hypertension and substantially increased the risk of blood pressure related CVD events in normotensives. Most Indians consumed between 10 to 15 g a day, putting them at severe risk of hypertension (WHO, 2013).

Hence, salt intake pattern of selected hypertensives was assessed by 24 hrs dietary recall method. Cogswell *et al.*, (2013) stated that 24-hrs dietary recalls had promise for monitoring temporal trends in average sodium intake.

From the above table and Figure -9 it was clear that, nearly fifty per cent of the selected hypertensives in both rural (48 per cent) and urban areas (48 per cent) consumed 10 g to 12 g of salt per day. It might be due to the reason given by Dhemia and Varma (2015). They opined that the urban Indian's routine diet, pickled with takeaways from fast food joints and instant foods that were ready in a jiffy at the end of a long working day, could worsen the present epidemic of hypertension due to its high proportion of salt.

The present study result was similar to the population studies given by Asian scientist (2013) which observed nine to twelve gram salt intake per day among Indians. The intake was reported to be higher in urban settings compared to rural settings. But the present study recorded similar intake in both rural and urban with respect to salt intake.

About 24 per cent of rural and 20-21 per cent of urban consumed <10 g of salt /day. This result was on par with a study quoted by Varma (2013) which stated that the intake of salt by Indians was nearly twice the amount recommended by the World Health Organisation (WHO). Indians consumed about 3.7 grams of sodium, corresponding to about 9.3 g of salt per day.

It was alarming to note about 12-14 g of salt consumption among 28 per cent of men and 35 per cent of women in rural and 34 per cent of men and 28 per cent of women in urban. In this study, the greatest per cent of the selected hypertensives were non vegetarians, therefore their regular meat intake might be one of the reasons for high consumption of salt.

The salt consumption amount below 10 g/day was observed among less than one quarter in rural and urban where as the rest three fourth consumed more than twice the amount of salt/day than WHO recommendation (5 g/day). This might be one of the primary reasons for increasing prevalence of hypertension in both rural and urban areas.

d. Type of oil and fat used

Table - XX and Figure -10 give the type of oil and fat used regularly by the selected hypertensives

TABEL - XX TYPE OF OIL AND FAT USED

Particulars*	Rural			Urban		
	Men	Women	Total	Men	Women	Total
	%	%	%	%	%	%
Sun flower oil	36	40	38	53	58	56
Ground nut oil	48	57	52	40	46	43
Palm oil	62	60	61	38	41	40
Rice bran oil	25	30	28	45	49	47
Coconut oil	34	38	36	51	41	46
Gingelly oil	40	32	36	16	23	19
Vanaspathi	26	19	23	15	13	14
Butter &Ghee	32	36	34	48	53	50

\*Multiple responses

Sharma (2012) stated that excessive intake of fats, especially saturated fats, was known to increase the risk of cardiovascular diseases. Health experts attributed the sharp rise in heart diseases in India due to excessive oil intake in various forms. According to Table -XX and Figure -10 oil namely sun flower oil, ground nut oil, palm oil, rice bran oil, coconut oil, gingelly oil, vasanpathy, butter and ghee were used regularly in the diet by the selected hypertensive men and women in rural and urban.

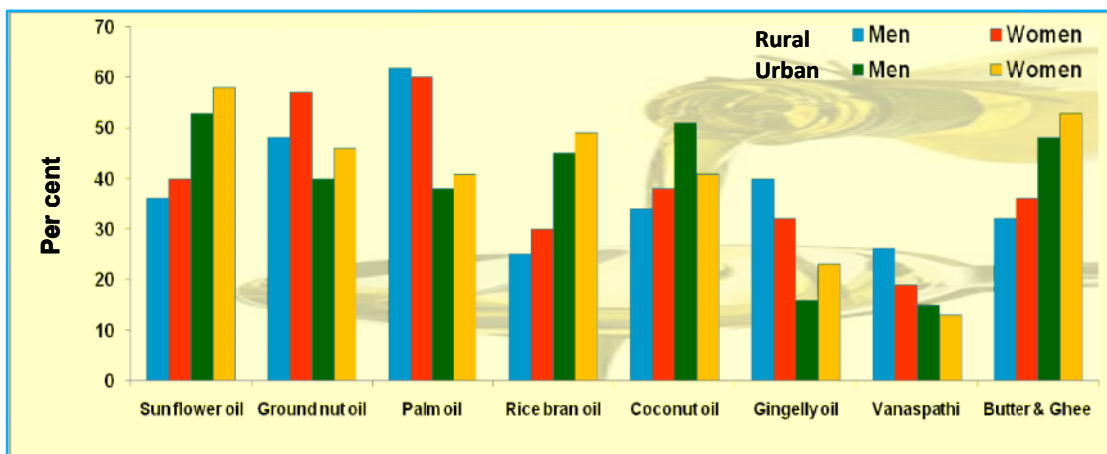


FIGURE -10 TYPE OF OIL AND FAT USED

In rural areas more than 60 per cent of selected hypertensive men and women used palm oil regularly. It might be due to the 20-30 per cent less cost when compared to all other edible oil and its easy availability in state public distribution system.

Palm oil usage was followed by ground nut oil (48 per cent in men and 57 per cent in women) and sun flower oil (36 per cent in men and 40 per cent in women). Around 30-40 per cent of rural hypertensive men and women used coconut oil, gingelly oil, butter and ghee and about one quarter used vanaspathi regularly.

With respect to urban, more than fifty per cent of urban hypertensive men (53 per cent) and women (58 per cent) used sunflower oil commonly in the diet. Even palm oil intake was seen in 38-41 per cent of urban men and women hypertensives and less than 16 per cent used gingelly oil and vanaspathi commonly.

Coconut oil usage was found among the one half of the selected hypertensive men succeeded by butter and ghee (48 per cent) and rice bran oil (45 per cent). Among all, butter and ghee (53 per cent) and rice bran oil (58 per cent) usage was found to be more in urban hypertensive women. The expensive butter and ghee, sun flower, coconut oil, etc usage was found to be more in urban whereas it was comparatively low in rural. But less expensive palm oil usage was comparatively more in rural.

As per the present study the greatest part of the selected urban hypertensives belonged to middle income group whereas in rural, it was low income group. It clearly showed that edible oil consumption was closely linked to economic status. Table – XX inferred that saturated fat intake was found to be more common in both rural and urban areas although it differed in type.

#### **e. Flesh foods intake pattern**

Consumption pattern of flesh foods is elicited in Table -XXI.

According to below table majority of the selected hypertensives from both rural and urban areas consumed chicken, mutton, fish, pork, beef and crab commonly. Among this chicken and meat were consumed more often in both rural

and urban areas. In rural areas, weekly once consumption of flesh foods was found to be more by 45-54 per cent followed by weekly twice by 22-24 per cent. Even weekly thrice was seen in 17 per cent of men and nine per cent of hypertensive women in rural areas.

**TABLE –XXI CONSUMPTION PATTERN OF FLESH FOODS**

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Weekly once</b>	57	45	70	54	<b>127</b>	<b>50</b>	19	15	14	11	<b>33</b>	<b>13</b>
<b>Weekly twice</b>	31	24	29	22	<b>60</b>	<b>23</b>	29	23	32	25	<b>61</b>	<b>24</b>
<b>Weekly thrice</b>	21	17	11	9	<b>32</b>	<b>13</b>	54	42	56	43	<b>110</b>	<b>42</b>
<b>Monthly twice</b>	Nil	Nil	Nil	Nil	<b>Nil</b>	<b>Nil</b>	9	7	6	5	<b>15</b>	<b>6</b>
<b>Nil</b>	18	14	19	15	<b>37</b>	<b>14</b>	17	13	21	16	<b>38</b>	<b>15</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

In urban areas, weekly thrice consumption was seen among greatest per cent of men (42 per cent) and women (43 per cent). Nearly one fourth consumed weekly twice and 11-15 per cent consumed weekly once. About five - seven per cent consumed the meat and meat products monthly twice. Even though consumption of meat and meat products were more common in both urban and rural hypertensives, the frequency was not similar. Most of the urban men and women consumed weekly twice whereas it was once in a week among the rural hypertensives.

Whatever the frequency might be, on the whole the present study observed increased consumption of fleshy foods, the one of the risk factors for hypertension, in most of the selected hypertensives in both rural and urban areas.

**f. Consumption pattern of processed foods**

Processed foods consumption pattern is given in Table –XXII

In recent times, due to changing lifestyles all were very much dependent on processed and ready-to-eat foods. The below table opined that compared to rural areas processed foods like pickles, jam, sauces and masala powder usage

frequency was more in urban areas. It might be due to the vigorous transformation of lifestyle in urban areas due to influence of mass media.

**TABLE-XXII PROCESSED FOODS CONSUMPTION PATTERN**

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Daily	11	9	17	13	28	11	7	5	17	13	24	9
Weekly twice	29	23	36	28	65	25	52	41	59	46	111	43
Weekly once	59	46	64	50	123	48	35	27	31	24	66	26
Monthly twice	19	15	12	9	31	12	25	20	15	12	40	16
Rarely	9	7	Nil	Nil	9	4	9	7	7	5	16	6
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

According to Table -XXII, nearly fifty per cent of rural men consumed processed food weekly once, followed by 23 per cent in weekly twice. About 15 per cent consumed monthly twice and even daily intake was recorded among nine per cent of rural hypertensive men. About seven per cent of the selected hypertensives, the frequency of consumption of processed foods was found to be less than once in a month.

Among rural hypertensive women, fifty per cent of women consumed weekly once, followed by weekly twice (28 per cent). About 13 per cent and nine per cent ate processed foods daily and monthly twice respectively. Mostly pickles were consumed daily by the selected rural hypertensive men and women.

In urban areas, 41 per cent of hypertensive men and 46 per cent of hypertensive women consumed processed foods weekly twice. About one fourth of urban hypertensive men and women consumed the processed foods weekly once. Five per cent of men and 13 per cent of women included the processed foods daily in their diet in the form of pickles, sauce, jams and masala powders and only five to seven per cent of urban hypertensives rarely used those products.

Generally processed foods were high in salt content which was one of the dreadful factors associated with hypertension. Consumption of these types of foods

were more common among both rural and urban hypertensives and not much difference was noticed in their frequency. It might be due to the influence of product advertisement on its convenience and taste.

**g. Ready to eat food intake pattern**

Consumption pattern of ready to eat foods pattern is depicted in Table -XXIII.

**TABLE –XXIII CONSUMPTION PATTERN OF READY TO EAT FOODS**

Frequency	Rural			Urban		
	Men	Women	Total	Men	Women	Total
	%	%	%	%	%	%
<b>Weekly twice</b>	Nil	Nil	<b>Nil</b>	Nil	10	<b>5</b>
<b>Weekly once</b>	20	Nil	<b>10</b>	38	43	<b>40</b>
<b>Monthly twice</b>	40	41	<b>40</b>	30	30	<b>30</b>
<b>Rarely</b>	40	59	<b>50</b>	32	17	<b>25</b>
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Chatterjee (2015) stated that packaged foods and ready-to-eat meals all had high salt content. They were also high, cholesterol and oil, and regular consumption resulted in weight gain and obesity, and in turn, hypertension. Table - XXIII stated that consumption of ready to eat foods like noodles, ready mixes, packed chappathies, parathas, gravies etc were found to be more prevalent in urban hypertensives especially women.

Vijayabhaskar and Sundaram (2012) stated that life style change was the key determinants of choosing these products. Other factors taken into consideration were couples working, unavailability of time to prepare masala, convenience and taste factors. On par with the above statement, in the present study also observed most of the selected urban women hypertensives were working and the increased usage of these types of foods among them might be due to lack of time.

Among urban hypertensive women, 43 per cent consumed once in a week followed by 30 per cent twice in a month. Weekly twice consumption was seen among 10 per cent of urban hypertensive women. In urban hypertensive men, not

much difference was seen between weekly once (38 per cent), rarely (32 per cent) and monthly twice (30 per cent). In rural areas consumption of ready to eat packed foods were not found to be often in both hypertensive men and women. About 40 per cent of men and 59 per cent of women consumed rarely. About 20 per cent of men consumed weekly once and 40-41 per cent of men and women consumed ready to eat foods monthly twice.

**h. Consumption pattern of bakery products**

Consumption pattern of bakery products is illustrated in Table-XXIV.

**TABLE –XXIV CONSUMPTION PATTERN OF BAKERY PRODUCTS**

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Daily</b>	32	25	25	19	<b>57</b>	<b>22</b>	43	34	46	36	<b>89</b>	<b>34</b>
<b>Weekly twice</b>	58	46	55	43	<b>113</b>	<b>44</b>	53	41	41	32	<b>94</b>	<b>37</b>
<b>Weekly once</b>	27	21	41	32	<b>68</b>	<b>27</b>	25	20	29	22	<b>54</b>	<b>21</b>
<b>Monthly twice</b>	10	8	8	6	<b>18</b>	<b>7</b>	7	5	13	10	<b>20</b>	<b>8</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

Bakery products were packed with salted saturated fats, sodium rich leavening agents (baking powder, soda bicarbonate). These foods might lead to increase in blood pressure and also obesity which aggravated the problem further (Moghul, 2013). Consumption of bakery product was found to be more common among both rural and urban hypertensives. Nearly one half of the rural hypertensive men consumed bakery products weekly twice and one fourth had it daily. Only meager per cent (eight per cent) included the bakery products only in monthly twice. In rural women, about 43 per cent consumed the bakery products weekly twice followed by weekly once (32 per cent). Around 19 per cent’s frequency of consumption was found to be daily and barely six per cent consumed monthly twice.

In urban, more than one quarter (34-36 per cent) consumed the bakery products daily. It might be due to their working nature and mushrooming of bakeries in nook and corner of urban areas in recent decade. About 41 per cent of men and 32 per cent of women consumed the bakery products twice in a week and

20-22 per cent included the bakery products once in a week. Only five per cent and 10 per cent of hypertensive men and women respectively were not taking the bakery products frequently and consumed only monthly twice.

Regardless of area, bakery products consumption was found to be more frequent among the selected hypertensives. Nowadays, the bakery products became one of the major snacks items with numerous varieties and different brand names. The extensive availability and taste of the foods might be the reason for this high consumption among selected hypertensives.

**i. Fast foods eating pattern**

Fast foods eating pattern is shown in Table -XXV.

**TABLE –XXV FAST FOODS EATING PATTERN**

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Daily</b>	5	4	Nil	Nil	<b>5</b>	<b>2</b>	10	8	3	2	<b>13</b>	<b>5</b>
<b>Weekly twice</b>	27	21	13	10	<b>40</b>	<b>16</b>	51	40	25	19	<b>76</b>	<b>29</b>
<b>Weekly once</b>	28	22	29	22	<b>57</b>	<b>22</b>	35	27	50	39	<b>85</b>	<b>33</b>
<b>Monthly twice</b>	54	43	60	47	<b>114</b>	<b>44</b>	29	23	39	31	<b>68</b>	<b>27</b>
<b>Rarely</b>	13	10	27	21	<b>41</b>	<b>16</b>	3	2	12	9	<b>15</b>	<b>6</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

Fast food referred to food that could be served quickly. In many cases, that means foods were highly processed and contained large amounts of carbohydrates, added sugar, unhealthy fats and salt (sodium). These foods generally contained a high number of calories but offered little or no nutritional value (Kruchik, 2014). In the present study, both the rural and urban hypertensives consumed this unhealthy food more commonly.

In rural areas, 43 per cent of men and 47 per cent of women ate fast foods monthly twice. There was not much difference noted in weekly once (22 per cent) and weekly twice (21 per cent) frequency in men. Twenty two per cent of rural women consumed weekly once and 10 per cent had fast foods twice in a week. Compared to all others, least frequency of consumption (21 per cent) was observed in rural hypertensive women.

When compared to rural hypertensives, consumption frequency was found to be greater in urban subjects. Frequency of eating fast foods was more in urban men compared to all other subjects and about 40 per cent ate weekly twice followed by weekly once (27 per cent). Greatest per cent of urban women ate fast foods once in a week (39 per cent) succeeded by monthly twice (31 per cent). Rare consumption of fast foods was observed on only two per cent men and less than 10 per cent of women in urban.

The present study observed more frequent consumption of fast foods among the rural and urban hypertensives and parallel with the study done by Steyn and Labadarios (2011). They showed that 11 per cent of the participants ate fast food daily, 27.6 per cent ate two to three times a week and 20.8 per cent ate fast food at least once a week. Only 3.8 per cent of the participants had fast food less than once per month.

Also on par with the study by Prabhavathi *et al.*, (2014) which stated that 45 per cent of the sample respondents were consumed fast food three times in a month, 34 per cent of them were consumed fast food for about once in a month and 13 per cent of the respondents consumed fast food occasionally i.e. once in two months or less. Working professionals and well educated persons forms major consumer segment in fast food sector. In both areas, men consumed these salt and fat rich fast foods more frequently than their counter parts.

**j. Consumption pattern of fried foods**

Consumption pattern of fried foods is displayed in Table –XXVI

**TABLE –XXVI CONSUMPTION PATTERN OF FRIED FOODS**

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Daily</b>	27	21	21	16	<b>48</b>	<b>19</b>	33	26	31	24	<b>64</b>	<b>25</b>
<b>Weekly twice</b>	49	39	51	40	<b>100</b>	<b>39</b>	54	42	59	46	<b>113</b>	<b>44</b>
<b>Weekly once</b>	38	30	45	35	<b>83</b>	<b>32</b>	31	24	31	24	<b>62</b>	<b>24</b>
<b>Monthly twice</b>	13	10	12	9	<b>25</b>	<b>10</b>	10	8	8	6	<b>18</b>	<b>7</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

A hypertension research by Harshfield (2012), at the Institute of Public and Preventive Health at Georgia Health Sciences University uncovered his findings among young adults and stated that both stress and fried foods contributed equally to high blood pressure. Hall (2007) stated that in a study, subjects who ingested high fat meals showed their blood pressure go up 1.25 to 1.5 times higher than counterparts who ate low fat offerings.

The findings of this present study synchronized with the above statements and showed that cent per cent of the subjects both in rural and urban areas ate fried Indian foods namely bajji, bonda, vadai, samosa, chips, murukku, chilly chicken, grilled chicken, etc often. There was not much difference noticed in the consumption of fat fried foods in rural and urban subjects. Majority of the rural subjects (men-39 per cent and women-40 per cent) and urban subjects (men-42 per cent and women-46 per cent) ate fried foods weekly twice, 30 per cent - 35 per cent of men and women in rural areas and 24 per cent of men and women in urban areas consumed these foods weekly once. It was surprising to note that nearly one fourth of the urban and 16 – 21 per cent of rural hypertensives consumed the fried products daily.

Generally the fried foods were used as snacks in Indian food habits often. Hence it was found to be more common among the rural and urban hypertensives and compared to rural, consumption frequency was more in urban areas. Increased consumption of fried foods often, might be one of the threatening factors for hypertension.

#### **k. Drinking pattern of carbonated beverages**

Drinking pattern of carbonated beverages is depicted in Table -XXVII.

Maximum per cent of rural men (39 per cent) and women (57 per cent) consumed carbonated beverage monthly twice. Twenty eight to 35 per cent of the rural hypertensives consumed rarely but 11 per cent of rural men consumed twice in a week. In urban subjects, majority of the men (37 per cent) consumed weekly

once, followed by weekly twice (30 per cent) and monthly twice (26 per cent). Even seven per cent of urban men consumed the soft drinks daily due to some or other reasons. The present study showed lesser consumption frequency when compared to a study by Singal, (2009) which observed consumption of soft drinks daily in 49 per cent respondents.

**TABLE –XXVII DRINKING PATTERN OF CARBONATED BEVERAGES**

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Daily	Nil	Nil	Nil	Nil	Nil	Nil	9	7	Nil	Nil	9	3
Weekly twice	14	11	Nil	Nil	14	5	39	30	19	15	58	23
Weekly once	19	15	19	15	38	15	47	37	67	52	114	44
Monthly twice	49	39	74	57	123	48	33	26	26	20	59	23
Rarely	45	35	36	28	81	32	Nil	Nil	17	13	17	7
Total	127	100	129	100	256	100	128	100	129	100	257	100

With respect to selected urban hypertensive women, even more than one part consumed carbonated beverages weekly once, 20 per cent and 15 per cent consumed monthly twice and weekly twice respectively. Occasional consumption of carbonated beverages was seen in only less than 14 per cent.

Winkelmayer *et al.*, (2005) stated that consumption of cola beverages was associated with an increased risk of hypertension, independent of whether it was sugared or diet cola. Soda drinking might directly increase hypertension risk by its solute load, as studies had shown that high amounts of solutes such as sodium in the diet was positively associated with hypertension (Mandge, 2007). These types of carbonated beverages like coco cola, sprite, pepsi, miranda etc were consumed more frequently by urban subjects when compared to rural subjects.

**I. Frequency of eating meals in outlets**

Frequency of eating meals in outlets by the selected hypertensives is shown in Table - XXVIII.

TABLE -XXVIII FREQUENCY OF EATING MEALS IN OUTLETS

Frequency	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Daily	8	6	Nil	Nil	8	3	21	16	12	9	33	13
Weekly twice	21	17	Nil	Nil	21	8	41	32	28	22	69	27
Weekly once	29	23	19	15	48	19	51	40	46	36	97	38
Monthly twice	28	22	39	30	67	26	7	6	25	19	32	12
Rarely	41	32	71	55	112	44	8	6	18	14	26	10
Total	127	100	129	100	256	100	128	100	129	100	257	100

According to the above table majority of the urban men (40 per cent) and women (36 per cent) ate at least one meal weekly once and succeeded by weekly twice (32 per cent men and 22 per cent women). Eating a meal in outlets was very common among selected urban hypertensives. It was concordant with the study by Ganguly *et al.*, (2014) which stated that the weekend was a time that most people eat out for convenience, entertainment. In urban areas eating out for entertainment was generally reserved for the weekends. Compared to all other selected hypertensives greater per cent (16 per cent) of urban men visited restaurant daily and even nine per cent of urban women ate a meal outside daily. It might be due to their working nature. Only 6 per cent of men and 20 per cent of women dined out monthly twice and only less than 15 per cent were not visiting eating outlets frequently.

About 32 per cent of rural hypertensive men ate restaurant food less than monthly once followed by weekly once (23 per cent) and weekly twice (17 per cent). Among them 6 per cent were having meals outside daily due to the nature of occupation. Among rural women, 55 per cent were not visiting eating outlets often and more than one fourth of them consumed restaurant food monthly twice. Even 15 per cent of rural women had practice of visiting food outlets at least weekly once. Generally restaurant foods were rich in sodium and fat content and frequency of eating these types of foods was more common in urban areas than in rural areas. Even it was more frequent in men than women in both the areas.

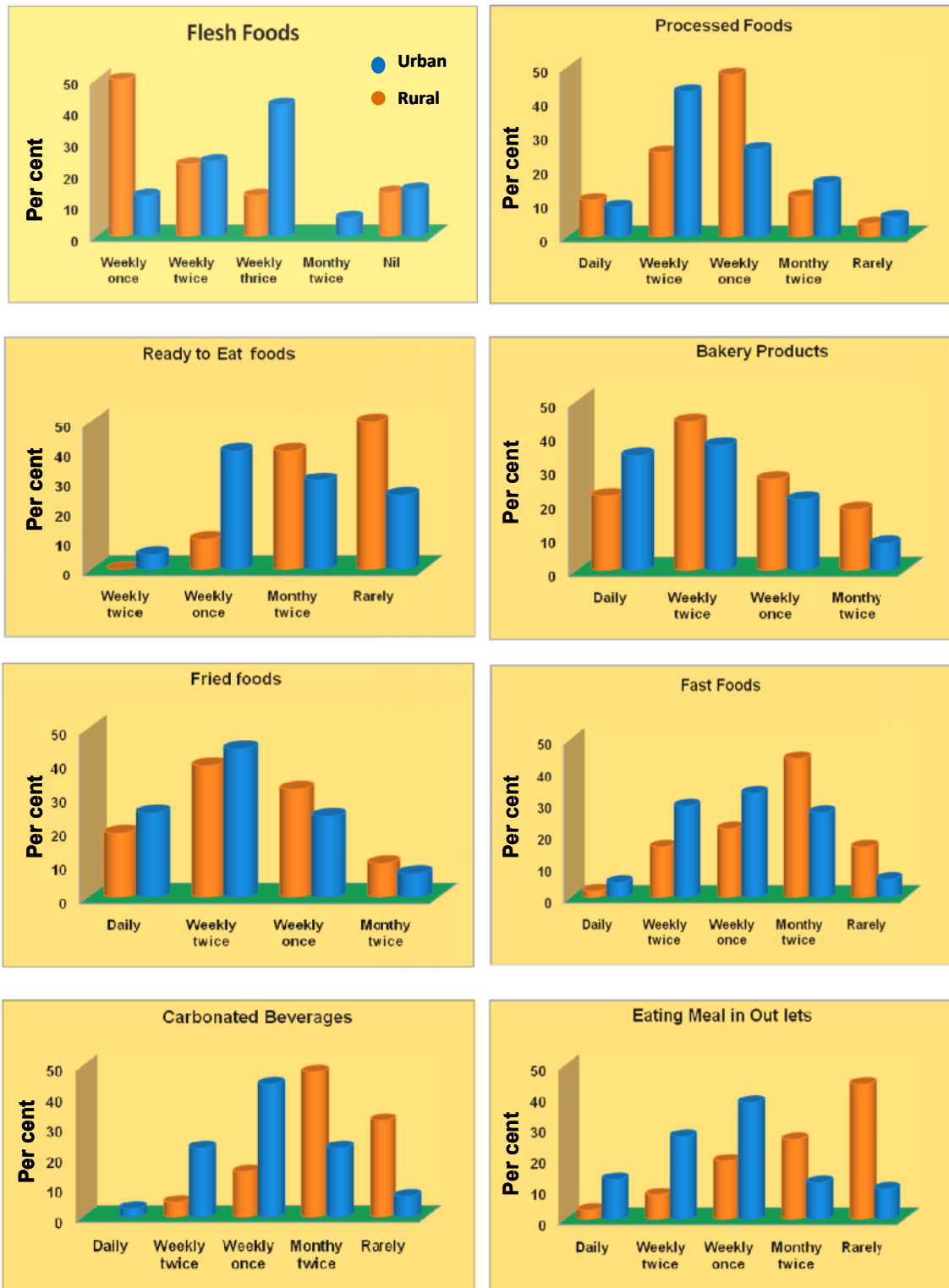


FIGURE- 11 CONSUMPTION PATTERN OF CALORIE RICH FOOD

### C. Physical activity pattern

Physical activity pattern of the selected rural and urban hypertensives were assessed using Global Physical Activity Questionnaire (GPAQ) given by WHO and the results are given below.

#### a. Physical activity pattern with respect to work, transport and recreational activities

Table - XXIX and Figure -12 depict the physical activity pattern of the selected hypertensives

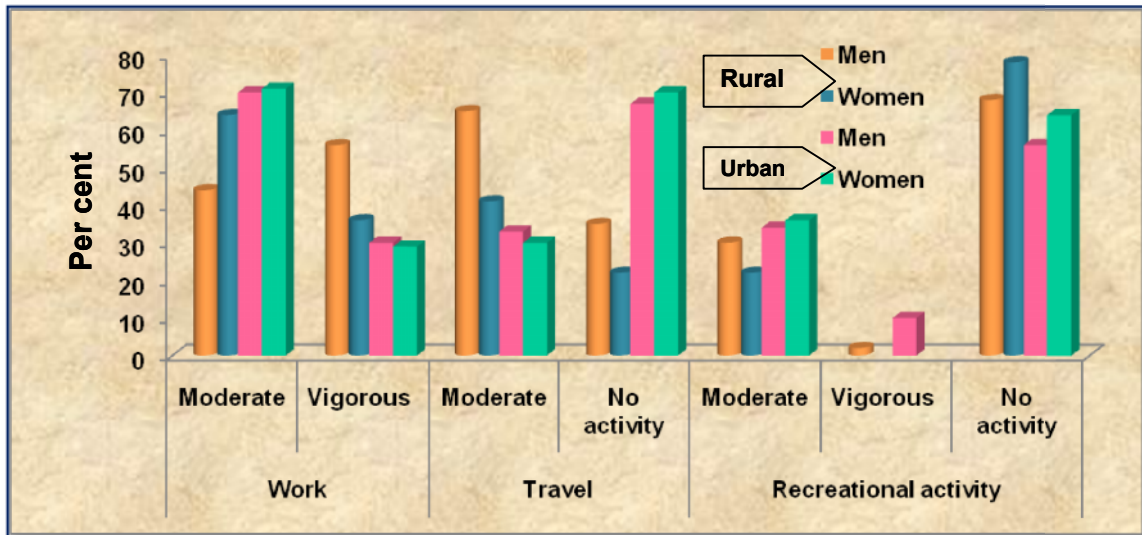
TABLE –XXIX PHYSICAL ACTIVITY PATTERN

Particulars	Rural						Urban					
	Men (n=127)		Women (n=129)		Total (N=256)		Men (n=128)		Women (n=129)		Total (N=257)	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Work</b>												
Moderate	56	44	83	64	139	54	89	70	92	71	181	70
Vigorous	71	56	46	36	117	46	39	30	37	29	76	30
<b>Travel</b>												
Moderate	82	65	53	41	135	53	42	33	39	30	81	32
No activity	45	35	76	59	121	47	86	67	90	70	176	68
<b>Recreational Activities</b>												
Moderate	38	30	29	22	67	26	44	34	46	36	90	35
Vigorous	3	2	-	-	3	1	13	10	-	-	13	5
No activity	86	68	100	78	186	73	71	56	83	64	154	60

Worldwide, 31.1 per cent of adults were physically inactive, with proportions ranging from 17 per cent in south east Asia to about 43 per cent in the Americas and the eastern Mediterranean. Inactivity raised with age, was higher in women than in men, and increased in high-income countries (Hallal, 2012).

Hence the physical activity pattern of the selected hypertensives was also observed in the present study. GPAQ was divided into three major domain namely work, transport and recreational activities. The type of physical activity performed by the selected hypertensives and its duration were recorded under each domain for a period of one week and analysed based on GPAQ guidelines.

Under the domain work, about 44 per cent and 64 per cent of rural men and women, 70 per cent and 71 per cent of urban men and women were found to have moderate activities like brisk walking, carrying light load for at least 10 minutes continuously. The vigorous activity like lifting heavy loads, digging and construction work was seen in 56 per cent, 36 per cent, 30 per cent and 29 per cent of rural and urban men and women respectively. With respect to work related physical activity,



**FIGURE -12 PHYSICAL ACTIVITY PATTERN**

more urban men and women were engaged in moderate level activity where as more rural men and women were engaged in vigorous level activities compared to their counter parts.

With respect to transport, it was dreadful to note that about 67 per cent of urban men and 70 per cent of urban women were not active and only 33 per cent and 30 per cent were found to use bicycle or walk at least for 10 minutes to travel from one place to other. But it was good to note that more than one part of men and 41 per cent of women in rural areas were found to use bicycle or walk at least for 10 minutes to commute from one place to another.

Figure -12 typically illustrated that most of the hypertensives were inactive with respect to recreational activities in both rural and urban. About 30-34 per cent of men and 22-36 per cent of women in rural and urban were found to have moderate level recreational activities like brisk walking, yoga etc.

Hallal *et al.*, (2012) stated that walking was a common, accessible, inexpensive form of physical activity and was an important component of total physical activity in adult populations.

It was alarming to note that only 2 per cent of rural men and 10 per cent of urban men were engaged in vigorous recreational activities like cycling, swimming, volley ball etc. It was shocking to note that no women in rural and urban were observed to do vigorous recreational activities. On the whole recreational activities were found be very low and eventhough the recreational activities were seen in few hypertensives , the mean time spent by them was observed to be inadequate that was lesser than 45 mts.

Al-Hamdan *et al.*, (2012) observed that 12.1 per cent, 20.2 per cent, and 46.1 per cent were physically active in recreational, work- and transport-related activities, respectively in hypertensives conducted at Dubai. Compared to the above study, the present study showed greater percent of physically active subjects in work, transport and recreational activities.

On the whole, it was pleasant to note that almost all the selected hypertensives from rural and urban were having moderate or vigorous work related activities at least for 10 minutes. But it was alarming to note that physical activity in transport was observed to be low especially in urban and the recreational activities were not seen in most of the hypertensives. Compare to men, more women were physically inactive. The rural hypertensive men were observed to be active than any other groups. The recreational activities were seen in urban over rural whereas the work and transport related physical activities were observed in rural over urban.

The prevalence of inactivity was higher in urban areas compared to rural areas. Factors like higher levels of income, less physically demanding occupations and increased availability of mechanized transport and house- hold appliances among urban dwellers could explain this disparity.

In Tamilnadu, a significantly greater proportion of urban residents were inactive compared to rural residents (71.0 per cent vs. 55.4 per cent) and compared to males, a higher proportion of female subjects were physically inactive

in both the urban as well as rural areas. (Anjana *et al.*, 2014) The present study results coincided with the above results.

Insufficient physical activity is one of the modifiable risk factors to prevent most of the non communicable diseases. Hence increasing physical activity among the hypertensive might help to trim down the blood pressure level and its further complications.

**b. Sedentary behaviour**

Another aspect of the human movement range that had received attention was sedentary behaviour, which was usually defined as time spent in sitting. Similar to physical activity, sedentary behaviours occurred in different domains (ie, at work, for leisure and entertainment, and while commuting)(Owen, 2010).

Table -XXX and Figure -13 explain the sedentary behavior of the selected hypertensives.

**TABLE -XXX SEDENTARY BEHAVIOR OF THE SELECTED HYPERTENSIVES**

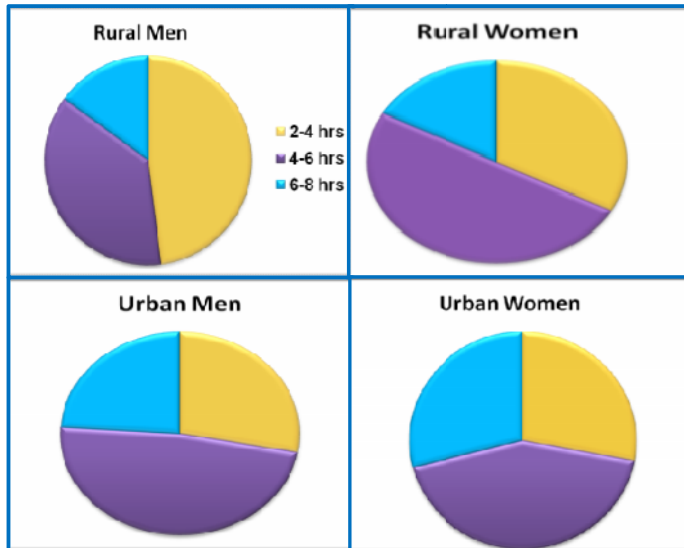
Time spent in sitting (hrs/day)	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>2-4 hrs</b>	61	48	43	33	<b>104</b>	<b>41</b>	36	28	36	28	<b>72</b>	<b>28</b>
<b>4-6 hrs</b>	47	37	64	50	<b>111</b>	<b>43</b>	61	48	56	43	<b>117</b>	<b>46</b>
<b>6-8hrs</b>	19	15	22	17	<b>41</b>	<b>16</b>	31	24	37	29	<b>68</b>	<b>26</b>
<b>Total</b>	127	100	129	100	<b>256</b>	<b>100</b>	128	100	129	100	<b>257</b>	<b>100</b>

It was panic to note that nearly one in two women in rural and urban were spending 4-6 hours in sitting at work or reclining activities like watching television, using computers, reading etc. About 37 per cent of rural and 48 per cent of urban men were spending 4-6 hrs in sitting and reclining activities. About 6-8 hrs of sitting and reclining activities was seen in one quarter of the urban and 15 to 17 per cent of the rural hypertensives.

A recent cohort study determined that prolonged sitting for more than 8 hours per day was significantly associated with higher all-cause mortality

independent of physical activity (Win *et al.*, 2015). The present study results were also agreed the above results.

About 48 per cent, 33 per cent of rural men and women and 28 percent of



**FIGURE -13 SEDENTARY BEHAVIOR OF THE SELECTED HYPERTENSIVES**

urban men and women spent 2-4 hours in sedentary behavior. Even though sedentary behavior was found to be very common in both areas, it was greater in urban than their counter parts and especially women spent more time in sitting and other reclining activities than men in

both the areas. A similar finding was noted in a study

from Tamil Nadu which observed that levels of sedentary behavior were more in the cities, followed by the smaller towns and the periurban villages (Guthold, 2008).

**C. Energy expenditure in physical activity**

Table -XXXI and Figure -14 illustrate the energy expenditure in physical activity

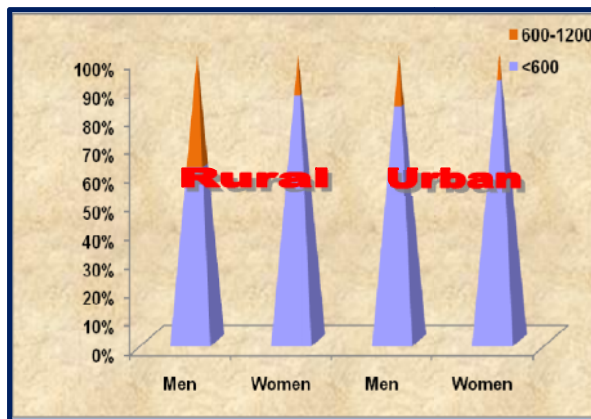
**TABLE -XXXI ENERGY EXPENDITURE IN PHYSICAL ACTIVITY**

Energy expenditure (MET-minutes)*	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Not Active &lt;600</b>	78	61	110	85	<b>188</b>	<b>73</b>	105	82	117	91	<b>222</b>	<b>86</b>
<b>Active 600-1200</b>	49	39	19	15	<b>68</b>	<b>27</b>	23	18	12	9	<b>35</b>	<b>14</b>

\*WHO, 2010

Over all energy expenditure was computed by considering the total time spent in physical activity during a typical week and the intensity of the physical

activity, based on GPAQ guidelines. WHO recommendation on physical activity for health is 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous –intensity physical activity of an equivalent combination of moderate and vigorous intensity physical activity achieving at least 600 MET-minutes (WHO, 2010).



**FIGURE –14 ENERGY EXPENDITURE IN PHYSICAL ACTIVITY**

Even though some form of physical activities observed among the selected hypertensives, about 61 per cent and 85 per cent of rural hypertensive men and women and 82 per cent and 91 per cent of urban hypertensive men and women were not meeting the WHO recommendations on physical activity for health and only 39 per cent

of men and 15 per cent of women from rural and 18 per cent of men and 9 per cent of women from urban were on par with the WHO recommendations.

When compared to urban, greater per cent of rural met the WHO recommended level in physical activity and on the whole inactiveness was very common among women especially urban women. Urban women recorded the least per cent in meeting the WHO recommendations. No one among the selected hypertensives was observed in highly active range (>1200 MET-minutes).

Physical inactivity had been identified as the fourth leading risk factor for global mortality (6 per cent of deaths globally) (WHO, 2010). In the present study, irrespective of the area, physical inactivity was more prevalent among the hypertensives.

From the above results on physical activity pattern of the selected hypertensives based on GPAQ, the present study illustrated vital need of mass approach to enhance the physical activity among adults in both sexes to reduce the onset of hypertension and other complications.

## D.Lifestyle pattern

### a. Physical exercise

Physical exercise pattern of the selected hypertensives is given in Table -XXXII.

**TABLE – XXXII PHYSICAL EXERCISE PATTERN**

Exercise pattern	Rural						Urban					
	Men (n=127)		Women (n=129)		Total (N=256)		Men (n=128)		Women (n=129)		Total (N=257)	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Yes</b>	44	35	29	22	<b>73</b>	<b>29</b>	57	45	46	36	<b>103</b>	<b>40</b>
<b>No</b>	83	65	100	78	<b>183</b>	<b>71</b>	71	55	83	64	<b>154</b>	<b>60</b>
<b>Type of physical exercise</b>												
<b>a. Moderate</b>												
<b>&lt;1/2 hrs</b>	23	52	23	79	<b>46</b>	<b>63</b>	15	26	29	63	<b>44</b>	<b>43</b>
<b>&gt;1/2 hrs</b>	18	41	6	21	<b>24</b>	<b>33</b>	29	51	17	37	<b>46</b>	<b>44</b>
<b>b. Vigorous</b>												
<b>30mts - 45mts</b>	3	7	Nil	Nil	<b>3</b>	<b>4</b>	13	23	Nil	Nil	<b>13</b>	<b>13</b>
<b>No. of days / Week</b>												
<b>5-7</b>	12	27	4	14	<b>16</b>	<b>22</b>	17	30	13	28	<b>30</b>	<b>29</b>
<b>2-4</b>	17	39	12	41	<b>29</b>	<b>40</b>	21	37	17	37	<b>38</b>	<b>37</b>
<b>&lt;2</b>	15	34	13	45	<b>28</b>	<b>38</b>	19	33	16	35	<b>35</b>	<b>34</b>

According to the above table, the greatest part of the selected hypertensives in both rural and urban areas was not doing any physical exercises. It might be due to lack of interest and lack of time. Some form of physical exercise like walking, cycling, jogging, gardening, shuttle etc was observed in 22 - 35 per cent of rural and 36-45 per cent of urban hypertensives. Women were generally physically inactive than their counter parts.

Adequate physical exercise pattern was not seen in most of the selected hypertensives. Even though 52 per cent of hypertensive men and 79 per cent of hypertensive women in rural were engaged in moderate physical exercise, it was followed for less than half an hour in a day. Among the 73 rural hypertensives,

about 41 per cent of men and 21 per cent of women did physical exercise more than half an hour and only seven per cent of men in rural followed vigorous physical exercise for 30mts – 45mts.

In urban areas, one in two men performed moderate level exercise for more than 30 minutes whereas one in four did moderate physical exercise less than half an hour. Greatest per cent (23 per cent) of vigorous exercise was seen in urban men compared to all other selected hypertensives. Where as in urban hypertensive women greatest part (63 per cent) engaged in moderate physical exercise less than half an hour and only 37 per cent performed moderate level physical exercise for more than half an hour.

Slow walking, gardening and yoga practice were observed to be the predominant moderate physical exercise among men and women and brisk walking, jogging, outdoor games and cycling were observed in the vigorous exercise. Even though physical exercise was observed in the selected hypertensives, most of them (37 to 40 per cent) followed it for 2-4 days in a week followed by less than 2 days in a week which was not adequate. Yoga practice was found more in urban areas when compared to rural areas. It was alarming to note that no vigorous physical exercise was seen in hypertensive women irrespective of the area.

Churilla and Ford (2010) found similar results which stated that hypertensives were less active overall than adults who do not have hypertension. Ogwumike *et al.*, (2014) observed that mean values of SBP, DBP, BMI and WHR were higher among participants with low physical activity. The present study also agreed the above results.

#### **b. Pan/tobacco chewing**

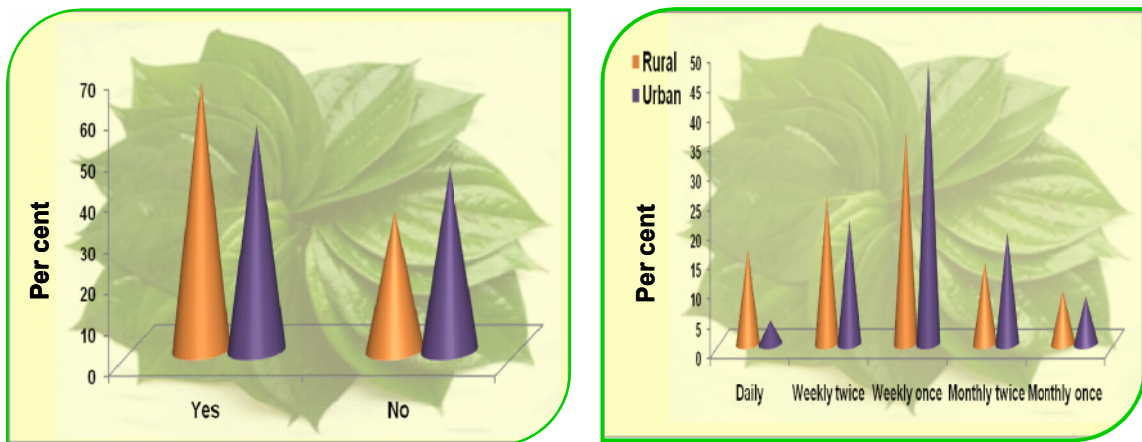
Pan / tobacco chewing habit of the selected hypertensives is highlighted in Table -XXXIII, Figure -15.

TABLE - XXXIII PAN/TOBACCO CHEWING HABIT

Pan/Tobacco chewing	Rural						Urban					
	Men (n=127)		Women (n=129)		Total (N=256)		Men (n=128)		Women (n=129)		Total (N=257)	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Yes</b>	71	56	97	75	<b>168</b>	<b>66</b>	74	58	67	52	<b>141</b>	<b>55</b>
<b>No</b>	56	44	32	25	<b>88</b>	<b>34</b>	54	42	62	48	<b>116</b>	<b>45</b>
<b>Frequency</b>												
<b>Daily</b>	11	15	17	18	<b>28</b>	<b>16</b>	5	7	Nil	Nil	<b>5</b>	<b>4</b>
<b>Weekly twice</b>	9	13	33	34	<b>42</b>	<b>25</b>	20	27	10	15	<b>30</b>	<b>21</b>
<b>Weekly once</b>	21	30	39	40	<b>60</b>	<b>36</b>	34	46	33	49	<b>67</b>	<b>48</b>
<b>Monthly twice</b>	15	21	8	8	<b>23</b>	<b>14</b>	8	11	19	28	<b>27</b>	<b>19</b>
<b>Monthly once</b>	15	21	Nil	Nil	<b>15</b>	<b>9</b>	7	9	5	8	<b>12</b>	<b>8</b>
<b>Quantity/ week</b>												
<b>&lt;4 nos</b>	49	69	62	64	<b>111</b>	<b>66</b>	57	77	67	100	<b>124</b>	<b>88</b>
<b>&gt;4 nos</b>	22	31	35	36	<b>57</b>	<b>34</b>	17	23	Nil	Nil	<b>17</b>	<b>12</b>
<b>Duration of habit</b>												
<b>&lt;5 years</b>	Nil	Nil	Nil	Nil	<b>Nil</b>	<b>Nil</b>	Nil	Nil	12	18	<b>12</b>	<b>8</b>
<b>5-10years</b>	24	34	22	23	<b>46</b>	<b>27</b>	19	26	10	15	<b>29</b>	<b>21</b>
<b>10-15 years</b>	23	32	40	41	<b>63</b>	<b>38</b>	23	31	29	43	<b>52</b>	<b>37</b>
<b>&gt;15years</b>	24	34	35	36	<b>59</b>	<b>35</b>	32	43	16	24	<b>48</b>	<b>34</b>

A new research by doctors from India's premier All India Institute of Medical Sciences has found that even chewing tobacco - as less as one gram - significantly raised heart rate (Sinha, 2011).

With reference to the above context, the Figure -15 also observed the habit of pan chewing including beetle leaves, areca nut and tobacco among the majority of the rural and urban hypertensives. This was parallel to the statement given by WHO (2004) which stated that habitual chewing was commonly practiced by men and women in India. Among south east Asian oral tobacco users, 82 per cent belonged to India.



**FIGURE - 15 PAN/TOBACCO CHEWING HABIT**

There was not much difference noticed between rural (56 per cent) and urban (58 per cent) men in pan chewing practice. Among women, pan chewing was more common in three fourth of women in rural areas and one half of a women in urban areas. This habit was seen in greatest per cent of rural hypertensive women when compared to all others.

According to Rani *et al.*, (2003) the prevalence of both chewing tobacco/*pan* masala was significantly higher in rural, poorer and uneducated populations compared to urban, wealthier, and more educated populations, respectively, both in men and women, though the differentials for chewing tobacco were smaller. The present study outcomes also agreed the above results.

The results were slightly higher than the studies by Joshi *et al.*, (2010) which observed 37.2 per cent of urban population of Gujarat was ever-tobacco-chewers and by Preeti and Raut (2012) which stated that tobacco use among men was 46.5 per cent and among women was 13.8 per cent in India. The prevalence of chewing might vary widely between different states and had a strong association with individual's socio-cultural characteristics.

The Figure -15 illustrated that weekly once consumption of pan was more common in both rural and urban areas. In rural areas, among the pan chewers 18 per cent of women consumed beetle nut with or without tobacco even daily and

most of them (40 per cent) had this habit weekly once followed by weekly twice (34 per cent). Only eight per cent used pan monthly twice.

Fifteen per cent of rural men were regular pan eaters and maximum of 30 per cent were having weekly once followed by 21 per cent in twice a month and once in a month. About 13 per cent of the men used weekly twice. However the frequency might be, the quantity of beetle leaves consumed was less than four numbers in most of the rural men (69 per cent) and women (64 per cent). About 31- 36 per cent consumed more than 4 numbers in a time.

Among urban hypertensive men and women, weekly once frequency was found to be more (46-49 per cent) and weekly twice was observed in more than one quarter of men and 15 per cent of women. Even seven per cent of urban hypertensive men were eating pan daily. Monthly twice frequency was found to be more in women (28 per cent) and men in urban (11 per cent).

When observing the quantity consumed by the selected urban subjects revealed that 77 per cent of men and cent per cent of women were consuming pan less than four numbers in a week time. Nearly one quarter of the hypertensive urban men were eating more than four numbers.

In rural areas entire selected men and women were having this habit for more than five years. In 34 per cent of rural men, the duration of pan chewing habit was found to be more than 15 years and five to ten years and in 32 per cent it was observed to be 10-15 years. In women, greatest per cent (41 per cent) was observed to be in 10-15 years duration succeeded by more than 15 years (36 per cent) and five to ten years (23 per cent).

Among urban hypertensives, majority of 43 per cent men were having this habit for more than 15 years followed by 10 -15 years (31 per cent) and five to ten years (26 per cent). In women, majority (43 per cent) were having pan chewing habit for 10-15 years, succeeded by more than fifteen years (24 per cent). About 18 per cent consumed pan for less than five years and 15 per cent had the pan chewing practice for 5-10 years.

On the whole, pan chewing habit was concerned, even though it existed in both areas, it was found to be more predominant in selected rural hypertensives when compared to urban. Compared to urban hypertensives, rural hypertensive used pan more often and in more numbers. Greatest per cent of men were having this habit for more than 15 years in comparison with their counter parts in urban.

**c. Alcohol intake**

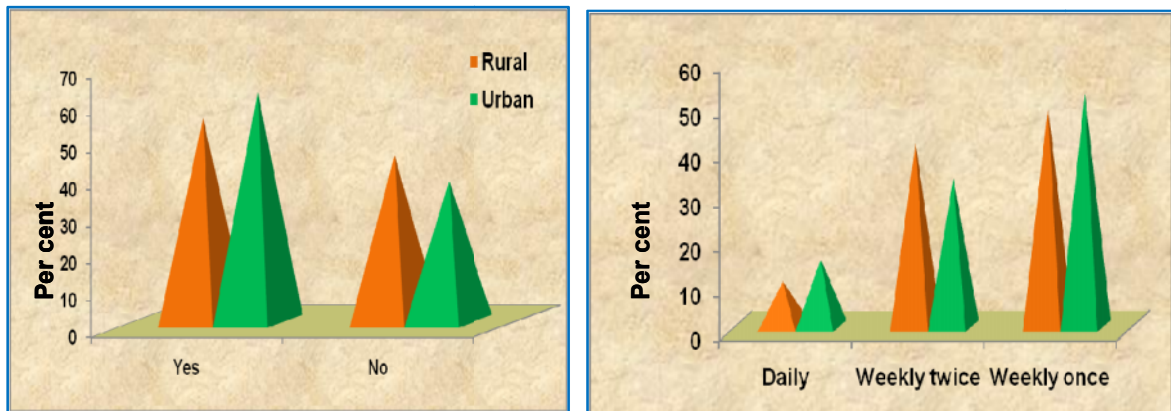
Alcohol intake pattern of the selected hypertensives is presented in Table - XXXIV, Figure -16.

**TABLE –XXXIV ALCOHOL INTAKE PATTERN**

Alcohol intake	Rural		Urban	
	Men (n=127)		Men (n=128)	
	Number	Per cent	Number	Per cent
<b>Yes</b>	70	55	79	62
<b>No</b>	57	45	49	38
<b>Frequency</b>				
<b>Daily</b>	7	10	12	15
<b>Weekly twice</b>	29	41	26	33
<b>Weekly once</b>	34	49	41	52
<b>Quantity/week</b>				
<b>90ml -135ml</b>	34	49	21	27
<b>135ml –180ml</b>	18	26	39	49
<b>&gt;180ml</b>	18	26	19	24
<b>Duration of habit</b>				
<b>&lt;5 years</b>	28	40	22	28
<b>6-10years</b>	24	34	37	47
<b>&gt;10 years</b>	18	26	20	25

The regular consumption of alcohol was found to elevate blood pressure, with global estimated attributable risk for hypertensive disease from alcohol was 16 per cent. The increase in blood pressure was approximately one mm Hg for each 10 g of alcohol consumed and was largely reversible within 2-4 weeks of abstinence or a substantial reduction in alcohol intake. The increase in blood pressure levels occurred irrespective of the type of alcoholic beverages (Puddey and Beilin, 2006).

According to the Figure -16, alcohol consumption, one of the risk factors for hypertension was observed among the greatest part of the selected hypertensive men. Among the selected hypertensives more than 50 per cent of the men in rural (59 per cent) and urban areas (62 per cent) were consuming alcohol. Similar trend was also given by Steptoe and McMunn (2009) which stated that hypertensive individuals were more likely to be heavy drinkers.



**FIGURE -16 ALCOHOL INTAKE PATTERN**

A substantial proportion of individuals above the age of 50 years were current consumers of alcohol and the prevalence was generally higher in urban compared to rural areas (Nadkarni, 2013). In present study also showed the similar results by observing more alcohol consumers in urban when compared to hypertensive in rural. It was also in accord with the study which showed that in southern India prevalence of current alcohol use varied between 33 per cent and 50 per cent, with a higher prevalence among the lesser educated and the poor (Das *et al.*, 2006).

The Figure -16 illustrated that once in a week consumption was seen in one in two men in both areas. Weekly twice frequency was more common in rural men (41 per cent) when compared to men from urban areas (33 per cent). It was adverse to note that 15 per cent of urban and 10 per cent of rural hypertensives were consuming daily.

Quantity of consumption per week was observed to 90 ml to 135 ml per week in one half of rural whereas in urban one in two consumed 135 ml – 180 ml

per week. One in four selected hypertensives consumed >180ml alcohol/week in both rural and urban areas.

Majority of the rural (40 per cent) and urban (47 per cent) hypertensive men were consuming alcohol for less than 5 years and for the past 6-10 years respectively and 28 per cent of urban were having this habit for less than 5 years. About 26 per cent and 25 per cent of rural and urban men were drinking alcohol for more than 10 years respectively. The increased alcohol consumption pattern in both urban and rural areas was one of the adverse conditions of changing lifestyle pattern.

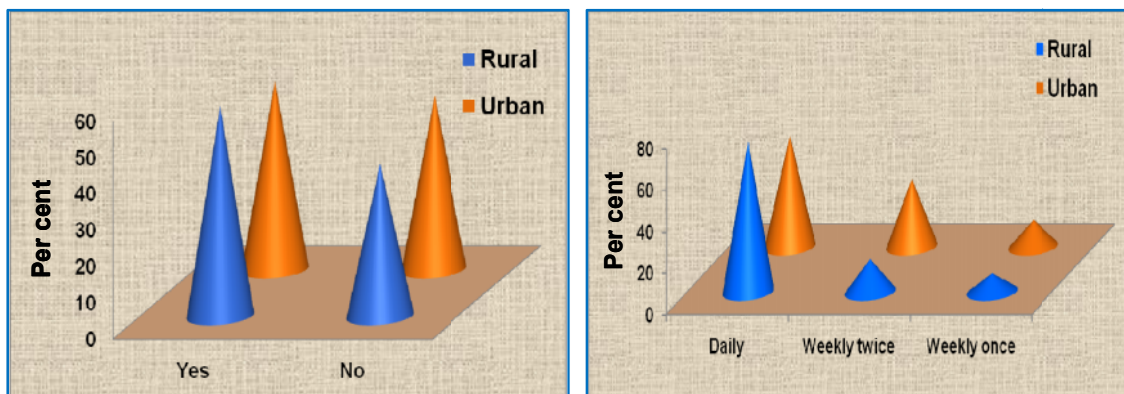
**c. Smoking frequency**

Smoking frequency of the selected hypertensives is illustrated in Table -XXXV, Figure -17.

**TABLE - XXXV SMOKING FREQUENCY OF THE SELECTED HYPERTENSIVES**

Smoking Habit	Rural		Urban	
	Men (n=127)		Men (n=128)	
	Number	Per cent	Number	Per cent
<b>Yes</b>	75	59	67	52
<b>No</b>	52	41	61	48
<b>Type</b>				
<b>Cigarette</b>	23	31	55	82
<b>Bidi</b>	52	69	12	18
<b>Frequency</b>				
<b>Daily</b>	55	73	36	54
<b>Weekly twice</b>	12	16	22	33
<b>Weekly once</b>	8	11	9	13
<b>Quantity/week</b>				
<b>1-2nos</b>	6	8	10	15
<b>3-5nos</b>	10	13	19	28
<b>&gt;6nos</b>	59	79	38	57
<b>Duration of habit</b>				
<b>&lt;5 years</b>	17	23	12	18
<b>6-10years</b>	31	41	33	49
<b>&gt;10 years</b>	27	36	22	33

Smoking was one of the predisposing factors for hypertension. Abtahi *et al.*, (2011) observed that prehypertension prevalence was more prevalent among smokers than non-smokers and prevalence of grade 1 hypertension was 35 per cent in smokers and 30.3 per cent in non-smokers. Synchronizing with the above study Figure -11 visualized clearly that one in two selected hypertensive men were smokers. The smoking habit was predominant in more than one half of rural and urban hypertensives and also smoking beedi (69 per cent) was more among the rural men whereas cigarette smoking (82 per cent) was predominant among urban men.



**FIGURE - 17 SMOKING HABIT AND FREQUENCY**

Figure -17 illustrated that three in four in rural and more than one in two in urban were regular smokers. The hypertensives who smoked twice in a week and once in a week was observed more in urban than rural.

Whatever the frequency might be, both in rural (79 per cent) and urban areas (57 per cent) smoked more than six number per week. Percentage of this crowd was maximum when compared to hypertensives who smoked three to five numbers and one to two numbers in both areas and it was found to be 13 per cent, 8 per cent in rural areas and 28 per cent, 15 per cent in urban areas respectively.

The present result showed that the majority of the selected hypertensive subjects were having the smoking habit for 6-10 years in 41 per cent of rural and 49 per cent of urban men. Even 36 per cent of rural and 32 per cent of urban men were smoking for more than 10 years. About 18 -23 per cent of the smokers acquired this habit within five years.

It was inferred that more than one part of both rural and urban hypertensives was current smokers and found to smoke daily. The quantity was observed to be more than 6 numbers/week for 6-10 years. Reducing these lifestyle risk factors might decline the prevalence of hypertension among both rural and urban areas.

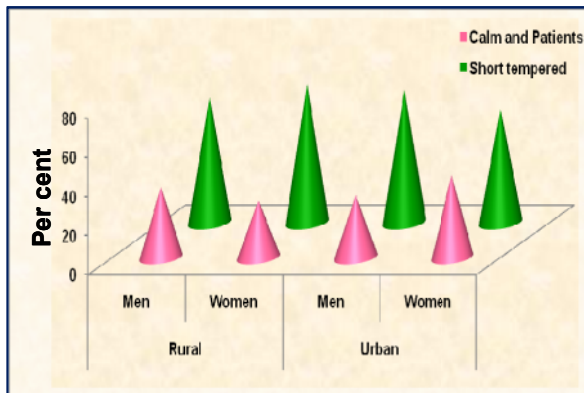
## E. Emotional health

### a. Emotional nature

Table -XXXVI and Figure -18 present the emotional nature of the selected hypertensives.

**TABLE –XXXVI EMOTIONAL NATURE OF THE SELECTED HYPERTENSIVES**

Emotional Nature	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Calm and patients</b>	46	36	38	29	<b>84</b>	<b>33</b>	41	32	54	42	<b>95</b>	<b>37</b>
<b>Short tempered</b>	81	64	91	71	<b>172</b>	<b>67</b>	87	68	75	58	<b>162</b>	<b>63</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>



**FIGURE - 18 EMOTIONAL NATURE OF THE SELECTED HYPERTENSIVES**

According to Figure - 18, greatest part of the selected hypertensives in rural (men: 64 per cent and Women: 71 per cent) and urban areas (Men: 68 per cent and Women: 58 per cent) were short tempered in emotional nature.

They used to get irritated easily and reacted aggressively when

provoked by any unfavourable events.

More per cent of rural men (36 per cent) and urban women (42 per cent) were found to be calm and patient when compared to their counter parts.

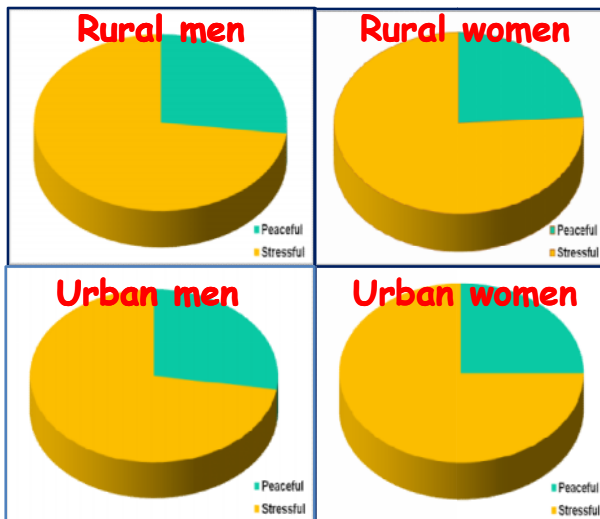
**b. Emotional life**

Table - XXXVII, Figure -19 and Figure -20 pin point the emotional life of the selected hypertensives

**TABLE - XXXVII EMOTIONAL LIFE OF THE SELECTED HYPERTENSIVES**

Emotional Life	Rural						Urban					
	Men (n=127)		Women (n=129)		Total (N=256)		Men (n=128)		Women (n=129)		Total (N=257)	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Peaceful</b>	31	24	35	27	66	26	42	33	32	25	74	29
<b>Stressful</b>	96	76	94	73	190	74	86	67	97	75	183	71
<b>Family issues</b>	34	35	57	61	91	48	31	36	47	48	78	43
<b>Financial issues</b>	69	72	59	63	128	67	68	79	73	75	141	77
<b>Work place stress</b>	30	31	47	50	77	41	54	63	42	43	96	52
<b>Work life imbalance</b>	13	14	63	67	76	40	79	92	79	81	158	86
<b>Illness of dear ones</b>	17	18	21	22	38	20	24	28	15	15	39	21
<b>Death of dear ones</b>	4	4	3	3	7	4	6	7	3	3	9	5
<b>Society</b>	17	18	15	16	32	44	27	31	35	36	62	34

\*Multiple responses



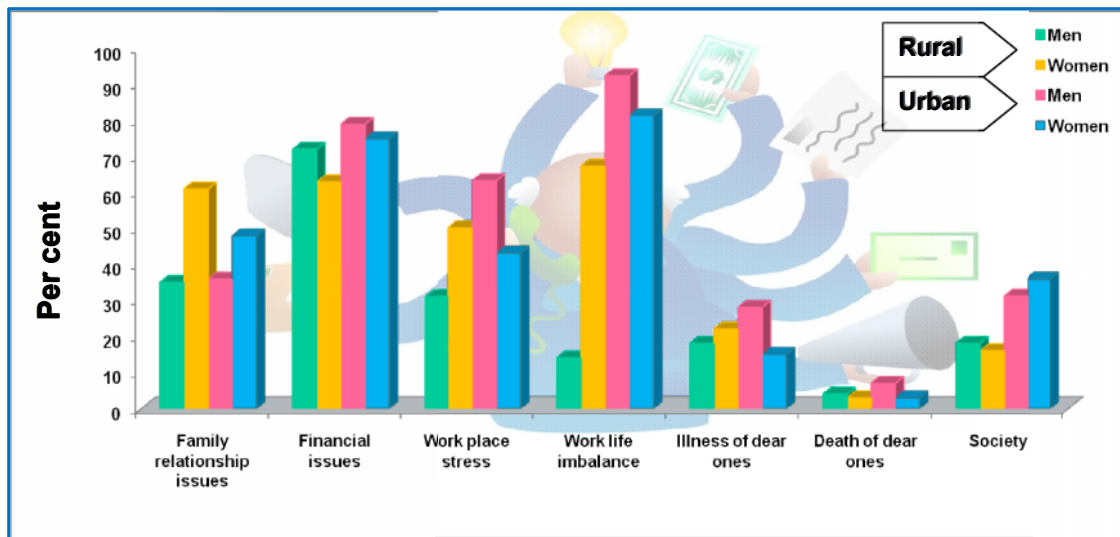
**FIGURE -19 EMOTIONAL LIFE OF SELECTED HYPERTENSIVES**

Table - XXXVII and Figure - 19 illustrated that nearly three in four among both rural and urban hypertensives were leading stressful family life due to one or more reasons and only one in four were having peaceful family life. The blood pressure persistently increased over a longer period in response to a wide range of stressful situations. Therefore, stressful life of the most of the selected hypertensive might be

one of the reasons to increase the blood pressure.

Figure - 20 clearly visualized that majority of rural hypertensive men were stressed due to financial issues (72 per cent), followed by family relationship issues (35 per cent) and work place stress (31 per cent). Illness of dear ones, work life imbalance, society and death of dear ones were quoted by less than 19 per cent of the rural hypertensive men as the reasons for their stress in life.

Among the rural hypertensive women, work life imbalance (67 per cent) was quoted as the peak reason for stress and not much difference was noticed between financial issues (63 per cent) and family relationship issues (61 per cent). One in two person cited work place stress and 22 per cent stated illness of dear ones was the reason for stress in their life. About 16 per cent said that influence of society and three per cent quoted death of dear ones in the family for their stress.



**FIGURE -20 REASONS FOR STRESS GIVEN BY THE SELECTED HYPERTENSIVES**

Greatest part of the urban hypertensive men (92 per cent) and hypertensives women (81 per cent) prone to stress due to work life imbalance succeeded by financial issues (men: 79 per cent and women: 75 per cent). Work place stress (63 per cent), family relationship issues (36 per cent), illness of dear ones (28 per cent), society (31 per cent) and death of dear ones (7 per cent) were the other reasons given by the selected urban hypertensives men.

In selected hypertensive women, nearly 50 per cent and 43 per cent had family relationship issues and workplace stress respectively. Societal influence

(36 per cent) was found to be more among the selected hypertensive women than any other group.

The present study observed that irrespective of the sex and area, work life imbalance, financial stress and family relationship issues were the most predominant causes for accumulating stress in their life. Among all financial issue was greatest stress among rural whereas it was work-life imbalance in urban areas. Due to one or other reason most of the selected hypertensives were packed with stress.

Long term prolonged stress might induce coronary heart disease and its related death rate. Hence, stress management should be insisted in any approach towards hypertension reduction.

## **F. Medical history**

### **a. Family history**

Table -XXXVIII and Figure -21 depict the family history of the selected hypertensives

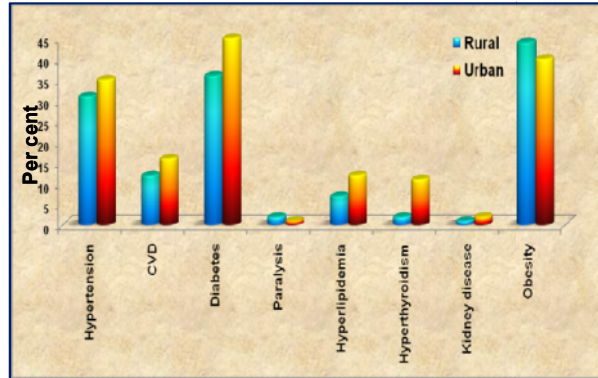
**TABLE –XXXVIII FAMILY HISTORY OF THE SELECTED HYPERTENSIVES**

Family medical history*	Rural			Urban		
	Men (n=127)	Women (n=129)	Total (N=256)	Men (n=128)	Women (n=129)	Total (N=257)
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Hypertension	31	32	<b>31</b>	34	36	<b>35</b>
Cardiovascular disease	13	10	<b>12</b>	16	15	<b>16</b>
Diabetes	42	31	<b>36</b>	43	47	<b>45</b>
Paralysis	2	2	<b>2</b>	1	2	<b>1</b>
Hyper lipidemia	9	5	<b>7</b>	13	12	<b>12</b>
Hyper thyroidism	2	2	<b>2</b>	9	12	<b>11</b>
Kidney disease	Nil	2	<b>1</b>	2	1	<b>2</b>
Obesity	39	44	<b>41</b>	44	36	<b>40</b>

\*Multiple responses

About 31-32 per cent of selected hypertensives in both areas observed to have family history of hypertension. In both rural and urban areas, more than 31-47 per cent had family history of diabetic and about 10 per cent and 13 per cent of

rural hypertensives and 15-16 per cent of urban hypertensives had family history of cardiovascular disease.



**FIGURE -21 FAMILY HISTORY**

About 39 per cent and 44 per cent of rural and 44 per cent and 36 per cent of urban men and women hypertensives were having family history of obesity. Hyper lipidemia and hyper thyroidism were found to be more in urban families than rural families. One to three per cent families were having kidney disease and paralysis history in both rural and urban hypertensives.

Among the rural hypertensives, maximum per cent were having family history of obesity, followed by diabetes and hypertension whereas in urban hypertensives, the greatest per cent were quoted family history of diabetes, succeeded by obesity and hypertension.

**b. Personal history**

Table –XXXIX gives the personal history of the selected hypertensives

**TABLE –XXXIX PERSONAL HISTORY OF THE SELECTED HYPERTENSIVES**

Personal Medical History*	Rural			Urban		
	Men (n=127)	Women (n=129)	Total (N=256)	Men (n=128)	Women (n=129)	Total (N=257)
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<b>Diabetes</b>	13	21	<b>17</b>	14	19	<b>16</b>
<b>Cardiovascular disease</b>	4	3	<b>4</b>	2	4	<b>3</b>
<b>Obesity</b>	32	52	<b>42</b>	45	49	<b>47</b>
<b>Thyroidism</b>	Nil	2	<b>1</b>	Nil	5	<b>3</b>
<b>Hyper lipidemia</b>	14	7	<b>11</b>	19	13	<b>16</b>
<b>Kidney stone</b>	6	Nil	<b>3</b>	9	Nil	<b>4</b>
<b>No medical history</b>	31	21	<b>26</b>	18	10	<b>14</b>

\*Multiple responses

Regarding personal medical history, obesity was found to be very common among the majority of the selected hypertensive men and women from both rural

and urban areas. It was found to be 32 per cent, 52 per cent, 45 per cent and 49 per cent in selected hypertensive men and women from rural and urban areas respectively. It was concordant to the study by Dua et al., (2014). He showed that overweight/obese subjects were more likely to have hypertension than those with normal BMI. When compared to hypertensive men in present study, obesity was more prevalent in hypertensive women in both rural and urban areas.

Next to obesity, hyperlipidemia was prevalent among men in rural (14 per cent) and urban (19 per cent) where as diabetic was more common in rural (21 per cent) and urban (19 per cent) women. Similar result was observed by Anand (2010) which observed 25.5 per cent of diabetes among hypertensives in the recent Chennai urban population study.

About two to four per cent of the selected hypertensives were found to have cardiovascular disease in rural and urban areas. Very meager per cent of women (two - five per cent) and men (six - nine per cent) were having hyper thyroidism and kidney stone problems in both rural and urban areas. The greatest per cent of rural hypertensives were free of any medical problem when compared to their counter parts.

**c. Symptoms of hypertension**

Table - XL displays the prevalence of hypertension symptoms among the selected hypertensives.

**TABLE -XL PREVALENCE OF HYPERTENSION SYMPTOMS**

Hypertension Symptoms*	Rural			Urban		
	Men (n=127)	Women (n=129)	Total (N=257)	Men (n=128)	Women (n=129)	Total (N=257)
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Head ache	23	26	25	26	18	22
Giddiness	7	8	7	6	11	9
Breathlessness	Nil	10	5	7	12	10
Tiredness	7	12	9	10	16	12
Palpitation	7	5	6	11	4	7
Blurred vision	Nil	2	1	2	2	2
No symptoms reported	56	37	46	38	37	38

\*Multiple responses

Table - XL declared that in rural areas, no prominent symptoms were noticed in 56 per cent of hypertensive men and 37 per cent of hypertensive women. Among the said symptoms, about one in four reported head ache and less than 13 per cent stated breathlessness, tiredness, giddiness, palpitation and blurred vision.

With respect to selected urban hypertensives, 37-38 per cent were not stated any felt symptoms and among the quoted symptoms, head ache was given by more per cent of urban men (26 per cent) and women (18 per cent) hypertensives. About 16 per cent of urban hypertensive women reported tiredness and less than 13 per cent of both urban men and women stated other symptoms like breathlessness, giddiness, palpitation and blurred vision.

Most of the hypertensives in both rural and urban areas reported head ache as a symptom and no symptoms was reported by 46 per cent of rural and 38 per cent of urban hypertensives.

**d. Treatment type**

Table -XLI presents the type of treatment followed by the selected hypertensives.

**TABLE – XLI TYPE OF TREATMENT FOLLOWED**

Treatment type	Rural						Urban					
	Men		Women		Total		Men		Women		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Allopathy</b>	31	24	16	12	<b>58</b>	<b>23</b>	57	45	33	26	<b>90</b>	<b>35</b>
<b>Homeopathy</b>	13	10	Nil	Nil	<b>18</b>	<b>7</b>	3	2	12	9	<b>15</b>	<b>6</b>
<b>Ayurvedham</b>	Nil	Nil	5	4	<b>5</b>	<b>2</b>	7	5	Nil	Nil	<b>7</b>	<b>3</b>
<b>Not under treatment</b>	83	66	108	84	<b>175</b>	<b>68</b>	61	48	84	65	<b>145</b>	<b>56</b>
<b>Total</b>	<b>127</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>256</b>	<b>100</b>	<b>128</b>	<b>100</b>	<b>129</b>	<b>100</b>	<b>257</b>	<b>100</b>

Among the 256 rural and 257 urban selected hypertensives, about 89 rural and 127 urban were known hypertensives and rest were detected through the health camp organized in the present study.

From the Table-XLI, it was clear that not all the known hypertensives were under treatment due to one or other reasons. Only 81 in rural and 112 in urban were under treatment. Among those who were under treatment, most followed allopathy succeeded by homeopathy and ayurveda treatment in both rural and urban areas.

The hypertensives who were identified through camp were not taking any medication because they were not aware of their blood pressure level until they attended the health camp.

**e. Hypertension control**

Table - XLII explains the hypertension control among the selected hypertensives

**TABLE – XLII HYPERTENSION CONTROL AMONG THE SELECTED HYPERTENSIVES**

Particulars	Rural						Urban					
	Men (n=61)		Women (n=28)		Total (N=89)		Men (n=80)		Women (n=47)		Total N=(127)	
	N	%	N	%	N	%	N	%	N	%	N	%
<b>Hypertension control</b>												
<b>Under control</b>	36	59	12	43	48	54	59	74	31	66	90	71
<b>Not under control</b>	25	41	16	57	41	46	21	26	16	34	37	29
<b>Regularity of the treatment</b>												
<b>Regular</b>	30	49	15	54	45	51	62	78	34	72	96	76
<b>Not regular</b>	31	51	13	46	44	49	18	23	13	28	31	24

Among the 89 known hypertensives in rural, only 36 men and 12 women reported that their blood pressure was under control and in rest (25 to 16 numbers) blood pressure was not under control. About 30 hypertensive men and 15 hypertensive women in rural areas were not taking regular treatment due to one or more reasons.

Among 80 men and 47 women known hypertensives in urban, 59 men and 31 women declared that they had control over their blood pressure and it was not seen in the rest. The blood pressure was found to be under control in more urban

hypertensives than rural counter parts. About 62 men and 34 women in urban were under regular treatment and this crowd also observed to be more in urban than rural.

The foremost reason stated for irregular treatment by greatest part of the rural was exorbitant treatment cost followed by no stabilized reduction. In urban, the reason stated by most of them was no constant reduction in blood pressure and followed by expensive treatment cost. But it was observed that ignorance of complications as an important factor for irregular treatment in both rural and urban areas.

The regular treatment and control of blood pressure was observed to be more in urban when compared to rural and it might be due to the difference in the educational and economic status of selected urban and rural hypertensives. Hence, improving the awareness level and introducing low cost non pharmacological treatments like dietary modification and life style modification might help to reduce the complications of hypertension in developing country like India.

## **G. Awareness on hypertension and hypotensive foods**

### **a. Awareness on hypertension complications**

Table – XLIII provides the awareness on hypertension complications among the selected hypertensives.

**TABLE – XLIII AWARENESS ON HYPERTENSION COMPLICATIONS**

Per cent Particulars	Rural			Urban		
	Men (n=127)	Women (n=129)	Total (N=256)	Men (n=128)	Women (n=129)	Total (N=257)
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<b>Awareness on hypertension complications</b>						
<b>Yes</b>	42	40	<b>41</b>	55	46	<b>51</b>
<b>No</b>	48	60	<b>59</b>	45	54	<b>49</b>
<b>Knowledge on hypertension complication*</b>						
<b>Diabetes</b>	36	29	<b>13</b>	45	36	<b>21</b>
<b>Paralysis</b>	32	21	<b>11</b>	32	22	<b>14</b>
<b>Kidney disease</b>	13	6	<b>4</b>	18	14	<b>8</b>
<b>Vision problem</b>	11	7	<b>4</b>	21	15	<b>9</b>
<b>Heart disease</b>	59	73	<b>27</b>	89	70	<b>40</b>

**\*Multiple responses**

According to Table -XLIII, maximum per cent of men (48 per cent) and women (60 per cent) in rural were not aware of the actual complications of hypertension. Among the rural hypertensives those who were aware (40 to 42 per cent) of complications, more than 50 per cent stated that uncontrolled hypertension leads to heart disease. The awareness on hypertensive complication such as onset of diabetes (men: 36 per cent and women: 29 per cent) and paralysis (men:32 per cent and Women:21 per cent) was observed in less than 37 per cent. About less than 14 per cent were aware about onset of kidney disease and vision problem due to uncontrolled hypertension in rural areas

Among the urban hypertensives the awareness level was more (46 to 55 per cent), when compared to rural areas (40 to 42 per cent). About 89 per cent of men and 70 per cent of women were aware of the onset of heart disease, 45 per cent and 36 per cent of men and women respectively stated the onset of diabetes and about 22 to 32 per cent pointed out the paralytic consequences due to uncontrolled hypertension. Less than 16 per cent were observed to know about the onset of kidney disease and vision problem due to prolonged elevated blood pressure.

The above table also proclaimed the need for mass approach to enrich the knowledge on hypertension to reduce the prevalence and further complications.

#### **b. Awareness on hypotensive foods**

Table -XLIV describes the awareness on hypotensive foods among selected hypertensives

According to the below table difference was noticed between rural and urban hypertensives in the awareness level on the role of functional foods in hypertension management and it was found to be 36 to 44 per cent in rural areas and 38 to 48 per cent in urban areas. Greatest part (76 -79 per cent) of the rural hypertensives stated low fat diet, 59 to 69 per cent pointed the low sodium diet and only 37-38 per cent quoted the diet rich in vegetables and fruits as the hypotensive diet.

TABLE –XLIV AWARENESS ON HYPOTENSIVE FOODS

Particulars	Rural			Urban		
	Men	Women	Total	Men	Women	Total
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<b>Awareness on hypotensive foods</b>						
<b>Aware</b>	44	36	<b>40</b>	48	38	<b>43</b>
<b>Unaware</b>	56	64	<b>60</b>	52	62	<b>57</b>
<b>Knowledge on hypotensive diet*</b>						
<b>Vegetable and fruits rich diet</b>	38	37	<b>47</b>	45	55	<b>61</b>
<b>Low fat diet</b>	79	76	<b>89</b>	100	98	<b>99</b>
<b>Low sodium diet</b>	69	59	<b>75</b>	55	67	<b>76</b>

\*Multiple responses

Hundred per cent of the urban hypertensives suggested low fat diet for hypertension and 55 -67 per cent recommended low sodium diet. Compared to rural hypertensives, more per cent of (45 to 55 per cent) of urban hypertensives were aware about beneficial effect of diet rich in vegetables and fruits in controlling blood pressure. No one in both rural and urban areas was aware on the beneficial effect of potassium rich foods in controlling blood pressure.

Even though awareness level on hypotensive diet was observed to be inadequate in both rural and urban areas, it was found better in urban areas when compared to rural hypertensives. The difference in the awareness level might be due to the difference in the educational status of the rural and urban hypertensives.

## H. Nutrition and Health status of the selected hypertensives

Nutritional and health status of the selected hypertensives are discussed under the following headings.

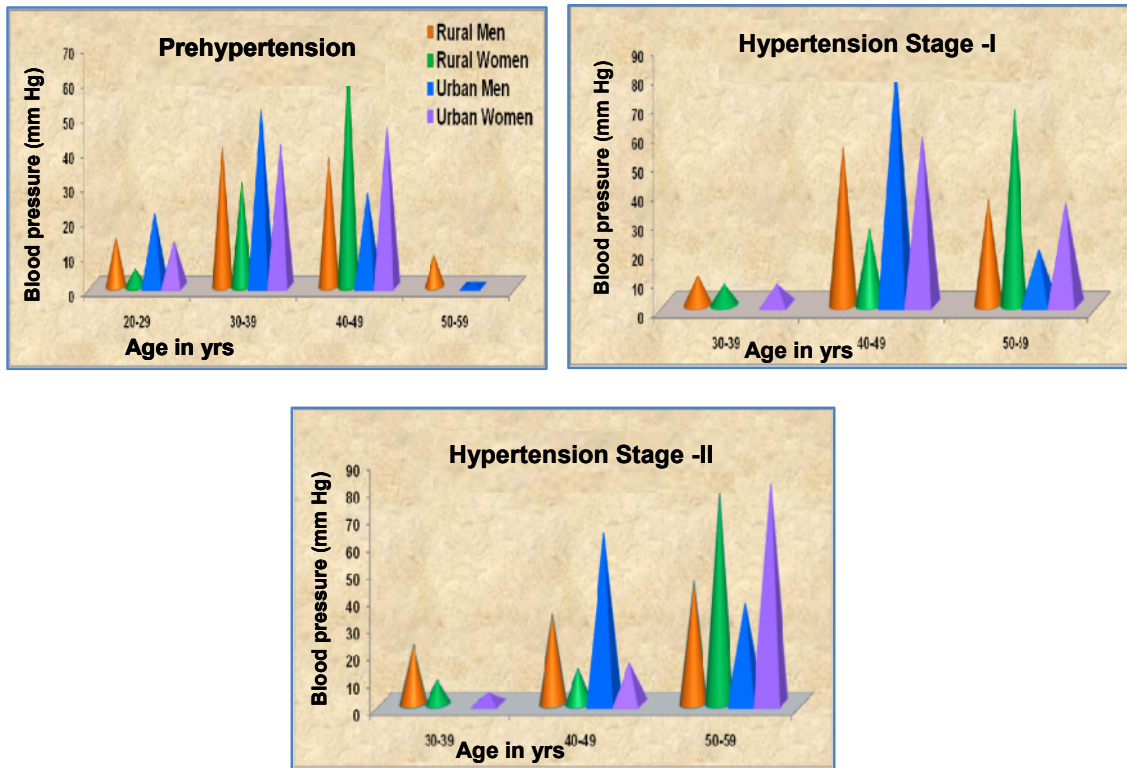
### a. Blood pressure levels

#### 1. Distribution of hypertensives based on age and blood pressure level

Table - XLV and Figure -22 give the distribution of hypertensives based on age and blood pressure levels.

TABLE –XLV DISTRIBUTION OF HYPERTENSIVES BASED ON AGE AND BLOOD PRESSURE LEVEL

Age (yrs)	Rural						Urban					
	Men (n=127)		Women(n=129)		Total (N=256)		Men (n=128)		Women(n=129)		Total (N=257)	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
<b>Pre hyper tension</b>												
<b>20-29</b>	11	14	3	5	<b>14</b>	<b>10</b>	18	21	10	13	<b>28</b>	<b>17</b>
<b>30-39</b>	31	40	19	30	<b>50</b>	<b>36</b>	43	51	31	41	<b>74</b>	<b>46</b>
<b>40-49</b>	28	37	41	65	<b>69</b>	<b>49</b>	23	27	35	46	<b>58</b>	<b>36</b>
<b>50-59</b>	7	9	Nil	Nil	<b>7</b>	<b>5</b>	1	1	Nil	Nil	<b>1</b>	<b>1</b>
<b>Total</b>	<b>77</b>	<b>100</b>	<b>63</b>	<b>100</b>	<b>140</b>	<b>100</b>	<b>85</b>	<b>100</b>	<b>76</b>	<b>100</b>	<b>161</b>	<b>100</b>
<b>Hypertension Stage -I</b>												
<b>30-39</b>	4	10	3	7	<b>7</b>	<b>8</b>	Nil	Nil	2	7	<b>2</b>	<b>4</b>
<b>40-49</b>	22	54	11	26	<b>33</b>	<b>39</b>	22	81	15	58	<b>37</b>	<b>70</b>
<b>50-59</b>	15	36	29	67	<b>44</b>	<b>53</b>	5	19	9	35	<b>14</b>	<b>26</b>
<b>Total</b>	<b>41</b>	<b>100</b>	<b>43</b>	<b>100</b>	<b>84</b>	<b>100</b>	<b>27</b>	<b>100</b>	<b>26</b>	<b>100</b>	<b>53</b>	<b>100</b>
<b>Hypertension Stage -II</b>												
<b>30-39</b>	2	22	2	9	<b>4</b>	<b>13</b>	Nil	Nil	1	4	<b>1</b>	<b>2</b>
<b>40-49</b>	3	33	3	13	<b>6</b>	<b>19</b>	10	63	4	15	<b>14</b>	<b>33</b>
<b>50-59</b>	4	45	18	78	<b>22</b>	<b>68</b>	6	37	22	81	<b>28</b>	<b>65</b>
<b>Total</b>	<b>9</b>	<b>100</b>	<b>23</b>	<b>100</b>	<b>32</b>	<b>100</b>	<b>16</b>	<b>100</b>	<b>27</b>	<b>100</b>	<b>43</b>	<b>100</b>



**FIGURE -22 DISTRIBUTION OF HYPERTENSIVES BASED ON AGE AND BLOOD PRESSURE LEVEL**

Table - XLV and Figure –22 depicted that greatest per cent (40 per cent) of the prehypertensives rural men were in the age group of 30-39 years, followed by 37 per cent of 40-49 years but in rural women, majority (65 per cent) were in the age group of 40 – 49 years followed by 30-39 years (30 per cent). It was shocking to note that about 14 per cent of prehypertensive men and five per cent of prehypertensive women in rural areas belonged to 20-29 years. It was adverse to note that even most of the rural people were influenced by westernized food habits, sedentary lifestyle and stressful lifestyle similar to urban. Weight was the positively associated risk factor for hypertension and it must be addressed primarily to reduce the prevalence of hypertension and its further complications.

In urban, about one in two prehypertensive men were in the age group of 30-39 years and around one in four were in the age group of 40-49 years. In urban women, 46 per cent belonged to 40-49 years and 41 per cent belonged to

30-39 years among prehypertensives. It was alarming to note about 21 per cent men and 13 per cent women prehypertensives between 20 -29 years in urban areas.

On the whole prehypertension was more prevalent among 40-49 years women and 30-39 years men in both rural and urban areas and the urban men were prone to prehypertension earlier when compared to other groups.

Among rural, about 54 per cent and 36 per cent of hypertensive stage I men belonged to 40-49 years and 50-59 years respectively and the greatest per cent of women hypertensives stage -I were found between 50-59 years (67 per cent) followed by 40-49 years (26 per cent). Whereas in urban areas, 81 per cent and 58 per cent of hypertensive stage I men and women were in the age group of 40-49 years followed by 50-59 years. About seven to ten per cent in rural and urban were found to be the victim of hypertensin stage -I at the age of 30-39 years.

Among the hypertensives stage -II, 45 per cent, 78 per cent and 81 per cent of men, women in rural and women in urban respectively belonged to 50-59 years whereas maximum of 63 per cent of urban men belonged to 40-49 years. About 22 per cent of rural men in the age group of 30-39 years were found to be hypertensive stage II and it was only 9 per cent and 4 per cent in rural and urban women. When compared to women, men in both rural and urban areas were more prone to hypertensive severity and the most affected crowd was urban men. It might be due to the multiple ways of stress induced by the current competitive world, changing food habits and the reduced physical activity due to advanced technical era. This transformation trend was greater in urban when compared to rural areas.

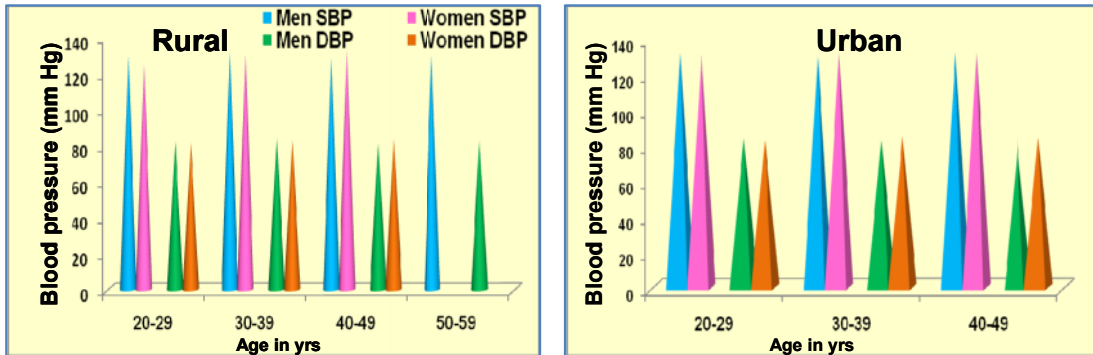
## **2. Blood pressure and age**

Table -XLVI and Figure -23 depict the blood pressure levels of the selected hypertensives

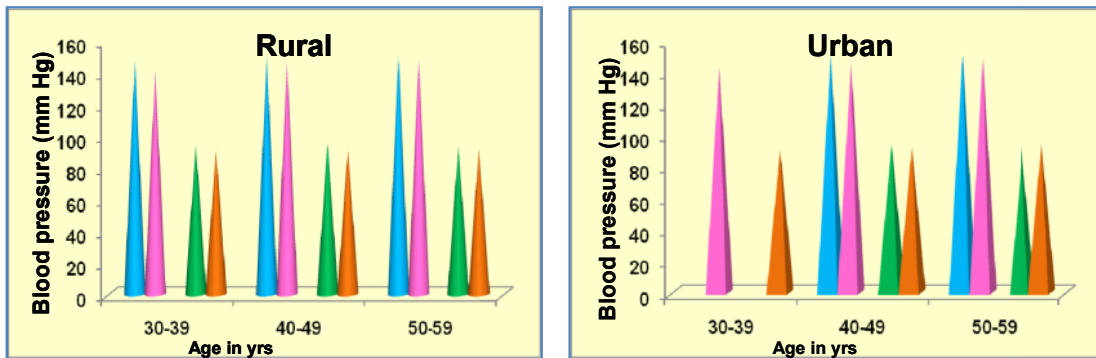
TABLE - XLVI BLOOD PRESSURE LEVELS OF SELECTED HYPERTENSIVES

Age (yrs)	Rural (N=256)				Urban (N=257)			
	Men (n=127)		Women (n=129)		Men (n=128)		Women (n=129)	
	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP
	(Mean (mm Hg) $\pm$ SD)							
<b>Pre hyper tension</b>								
<b>20-29</b>	129.7 $\pm$ 4.61	82.1 $\pm$ 3.06	124.7 $\pm$ 2.08	81.3 $\pm$ 4.04	131.2 $\pm$ 4.33	83.4 $\pm$ 3.07	130.3 $\pm$ 2.21	82.6 $\pm$ 2.88
<b>30-39</b>	131.5 $\pm$ 4.53	83.9 $\pm$ 2.39	130 $\pm$ 5.66	82.6 $\pm$ 4.63	129.5 $\pm$ 4.01	82.4 $\pm$ 2.38	131.3 $\pm$ 3.22	84.5 $\pm$ 5.09
<b>40-49</b>	128.1 $\pm$ 4.07	81.2 $\pm$ 1.63	132.3 $\pm$ 5.12	83.2 $\pm$ 4.46	131.6 $\pm$ 5.25	83.8 $\pm$ 2.53	131.4 $\pm$ 2.93	84 $\pm$ 4.24
<b>50-59</b>	129.6 $\pm$ 5	82.3 $\pm$ 2.8	Nil	Nil	Nil	Nil	Nil	Nil
<b>Hypertension Stage –I</b>								
<b>30-39</b>	147.5 $\pm$ 5.45	93.8 $\pm$ 2.99	141 $\pm$ 2.89	90.7 $\pm$ 1.15	Nil	Nil	143.5 $\pm$ 4.95	90.5 $\pm$ 2.12
<b>40-49</b>	150.1 $\pm$ 3.91	94.2 $\pm$ 1.72	146.3 $\pm$ 4.67	90.9 $\pm$ 1.15	151.2 $\pm$ 5.07	93.2 $\pm$ 2.6	145.9 $\pm$ 4.50	92.3 $\pm$ 2.05
<b>50-59</b>	149.5 $\pm$ 6.03	93.2 $\pm$ 2.76	147.3 $\pm$ 5.42	91.8 $\pm$ 1.93	150.6 $\pm$ 3.51	92.2 $\pm$ 2.17	149.2 $\pm$ 4.01	94.3 $\pm$ 2.05
<b>Hypertension Stage –II</b>								
<b>30-39</b>	161.5 $\pm$ 2.12	100.5 $\pm$ 0.71	161.5 $\pm$ 2.12	95.5 $\pm$ 0.71	Nil	Nil	160.0 $\pm$ 0.0	97.0 $\pm$ 0.0
<b>40-49</b>	162.3 $\pm$ 2.52	99.7 $\pm$ 0.58	164.3 $\pm$ 5.13	95.7 $\pm$ 0.58	164.1 $\pm$ 4.66	100.1 $\pm$ 0.99	162.5 $\pm$ 5	94.5 $\pm$ 9.71
<b>50-59</b>	164.3 $\pm$ 4.65	99.8 $\pm$ 0.96	164.1 $\pm$ 4.66	98 $\pm$ 2.07	167.3 $\pm$ 3.27	99.5 $\pm$ 1.04	165.5 $\pm$ 5.19	95.8 $\pm$ 7.08

Prehypertension



Hypertension stage - I



Hypertension stage - II

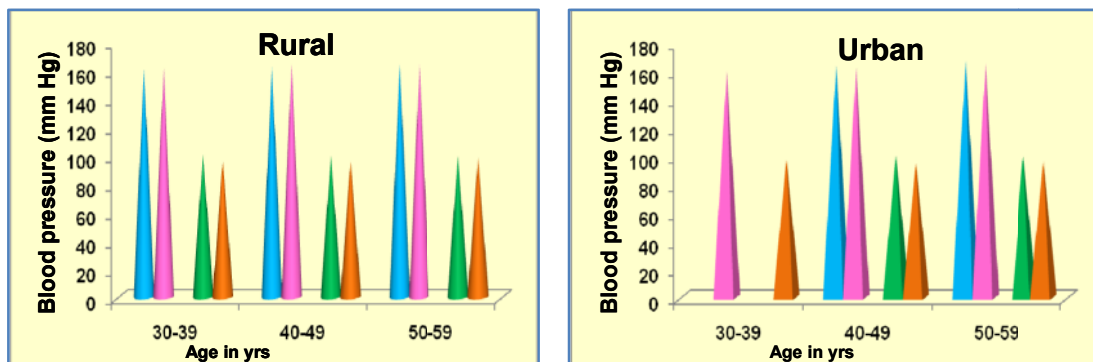


FIGURE - 23 BLOOD PRESSURE LEVELS OF SELECTED HYPERTENSIVES

Among the prehypertensives, 20-29 years urban men recorded the highest SBP/ DBP as 131.2/ 83.4 mm Hg followed by urban women by recording 130.3/82.6 mm Hg. Among 30-39 years rural men recorded SBP as 131.5 and observed to be highest and the urban women had highest DBP as 84.5 and seen to have second highest SBP as 131.3 next to rural men. Among the prehypertensives, the SBP and DBP increased with increase in age in all groups except rural men.

Hence it was obvious that when the prehypertension was not controlled, they might advance into hypertension more rapidly with increase in age. So, hypertension prevention measures should address the prehypertensives primarily to reduce the growing hypertension endemic.

Even at the age of 20-29 yrs, the urban men were found to have SBP>130 mm Hg and DBP >82 mm Hg where as similar range was seen in rural men only after 30 years of age. In women, the urban women recorded SBP>130 mm Hg and DBP>80 mm Hg at the age of 20-29 years where as it was found to be low in rural women. Their SBP was <125 mm Hg and DBP was <82 mm Hg in at the age of 20-29 years. It showed the adverse effect of lifestyle changes in urban areas on their health status.

But it was shocking to note that when age advanced the urban women recorded gradual increase in SBP but the rural women showed vigorous increase and recorded more SBP at the age of 40-49 years than urban women. It needed further related research to assess the associated factors.

In hypertension stage-I, 40-49 years urban men recorded highest SBP as 151.2 mm Hg and the rural men recorded highest DBP as 94.2 mm Hg. Except rural and urban men, other hypertensive stage –I women recorded SBP and DBP in increasing order with increase in age. In rural women SBP/DBP was increased from 141 / 90.7 mm Hg to 147.3 /91.8 mm Hg on par with the increase in age from 30-39 years to 50-59 years. In urban, it was increased from 143.5 /90.5 mm Hg to 149.2 /92.3 mm Hg.

Among hypertension stage-II, urban men at the age of 50-59 years recorded highest SBP as 167.3 mm Hg followed by urban women of 50-59 years (SBP 165.5 mm Hg) and 40-49 years of urban men recorded highest DBP (100.1 mm Hg) followed by 40-49 years rural men (99.7 mm Hg) and 50-59 years urban men (99.5 mm Hg). On the whole urban hypertensive men were recording highest SBP and DBP level when compared to others with respect to age.

It was dreadful to note that hypertension stage - I and stage - II, the urban recorded more SBP than the rural at all age groups. It visualized the risk of urban to get cardio vascular diseases in advance when it was not controlled at the earlier stage. With respect to DBP, variation was observed between rural and urban. Bethesda (2004) stated that since most persons with hypertension, reached the DBP goal once the SBP goal was achieved, the primary focus should be on attaining SBP goal. Hence initiatives should focus to decrease the SBP, the prime factor. The present alarming condition in rural and urban areas call for population based hypertension prevention programme to reduce the loss of population at productive years. Especially it was a burning need in urban areas.

**b. Anthropometric measurements**

**1. Weight**

Table -XLVII and Figure -24 illustrate the weight of the selected hypertensives

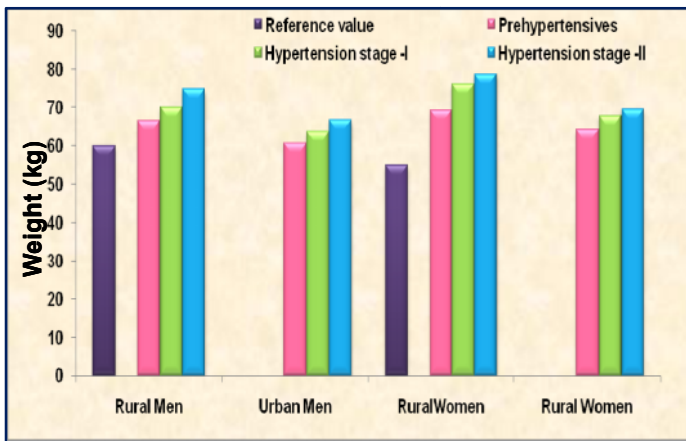
**TABLE – XLVII WEIGHT OF THE SELECTED HYPERTENSIVES**

Blood pressure level (mm Hg)	Rural		Urban	
	Men (n=127)	Women (n=129)	Men (n=128)	Women (n=129)
	Mean (Kg) ± SD			
Pre hyper tension (120-139 or 80-89)	66.5 ± 5.66	60.7±9.13	69.2±7.63	64.1± 6.71
Hypertension Stage- I (140-159 or 90-99)	69.9± 9.29	63.6±15.99	76.2±7.34	67.8±7.70
Hypertension stage -II (>160 or >100)	74.9 ± 4.83	66.7±6.37	78. 8±8.69	69.4 ± 8.60

Reference value (ICMR, 2010): Men-60 kg, Women-55 kg.

According to Table -XLVII, the weight of the selected prehypertensive rural men was found to be 66.5 kg and increased to 69.9 kg in hypertension stage I and 74.9 kg in hypertension stage II. In rural women, it was found to be 60.7 kg in prehypertensives, 63.6 kg in hypertension stage I and 66.7 kg in hypertension stage-II.

The weight of urban men was found to be 69.2 kg, 76.2 kg and 78.8 kg and in urban women, it was recorded as 64.1 kg, 67.8 kg and 69.4 kg in prehypertension, hypertension stage- I and hypertension stage-II respectively. The weight was found to increase with increase in blood pressure.



**FIGURE -24 WEIGHT OF THE SELECTED HYPERTENSIVES**

On the whole, the mean weight of all the selected hypertensives was found to be more than their standards weight given by ICMR. Compared to selected rural hypertensives, urban hypertensive men and women had higher weight at different level of blood

pressure. Gouda *et al.*, (2014) showed that prevalence of overweight and obesity was very high in urban areas, more noticeably among the non-poor households in India furthermore, over weight and obesity increased with age, education and parity of women. The observation in the present study was concordant with the above results.

Harsha and Bray (2008) stated that there was a positive relationship between overweight or obesity and blood pressure and risk for hypertension. More recent data from the Framingham study also demonstrated the increasing blood pressures with increased overweight. The present study also showed increment in weight with increase in blood pressure.

Increased weight was one of the associated risk factor for hypertension. Therefore, it was must to insist weight loss among the hypertensives to reduce the further complications.

**2. Height**

Table - XLVIII gives the height of the selected hypertensives.

**TABLE –XLVIII HEIGHT OF THE SELECTED HYPERTENSIVES**

Blood pressure level (mm Hg)	Rural		Urban	
	Men (n=127)	Women (n=129)	Men (n=128)	Women (n=129)
	Mean(cm) ± SD			
Pre hyper tension (120-139 or 80-89)	167.9±4.20	153.5±6.06	167.4± 5.68	153.1±6.96
Hypertension Stage -I (140-159 or 90-99)	169.2±4.78	152.5±5.31	169.2± 2.68	154.1±4.36
Hypertension stage -II (>160 or >100)	169.3±3.97	155.5±3.82	169.4± 2.19	155.1±4.28

Reference value (ICMR, 2010): Men -175 cm      Women -161.5 cm.

The below table clearly illustrates that height of the both rural and urban selected hypertensives were found to be similar and it was recorded as 167.9 cm in prehypertensives, 169.2 cm in hypertensives stage I and 169.3 cm in hypertensives stage II among rural men and it was noted as 167.4 cm, 169.2 cm, 169.4 cm in urban prehypertensives, hypertensives stage I and stage II men respectively.

The average height of the rural and urban hypertensive women was found to be 153.5 cm and 153.1 cm in prehypertensives, 152.5 cm and 154.1 cm in hypertensives stage I and 155.5 cm and 155.1 cm in hypertensives stage II. Overall, the height of both rural and urban was observed to be lower than their reference value given by ICMR.

**3. Body Mass Index (BMI)**

Table - XLIX depicts the Body Mass Index of the selected hypertensives.

TABLE –XLIX BODY MASS INDEX OF THE SELECTED HYPERTENSIVES

Blood pressure level (mm Hg)	Rural		Urban	
	Men (n=127)	Women (n=129)	Men (n=128)	Women (n=129)
	Mean $\pm$ SD			
Pre hyper tension	23.8 $\pm$ 2.53	25.9 $\pm$ 3.81	24.8 $\pm$ 3.31	27.5 $\pm$ 3.48
Hypertension Stage -I	24.4 $\pm$ 2.94	27.7 $\pm$ 5.53	26.6 $\pm$ 2.18	28.6 $\pm$ 3.20
Hypertension stage -II	26.2 $\pm$ 1.69	27.9 $\pm$ 2.54	27.5 $\pm$ 2.95	28.9 $\pm$ 3.84

Lee *et al.*, (2015) stated that obesity was one of the most significant risk factors for hypertension and similar trend was observed in the present study also. Table - XLIX clearly showed that BMI of both rural and urban hypertensives increased with increase in blood pressure.

Tesfaye *et al.*, (2007) also observed the parallel trend in his study. The prehypertensive men in rural and urban men recorded 23.8 and 24.8 and found to be at risk of obesity where as prehypertensive women in rural and urban women recorded BMI as 25.9 and 27.5 and observed to be in obese stage -I.

The BMI of the rural men in hypertension stage-I was 24.4 and in hypertension stage-II was 26.2. The BMI of urban men in hypertension stage-I and stage-II was seen to be higher than rural men and it was recorded as 26.6 and 27.5. Women hypertensives stage I and hypertensives sage II recorded BMI as 27.7 and 27.9 in rural and 28.6 and 28.9 in urban respectively. At different blood pressure levels BMI of urban women was found to be more when compared to rural women.

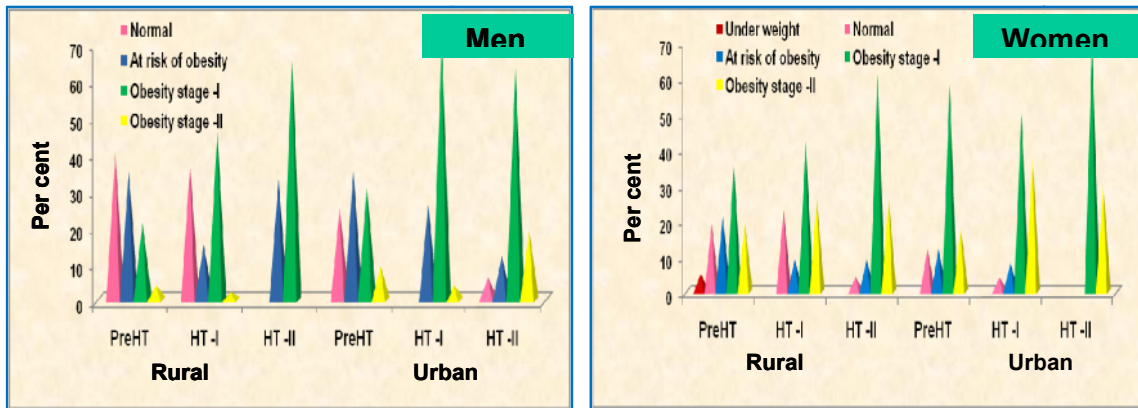
Over all, BMI was found to be higher in urban hypertensives when compared to rural hypertensives and it was higher in women when compared to men. The results were found to be in line with the study by Dua *et al.*, (2014) which observed higher BMI among women than men. It can be inferred that reducing BMI might in turn reduce the blood pressure.

#### 4. Prevalence of overall obesity

Table - L and Figure - 25 give the prevalence of overall obesity among the selected hypertensives

TABLE – L PREVALENCE OF OVERALL OBESITY AMONG THE SELECTED HYPERTENSIVES

Body Mass Index (BMI)	Rural (N=256)							Urban (N=257)							
	Pre hypertension		Hypertension stage-I		Hypertension Stage II		Total (%)	Pre hypertension		Hypertension stage-I		Hypertension Stage II		Total (%)	
	Men %	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)		Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)		
Underweight >18.5	Nil	(5)	Nil	Nil	Nil	Nil	<b>1</b>	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<b>Nil</b>
Normal (18.5 to 22.9)	40	19	37	23	Nil	4	<b>27</b>	25	12	Nil	4	6	Nil	<b>13</b>	
At risk of obesity (23 to 24.9)	35	21	15	9	33	9	<b>21</b>	35	12	26	8	12	Nil	<b>19</b>	
Obesity stage –I (25 to 29.9)	21	36	46	42	67	61	<b>38</b>	31	58	70	50	63	70	<b>51</b>	
Obesity stage –II (>30)	4	19	2	26	Nil	26	<b>13</b>	9	18	4	38	19	30	<b>17</b>	



**FIGURE -25 PREVALENCE OF OVERALL OBESITY AMONG THE SELECTED HYPERTENSIVES**

The prevalence of overall obesity with respect to BMI was found to be more in both rural and urban hypertensives. It was observed to increase with increase in blood pressure level. Among prehypertensives, obesity stage -I was more prevalent among women and at risk of obesity was more common among men. About 36 per cent of rural women and 58 per cent of urban women were at obesity stage I and 35 per cent of men in rural and urban were at risk of obesity.

The prehypertensive men and women with normal weight were noticed to be more in rural men and women when compared to urban men and women. It was recorded as 40 per cent, 19 per cent, 25 per cent and 12 per cent in rural and urban men and women in order. The prevalence of obesity stage -II was found to be more among prehypertensive women in rural and urban areas in comparison with men and it was recorded as 19 per cent and 18 per cent in rural and urban prehypertensive women and four per cent and nine per cent in rural and urban prehypertensive men. Even five per cent rural hypertensives women were observed to be underweight and it was not seen in others.

Greatest per cent of hypertensives stage I were having BMI between 25 to 29.9 (obesity stage -I) and it was found to be 70 per cent in urban men, 46 per cent in rural men, 50 per cent in urban women and 42 per cent in rural women. Hypertensive stage I with normal weight was found to be 37 per cent in rural men

and 23 per cent in rural women, and it was only four per cent in urban women and no urban men with hypertensive stage I was seen in that category.

Similar to prehypertensives, more hypertensive stage I women belonged to obesity stage –I when compared to men in both rural and urban areas. Their prevalence in present study was 42 per cent, 50 per cent in urban and rural women and 46 per cent and 70 per cent in rural and urban men.

It was similar to the results given by Patil *et al.*, (2015) which observed significantly high obesity in women compared to men with respect to BMI. More than one half of the hypertensives stage II from rural and urban areas belonged to obesity stage I and the prevalence of obesity stage II was more among women than men in both rural and urban areas.

It was recorded as 30 per cent and 26 per cent in urban and rural women and 19 per cent in urban men respectively. About four per cent of rural women and 6 per cent of urban men in hypertensive stage II were observed to have normal BMI.

On the whole, greater part of the selected hypertensives were in the stage of obesity stage-I in both rural and urban areas. When compared to rural, it was greater in urban hypertensives. It was found to be 38 per cent in rural and 51 per cent in urban.

Present study results coincided with the result given by Saxena and Prakash (2014) which stated that mean values of body mass index was significantly higher among hypertensive than non hypertensive in both sexes. This was followed by 27 per cent normal BMI in rural and 19 per cent at risk of obesity in urban.

## **5. Waist to Hip Ratio (WHR)**

Table - LI presents the Waist Hip Ratio of the selected hypertensives.

TABLE - LI WAIST HIP RATIO OF THE SELECTED HYPERTENSIVES

Blood Pressure (mm Hg)	Rural		Urban	
	Men (n=127)	Women (n=129)	Men (n=128)	Women (n=129)
	Mean $\pm$ SD			
Pre hyper tension	0.88 $\pm$ 0.03	0.84 $\pm$ 0.05	0.89 $\pm$ .03	0.81 $\pm$ 0.04
Hypertension Stage -I	0.89 $\pm$ 0.04	0.85 $\pm$ 0.04	0.91 $\pm$ 0.03	0.83 $\pm$ 0.05
Hypertension stage -II	0.91 $\pm$ 0.03	0.87 $\pm$ 3.93	0.92 $\pm$ 0.04	0.84 $\pm$ 0.03

Reference value (ICMR, 2010): Men-  $\leq$ 0.90 Women-  $\leq$ 0.80

Many studies observed that waist-to-hip ratio were independently correlated with both systolic and diastolic blood pressures. (Zafar *et al.*, 2007). According to below table the WHR was also increased with increase in blood pressure level in both men and women. The WHR was noted in rural as 0.89 and 0.84 in prehypertensives 0.89 and 0.85 in hypertensives stage-I and 0.91 and 0.87 in hypertensives stage II men and women respectively.

About 0.89, 0.91, 0.92 of WHR was recorded by prehypertensives, hypertensives stage-I and hypertensives stage –II urban men. The WHR was noted as 0.81, 0.83, 0.84 in urban women with respect to different blood pressure levels. The rural women recorded WHR greater than urban women whereas the rural men displayed WHR lesser than urban men.

Prehypertensive rural and urban men and hypertensive stage –I rural men were observed to have WHR within the normal range where as it was not seen in women at any blood pressure level. It was stated that fat deposits at abdomen region was more common in women than men. Many studies stated that it was directly associated with hypertension.

## 6. Waist to Height Ratio (WHtR)

Waist Height Ratio of the selected hypertensives is given in Table –LII.

TABLE – LII WAIST HEIGHT RATIO OF THE SELECTED HYPERTENSIVES

Blood Pressure (mm Hg)	Rural		Urban	
	Men (n=127)	Women (n=129)	Men (n=128)	Women (n=129)
	Mean ± SD			
Pre hyper tension	0.549 ±0.036	0.536 ±0.045	0.541 ±0.046	0.550 ±0.047
Hypertension Stage I	0.556 ±0.041	0.557 ±0.044	0.551 ±0.032	0.555 ±0.040
Hypertension stage II	0.578 ±0.026	0.562 ±0.033	0.584 ±0.035	0.564 ±0.034

Reference value (Xin *et al*, 2012): Men- 0.536 Women- 0.492

Cross-sectional and prospective studies had shown that the WHtR was appeared to be better predictor of diabetes, hypertension and other cardiovascular conditions than BMI, because of the relation between waist circumference and central obesity (Guasch-Ferre *et al.*, 2012).

The Table -LII obviously stated that WHtR was recorded more in both rural and urban hypertensives when compared to their reference values. This was in comparison with the results given by Sayeed *et al.*, (2010) which observed significantly higher mean (SD) values of WHtR for subjects with hypertension in either sex. It also found to increase with increase in blood pressure levels.

The rural men and women recorded WHtR as 0.549 and 0.536 in prehypertensives, 0.556 and 0.557 in hypertensives stage I and 0.578 and 0.562 in hypertensives stage II. The WHtR was noted as 0.541, 0.551, 0.584 in urban men and it was recorded as 0.550, 0.555, 0.564 in urban women at different blood pressure levels.

Among men, rural hypertensive men recorded more WHtR at all levels of blood pressure except hypertension stage –II where as among women, urban displayed more WHtR except hypertension stage I than their counterparts.

## 7. Prevalence of central obesity

Prevalence of central obesity is illustrated in the Table –LIII and Figure -26.

TABLE – LIII PREVALENCE OF CENTRAL OBESITY AMONG SELECTED HYPERTENSIVES

Wais tot Height Ratio (WHtR)	Rural				Urban			
	Pre hypertension	Hypertension stage - I	Hypertension Stage - II	Total	Pre hypertension	Hypertension Stage - I	Hypertension Stage - II	Total
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
<b>Men</b>								
>0.536	52	56	89	<b>56</b>	47	53	94	<b>56</b>
<0.536	48	44	11	<b>44</b>	53	37	6	<b>44</b>
<b>Women</b>								
>0.492	84	100	100	<b>92</b>	88	92	96	<b>91</b>
<0.492	16	Nil	Nil	<b>8</b>	12	8	4	<b>9</b>

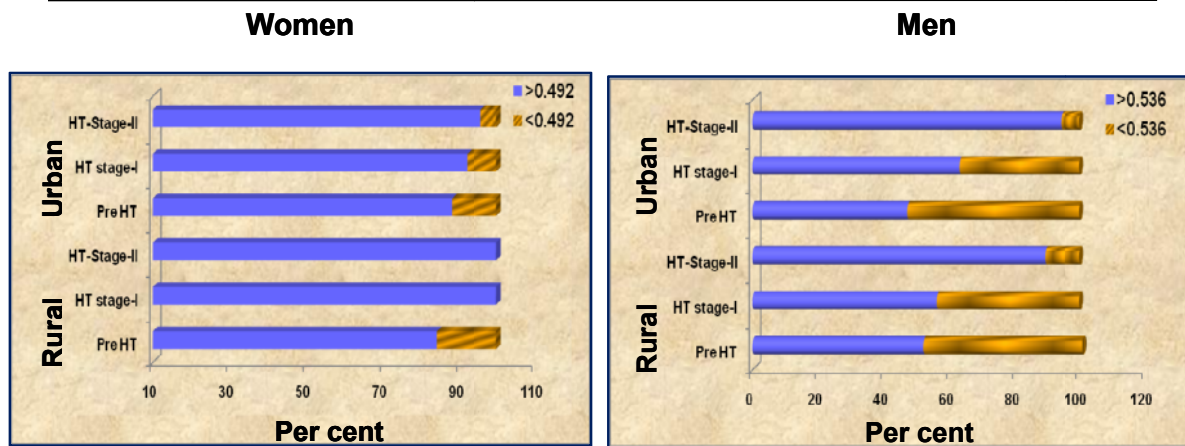


FIGURE –26 PREVALENCE OF CENTRAL OBESITY AMONG THE SELECTED HYPERTENSIVES

Stamatikos and Deyhim, (2012) stated that a better predicting marker for hypertension was the estimate of intra-abdominal adiposity, commonly known as visceral fat. The clinical name of excessive amounts of adipose tissue around the midsection was central obesity. Recently, many researchers had suggested that WHtR as a measure of excess central adiposity. The rationale underlying this index was that, for a given height, there was an acceptable degree of fat stored on the upper body (Zabeen *et al.*, 2015). The use of WHtR had been proposed as it might explain the metabolic consequences of obesity and identify abdominal obesity, particularly in individuals who would not be classified as overweight or obese by BMI (Cintra *et al.*, 2014).

From the Table -LIII and Figure -26, it was clear that central obesity was more prevalent among the greatest part of selected hypertensives and also there was not much difference noticed between rural and urban. It was found to be 84 per cent among prehypertensives and cent per cent among hypertensives stage I and hypertensives stage –II in rural women and it was almost similar in urban women. Among the urban women 88 per cent, 92 per cent and 96 per cent of prehypertensives, hypertensives stage I and hypertensives stage-II respectively were having central obesity.

In men, central obesity was prevalent in more than fifty per cent among prehypertensives and hypertensives stage –I and it was found to be more than

three fourth in hypertensives stage –II. About 52 per cent, 56 per cent and 89 per cent of rural men and 47 per cent, 63 per cent and 94 per cent of urban men with different blood pressures were observed to have central obesity.

In the present study the per cent of central obesity increased with increase in blood pressure level in both rural and urban. It was more prevalent in women when compared to men in both areas. Girotto *et al.*, (2009) also reported abdominal obesity was more prevalent in women hypertensives than men hypertensives in his study. These results reinforced the need for strategies to reduce abdominal obesity among hypertensive patients to avoid further complications.

### **c. Food and Nutrient Intake of the selected hypertensives**

#### **1. Food intake**

As diet was an important risk factor for chronic diseases, understanding the changes in dietary intake might provide clues to the causes of increases in chronic conditions. Therefore, the food intake of the selected hypertensives was assessed by 24 hr recall method and then their nutrient intake was computed. The results are given below.

Food intake of the selected hypertensives is shown in the below Table - LIV.

It revealed that the selected hypertensives consumed more cereals and millets than their Recommended Dietary Allowance (RDA) in all the hypertensives. It might be due to the cereal based traditional diet pattern followed by Indians. In contrast to cereals and millets intake, they consumed inadequate pulses intake and the deficit was recorded as 40 per cent, 28 per cent, 38 per cent and 24 per cent in men and women in rural and urban respectively. The deficit was greater in men than women in pulses intake.

Both rural and urban selected hypertensives consumption was low in milk and milk products, roots and tubers, green leafy vegetables and other vegetables when compared to RDA. The deficit was greater in milk and milk products (65 per cent in men and 63 per cent in women) and green leafy vegetables (62 per cent in

TABLE - LIV FOOD INTAKE OF THE SELECTED HYPERTENSIVES

Food groups	RDA for men* (g)	RDA for women* (g)	Rural				Urban			
			Men (n=127)		Women (n=129)		Men (n=128)		Women (n=129)	
			Actual intake (g)	Excess/Deficit (%)	Actual intake (g)	Excess/Deficit (%)	Actual intake (g)	Excess/Deficit (%)	Actual intake (g)	Excess/Deficit (%)
Cereals and Millets	375	270	410	9	326	21	381	2	321	19
Pulses	75	60	46	-40	43	-28	46	-38	46	-24
Milk and milk products	300	300	104	-65	110	-63	175	41	154	-49
Roots and Tubers	200	200	122	-39	137	-31	153	24	143	-28
Green Leafy Vegetables	100	100	38	-62	35	-65	40	-60	36	-64
Other vegetables	200	200	115	-43	109	-46	142	-29	134	-33
Fruits	100	100	101	1	80	-20	128	28	136	36
Sugar	20	20	20	Nil	24	21	17	-15	28	38
Fat	25	20	45	81	43	113	43	72	46	126

\*ICMR (2010)

men and 65 per cent in women) in rural as well as in urban which recorded 42 per cent and 49 per cent in milk and milk products and 60 per cent and 64 per cent by men and women respectively.

It was surprising to note the surplus intake of fruits when compared to RDA in all the selected hypertensives, except rural women hypertensives and it was dreadful to observe the enormous fat intake in entire group of men and women irrespective of the area. Even though over intake of fat was seen in both men and women, it was found to be more than 100 per cent excess in women whereas it was recorded as 72-80 per cent excess in rural and urban men. The highest excess intake of fat was noted in urban women followed by rural women, rural men and urban men. The sugar intake was also found to be adequate/excess in all the hypertensives except urban men.

Generally the hypertensives had poor food choice and included excess amount of fat which was an important risk factor for hypertension. Their intake was inadequate with regard to hypotensive foods.

## **2. Nutrient Intake of the selected hypertensives**

Nutrient intake of the selected hypertensives is given in Table -LV.

The energy intake of the selected hypertensives men and women was observed to be excess by 6 per cent to 11 per cent than the recommended dietary allowance whereas the protein intake was observed to be deficit by 10 per cent to 17 per cent in both rural and urban areas. It might be due to their excess intake of cereals and deficit intake of pulses and milk and milk products.

Even though the deficit observed in calcium and iron intake in both areas, it was recorded more in rural when compared to urban. The intake of thiamine was found to be excess/adequate in all the groups and deficit was seen in niacin intake of rural men and women where as it was excess in urban men and women. About 47 per cent, 75 per cent, 76 per cent and 77 per cent shortfall was observed in fibre consumption among men and women of rural and urban.

Many studies revealed that excess fat and sodium intake were main risk factors for hypertension and its complications. It was shocking to note that the

TABLE – LV NUTRIENT INTAKE OF THE SELECTED HYPERTENSIVES

Nutrients	RDA for men*	RDA for women*	Rural				Urban			
			Men (n=127)		Women (n=129)		Men (n=128)		Women (n=129)	
			Actual intake	Excess/Deficit (%)	Actual intake	Excess/Deficit (%)	Actual intake	Excess/Deficit (%)	Actual intake	Excess/Deficit (%)
Energy (Kcal)	2320	1900	2447	6	2081	10	2433	5	2113	11
Protein (g)	60	55	50	-17	46	-16	51	-15	49	-10
Fat (g)	25	20	55	118	53	163	56	125	51	154
Fibre (g)	40	40	21	-47	10	-74	9	-75	9	-77
Calcium (mg)	600	600	580	-3	520	-13	573	-4	591	-1
Iron (mg)	17	21	15	11	13	-39	16	-5	21	-2
Beta-Carotene (mcg)	4800	4800	3007	-37	1360	-72	2234	-54	1958	-59
Thiamine (mg)	1.2	1	2	50	1	30	1	Nil	1	20
Riboflavin (mg)	1.4	1.1	1	-14	1	-18	1	-14	1	Nil
Niacin (mg)	16	12	13	-21	15	-26	20	23	17	38
Vitamin C (mg)	40	40	58	44	60	50	70	76	90	126
Sodium (mg)	1500	1500	4146	176	4340	189	4874	225	4323	188
Potassium (mg)	4700	4700	1545	-67	1572	-67	1908	-59	1513	-68

\*ICMR (2010)

225 per cent in rural and urban. The excess sodium intake was mainly through more inclusion of salt in cooking.

A number of studies had proved the positive association between potassium and blood pressure. But the potassium intake was observed to be less by 59 per cent to 68 per cent in rural and urban. The present study result was in accord with the statement given by WHO (2012). It described that data from around the world stated that the population average potassium consumption in many countries was below 70–80 mmol/day. Urban women and rural men consistently had lower levels of potassium intake than their counterparts, but both groups commonly consumed a level that was below the current recommendations.

The nutrient intake of the selected hypertensives were more or less similar in urban and rural and their energy, fat and sodium intake was found to be excess and potassium, calcium, iron and fibre intake was deficit in all, irrespective of the sex and area. It was good to note that vitamin C intake was more than RDA in all the groups, it might be due to inclusion of more fruits.

## **I. Impact of dietary intervention on the selected hypertensives**

Dietary intervention can be stated as any alteration or treatment in an individual's diet with a planned goal, usually designed to improve the individual's overall health. In this present study, dietary intervention was designed systematically and implemented among the selected experimental groups. The outcomes of the dietary intervention are discussed below.

### **a. Anthropometric measurements**

#### **1. Weight**

Table - LVI and Figure - 27 illustrate the impact of dietary intervention on body weight.

According to below table and Figure-27, initial weight of both experimental and control groups was found to be excess when compared to their reference value (men:60 Kg, Women:55 kg.). After intervention, it was good to note the significant weight reduction from 72.23 kg to 67.93 kg in group DIM and from 67.14 kg to 62.50 kg in group DIW.

TABLE - LVI IMPACT OF DIETARY INTERVENTION ON BODY WEIGHT

Experiment groups (N=60)					Control groups (N=60)				
Groups	Initial	Final	Mean Diff.	t-value	Groups	Initial	Final	Mean Diff.	t-value
	Mean (kg) ± SD					Mean (kg) ± SD			
<b>DIM (n=30)</b>	72.23 ±7.41	67.93 ±7.34	-4.30 ±1.03	22.86**	<b>CTM (n=30)</b>	68.42 ±7.13	68.94 ±6.72	0.52 ±1.78	1.63 <sup>NS</sup>
<b>DIW (n=30)</b>	67.14 ±6.50	62.50 ±6.66	-4.64 ±0.95	26.72**	<b>CTW (n=30)</b>	62.53 ±5.29	63.07 ±5.08	0.54 ±1.79	1.63 <sup>NS</sup>

\*\*Significant at (p≤0.01) level

NS - Not Significant

DIM- Dietary Intervention Men

DIW – Dietary Intervention Women

CTM- Control Men

CTW- Control Women

The weight reduction was found to be more in the experimental group DIW than group DIM. It was recorded as 4.64 kg and 4.30 kg in group DIW and group DIM respectively.

In contrast to the experimental group, the control groups who were not received the dietary supplement showed slight increase in the weight during the period and was found to be not significant.

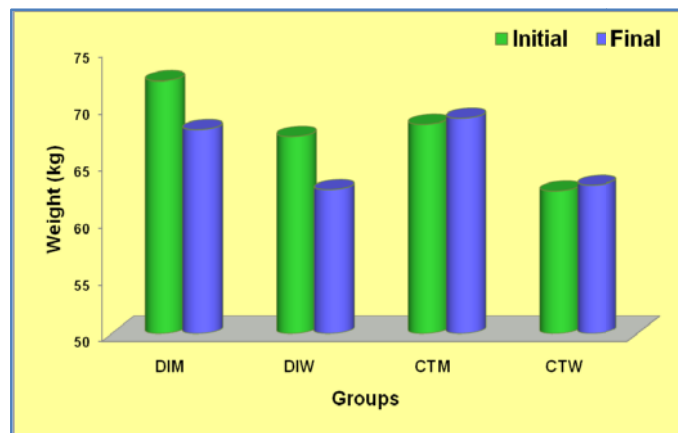


FIGURE - 27 IMPACT OF DIETARY INTERVENTION ON BODY WEIGHT

The weight reduction in the experimental groups might be due to the quantity of pulses incorporated in the supplement. Mccrory *et al.*, (2010) quoted that meal containing high-unavailable carbohydrate regimen contained pulses resulted in lesser hunger. He stated that the diet high in unavailable carbohydrates resulted in a significantly lower rapid rise in postprandial carbohydrate oxidation, and the delayed carbohydrate oxidation associated with the diet high in unavailable carbohydrate resulted in less hunger. Slavin (2012)

stated that both animal and plant proteins consumed at higher levels in the diet had been linked to increased satiety, decreased food intake and increased weight loss.

In line with the above observations, the experimental groups also reported less hunger cues which might have decreased their regular food intake. They also quoted that snacking empty calorie foods were reduced by consuming the nutritional supplement in the midmorning and evening regularly.

The weight reduction was an anticipated factor for blood pressure reduction. Hence, the dietary intervention given to the experimental groups showed beneficial results towards blood pressure reduction.

**2. Body Mass Index (BMI)**

Table - LVII depicts the Impact of dietary intervention on Body Mass Index.

**TABLE – LVII IMPACT OF DIETARY INTERVENTION ON BODY MASS INDEX**

Experiment groups					Control groups				
Groups	Mean ± SD			t-value	Groups	Mean ± SD			t-value
	Initial	Final	Mean Difference			Initial	Final	Mean Difference	
<b>DIM (n=30)</b>	25.52 ±2.96	24.01 ±2.91	-1.51 ±0.39	21.41**	<b>CTM (n=30)</b>	24.64 ±2.91	24.83 ±2.81	0.19 ±0.64	1.61 <sup>NS</sup>
<b>DIW (n=30)</b>	28.86 ±3.53	26.84 ±3.42	-2.02 ±0.48		<b>CTW (n=30)</b>	26.83 ±3.09	27.05 ±2.89	0.22 ±0.76	

**\*\*Significant at (p<0.01) level**

**DIW – Dietary Intervention Women**

**NS – Not Significant**

**CTM- Control Men**

**DIM- Dietary Intervention Men**

**CTW- Control Women**

Before intervention, experimental as well as control groups were found to have BMI greater than their normal range. On completion of dietary intervention, both the experimental group DIM and group DIW showed reduction in BMI. The BMI was decreased by 1.51 from 25.52 to 24.01 in group DIM and reduced by 2.02 from 28.86 to 26.84 in group DIW. The reduction was observed to be more in group DIW among the experimental groups and the reduction in the both the experimental groups was noted to be statistically significant. With respect to control

groups, non significant increment of 0.19 in group CTM and 0.22 in group CTW was noted at the end.

The reduction in BMI of the experimental groups might be due to the beneficial effect of dietary intervention on weight and the consequence changes in the BMI. Many epidemiological studies stated that elevated blood pressure was positively correlated with body mass index (BMI) and weight. Weight loss also had been shown to lower BP levels (Chakraborty *et al.*, 2009). Synchronizing with the above study it was positive to note that the dietary supplement along with nutrition education had helped to reduce the weight and BMI, the highly influencing factor of individual’s blood pressure.

**3. Prevalence of overall obesity**

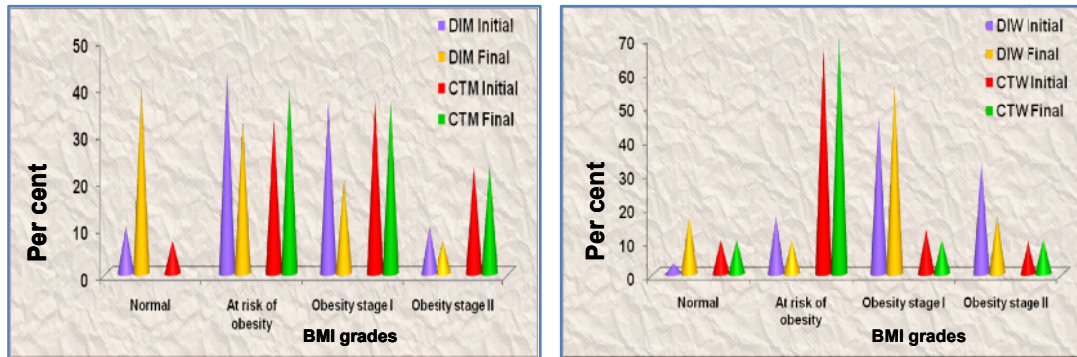
Table –LVIII and Figure -28 show the Impact of dietary intervention on prevalence of overall obesity.

**TABLE - LVIII IMPACT OF DIETARY INTERVENTION ON PREVALENCE OF OVERALL OBESITY**

BMI grades	Experimental groups				Control groups			
	DIM (n=30)		DIW (n=30)		CTM (n=30)		CTW (n=30)	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
	%	%	%	%	%	%	%	%
Normal (18.5 to 22.9)	10	40	3	17	7	Nil	10	10
At risk of obesity (23 to 24.9)	43	33	17	10	33	40	67	70
Obesity stage – I (25 to 29.9)	37	20	47	56	37	37	13	10
Obesity stage – I (>30)	10	7	33	17	23	23	10	10

*DIM- Dietary Intervention Men      DIW – Dietary Intervention Women*  
*CTM- Control Men                      CTW- Control Women*

From the Table -LVIII, it was observed that most of the men in experimental group DIM recorded BMI between 23 to 24.9 and observed to be at risk of obesity followed by obesity stage I (25 to 29.9). About 10 per cent had normal BMI (18.5-22.9) and obesity stage II (>30). In group DIW, about 47 per cent were at obesity stage I succeeded by obesity stage II.



**FIGURE - 28 IMPACT OF DIETARY INTERVENTION ON PREVALENCE OF OVERALL OBESITY**

Normal and at risk of obesity were noted as three per cent and 17 per cent before dietary intervention. With respect to control groups maximum were found at risk of obesity in group CTM (37 per cent) and at obesity stage –I in group CTW (67 per cent).

After dietary intervention the experimental groups recorded favourable changes in obesity status. In group DIM, the percentage of normal was increased to 40 per cent and at risk of obesity, obesity stage –I and obesity stage –II was declined to 33 per cent, 20 per cent and seven per cent respectively. From the Table – LVIII, it can be concluded that the significant reduction in weight and the consequent decrease in BMI might have moved the experimental groups towards subsequent lower stages in obesity.

It was good to note that at the end of dietary intervention in group DIW, the normal status was increased to 17 per cent and at risk of obesity and obesity stage –II was reduced to 10 per cent and 17 per cent respectively at the end. The decrease might be due to the favourable weight reduction through dietary intervention by which the experimental groups would have migrated from advanced stage of obesity towards normal range. The increment noted in the obesity stage – I might be due to the migration of hypertensives from obesity stage – II to stage-I due to weight reduction.

In control groups not much changes were noticed in the prevalence of obesity between before and at the end of dietary intervention, whereas the

experimental groups had recorded noteworthy reduction in the prevalence of obesity at the end of intervention. It added the evident to the beneficial impact of dietary intervention

**4. Waist to Hip Ratio (WHR)**

Table - LIX and Figure -29 provide the impact of dietary intervention on Waist Hip Ratio.

**TABLE - LIX IMPACT OF DIETARY INTERVENTION ON WAIST HIP RATIO**

Experiment groups					Control groups				
Groups	Initial	Final	Mean Difference	t-value	Groups	Initial	Final	t-value	
	Mean ± SD					Mean ± SD			
<b>DIM (n=30)</b>	0.895 ±0.040	0.871 ±0.035	-0.024 0.013	9.67**	<b>CTM (n=30)</b>	0.889 ±0.031	0.891 ±0.031	0.002 ±0.006	1.83 <sup>NS</sup>
<b>DIW (n=30)</b>	0.857 ±0.031	0.827 ±0.025	-0.030 0.023		<b>CTW (n=30)</b>	0.830 ±0.037	0.831 ±0.036	0.001 ±0.008	

\*\*Significant at (p≤0.01)level

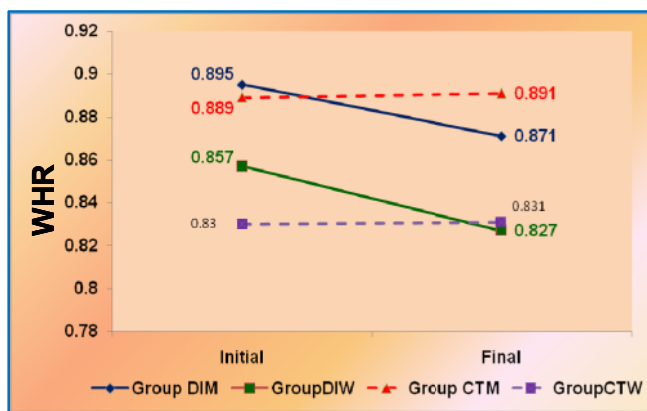
DIW – Dietary Intervention Women

NS – Not Significant

CTM- Control Men

DIM- Dietary Intervention Men

CTW- Control Women



**FIGURE -29 IMPACT OF DIETARY INTERVENTION ON WAIST HIP RATIO**

Before dietary intervention, group DIM and group CTM recorded WHR within reference value whereas group DIW and group CTW showed WHR more than the reference value. WHR had been suggested to be a better indicator of cardiovascular risk, as it was less dependent on

body size and height. Furthermore, the measurements correlated significantly with systolic and diastolic blood pressures (Sanya *et al.*, 2009). Hence it was encouraging to note the significant decrease in the WHR of the experimental

groups at the end of intervention. The groups DIM portrayed reduction from 0.895 to 0.871 and the group DIW showed decrease from 0.857 to 0.827 at the end of dietary intervention.

With respect to control groups, group CTM and Group CTW showed negligible increment in WHR at the end of the dietary intervention. It clearly depicted that the groups those were not consumed the supplement showed no positive changes in WHR but the groups those consumed supplements along with nutrition education displayed beneficial reduction in the WHR. Therefore, the dietary intervention had brought beneficial alterations in WHR and consequently might have facilitated blood pressure reduction in hypertensives.

#### 4. Waist to Height Ratio (WHtR)

Table -LX and Figure -30 give the Impact of dietary intervention on Waist to Height Ratio.

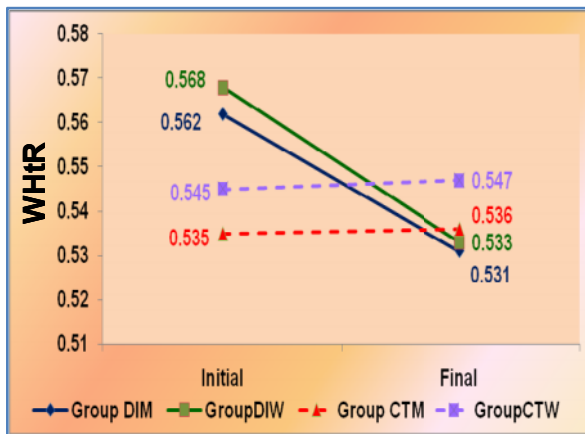
**TABLE - LX IMPACT OF DIETARY INTERVENTION ON WAIST HEIGHT RATIO**

Experiment groups (N=60)					Control groups (N=60)				
Groups	Initial	Final	Mean Difference	t-value	Groups	Initial	Final	Mean Difference	t-value
	Mean $\pm$ SD					Mean $\pm$ SD			
<b>DIM</b> (n=30)	0.562 $\pm 0.052$	0.531 $\pm 0.044$	-0.031 $\pm 0.011$	14.37**	<b>CTM</b> (n=30)	0.535 $\pm 0.037$	0.536 $\pm 0.037$	0.001 $\pm 0.004$	1.81 <sup>NS</sup>
<b>DIW</b> (n=30)	0.568 $\pm 0.040$	0.533 $\pm 0.035$	-0.035 $\pm 0.018$		<b>CTW</b> (n=30)	0.545 $\pm 0.048$	0.547 $\pm 0.046$	0.002 $\pm 0.005$	

\*\*Significant at ( $p \leq 0.01$ ) level      NS-Not Significant      DIM- Dietary Intervention Men  
 DIW – Dietary Intervention Women      CTM- Control Men      CTW- Control Women

The increased risk of high blood pressure with high WHtR was confirmed by Mishra *et al.*, (2015) in his study. Even it was agreed by the present study. Initially WHtR was found to be more when compared to their reference value in group DIM and group DIW. Figure -30 clearly explained that at the end of dietary intervention, the group DIM recorded WHtR as 0.531 and the group DIW showed WHtR as 0.533 with the reduction of 0.031 and 0.035 respectively. Even though the reduction was more in group DIW than group DIM, it was pleased to observe that the group DIM returned to normal WHtR range at the end of intervention. The

changes in WHtR of both the experimental groups were statistically significant at ( $p < 0.01$ ) level.



**FIGURE -30 IMPACT OF DIETARY INTERVENTION ON WHtR**

In contrast to experimental groups, the control groups showed increment in the WHtR at the end and was found to be not significant. When compared to control groups, the experimental groups who consumed the supplement regularly showed a reduction in waist circumference and thereby decreased the WHtR, the highly associated factor for blood pressure.

Venn *et al.*, (2013) stated that incorporation of pulses into the weight loss program resulted in a greater reduction in waist circumference. On par with the above results, WHtR reduction in the experimental group of the present study might be due to the pulses included in the supplement and its consequential reduction in the waist circumference.

**b. Blood pressure**

Impact of dietary intervention on blood pressure level is presented in the Table - LXI and Figure - 31.

According to the below table, the experimental group DIM showed SBP and DBP as 130.63 mm Hg and 83.50 mm Hg and group DIW displayed SBP and DBP as 127.77 mm Hg and 83.23 mm Hg. The control groups recorded SBP and DBP as 134.50 mm Hg and 83.97 mm Hg in group CTM and noted as 131.87 mm Hg and 82.67 mm Hg in group CTW. Initially among all the groups, group CTM recorded the highest SBP and group DIW showed the lowest SBP level.

After intervention, it was glad to note that the experimental groups had shown significant decrease in the SBP and DBP levels. The group DIM showed SBP and DBP as 122.33 mm Hg and 80.80 mm Hg and the group DIW displayed SBP as 120.47 mm Hg and DBP as 79.33 mm Hg.

TABLE – LXI IMPACT OF DIETARY INTERVENTION ON BLOOD PRESSURE LEVEL

Blood pressure (mm Hg)	Experiment groups				t-value	Blood pressure (mm Hg)	Control groups				EX Vs CT (t-value)
	Mean ± SD			t-value			Mean ± SD			t-value	
	Initial	Final	Mean Diff.				Initial	Final	Mean Diff.		
<b>DIM (n=30)</b>					<b>CTM (n=30)</b>						
<b>SBP</b>	130.63 +4.02	122.33 +3.67	-8.30 +1.29	21.75**	<b>SBP</b>	134.50 +3.68	135.03 +3.71	0.53 +1.91	1.62 <sup>NS</sup>	17.00**	
<b>DBP</b>	83.93 +2.89	80.80 +3.03	-3.13 +0.86		<b>DBP</b>	83.97 +2.26	84.27 +2.42	0.30 +1.24			1.33 <sup>NS</sup>
<b>DIW (n=30)</b>					<b>CTW (n=30)</b>						
<b>SBP</b>	127.77 +2.16	120.47 +2.85	-7.30 +1.47	27.28**	<b>SBP</b>	131.87 +5.22	132.57 +5.32	0.70 +2.72	1.41 <sup>NS</sup>	14.19**	
<b>DBP</b>	83.23 +3.87	79.33 +3.84	-3.90 +0.96		<b>DBP</b>	82.67 +3.30	83.07 +3.64	0.40 +1.38			1.59 <sup>NS</sup>

Normal value (JNC-VII,2008):SPB/DBP<120/80 mm Hg \*\*Significant at (p≤0.01) level NS –Not Significant  
EX- Experimental CT- Control



FIGURE - 31 IMPACT OF DIETARY INTERVENTION ON BLOOD PRESSURE LEVEL

The decline in SBP was more (8.30 mm Hg) in group DIM when compared to group DIW (7.30 mm Hg) whereas the decrease in DBP was more in group DIW (3.90 mm Hg) in comparison with group DIM (3.13 mm Hg). Aburto *et al.*, (2013) observed that the group consumed potassium 90-120 mmol/day, reduced the systolic (7.16 mm Hg) and diastolic (4.01 mm Hg) blood pressure. The present study results coincided with the above results.

With respect to control groups, group CTM showed an increase to 135.03 mm Hg by 0.53 mm Hg in SBP and elevated to 84.27 mm Hg by 0.30 mm Hg in DBP and in group CTW SBP raised to 132.57 mm Hg by 0.70 mm Hg in SBP and DBP increased to 83.07 mm Hg by 0.40 mm Hg at the end. Compared to

control groups, the experimental groups illustrated a statistically significant depletion whereas the changes in control groups were not significant.

Edwards *et al.*, (2014) findings stated that potassium had primarily been associated with its blood pressure lowering effects. Meta-analysis in various studies demonstrated that a low potassium intake played a role in elevated blood pressure. Another study by Houston (2013) observed that significant BP lowering with doses of potassium in the range of 1900 to 4700 mg/d resulted in BP lowering of approximately 2 to 6 mm Hg for SBP and 2 to 4 mm Hg for DBP. The present study also showed significant reduction in blood pressure at the end of potassium rich dietary supplementation.

In the present study, the dietary supplement supplied 1196 mg of potassium in addition to their daily intake and it was consumed regularly by the experimental groups. This beneficial reduction in blood pressure of the experimental groups might be due to the cumulative effect of potassium rich supplement along with nutrition education programme and its favourable impact on weight, BMI, waist circumference and other associated risk factors. Morrison (2011) stated that blood pressure control throughout the life course substantially reduces lifetime risk of CVD.

Hence it can be concluded that the implementation of dietary intervention had produced constructive positive changes in factors associated with blood pressure and thereby helped to reduce the blood pressure. The beneficial outcomes in different parameters showed the potential impact of dietary intervention on hypertensives.

Therefore, changing dietary pattern of hypertensives with hypotensive functional foods with effective awareness programme can be considered as a cost effective treatment method to reduce blood pressure and eliminate onset of its further complications.

### **c. Biochemical parameters**

#### **1. Fasting Blood Glucose (FBG) level**

Table - LXII and Figure -32 illustrate the Impact of dietary intervention on Fasting Blood Glucose level

TABLE – LXII IMPACT OF DIETARY INTERVENTION ON FBG LEVEL

Experiment groups					Control groups					EX Vs CT (t-value)
Groups	Initial	Final	Mean Diff.	t-value	Groups	Initial	Final	Mean Diff.	t-value	
	Mean (mg/dl) ± SD					Mean (mg/dl) ± SD				
<b>DIM</b> (n=30)	95.83 ±7.86	91.47 ±7.52	-4.37 ±1.06	22.49**	<b>CTM</b> (n=30)	86.61 ±9.54	87.5 ±8.97	0.89 ±2.88	1.69 <sup>NS</sup>	<b>9.37**</b>
<b>DIW</b> (n=30)	92.88 ±8.16	87.49 ±7.04	-5.39 ±3.72		7.93**	<b>CTW</b> (n=30)	90.72 ±9.34	91.81 ±9.28	1.09 ±3.16	

\*\*Significant at (p≤0.01) level NS – Not Significant EX- Experimental CT- Control

Hypertension and diabetes were both end results of the metabolic syndrome. There was substantial overlap between diabetes and hypertension in etiology and disease mechanisms. They may, therefore, developed one after the other in the same individual. Therefore, optimization of lifestyle remained the cornerstone in the prevention and treatment of diabetes and hypertension (Cheung and Li 2012).

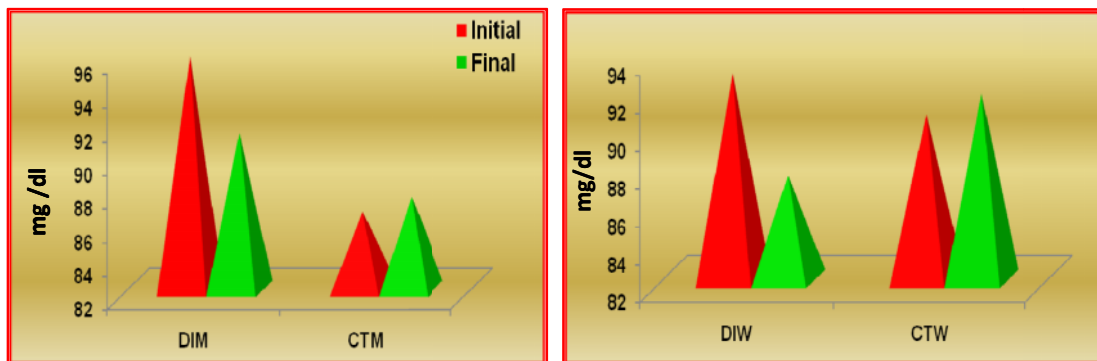


FIGURE - 32 IMPACT OF DIETARY INTERVENTION ON FBG LEVEL

Hence FBG level was analysed in both experimental and control groups. The FBG level in group DIM was observed to be 95.83 mg/dl and in group DIW was noted as 92.88 mg/dl at the beginning of the dietary intervention. Pooja and Mittal (2014) stated that hypertensive patients had fasting blood glucose level higher than normal healthy controls. The mean fasting blood glucose level observed among hypertensive patients in their study (98.57 mg/dl) was similar with the present study.

At the end of the intervention, group DIW showed more reduction of 5.39 mg/dl in FBG level by recording 87.49 mg/dl than the group DIM. The group DIM showed reduction of 4.37 mg/dl by recording 91.47 mg/dl on completion of intervention. The reduction in the experimental group was found to be statistically significant at  $p(<0.01)$  level.

The control groups, group CTM and group CTW recorded 86.61 mg/dl and 90.72 mg/dl as fasting glucose level initially and increased to 87.5 mg/dl and 91.81 mg/dl respectively at the end of dietary intervention. The elevation was noted to be statistically not significant.

The difference observed in the experimental and control groups portrayed the beneficial effect of supplement given to the experimental groups. Legumes contained good amount of fibre and low glycemic value. Studies observed that those who suffering from diabetes were more than 40 percent lower among men who consumed legumes daily, 61 percent lower among those who consumed legumes at least weekly, 58 percent lower among those who consumed them occasionally, as compared to those who never consumed legumes (Agarwal and Ebrahim, 2013).

According to Chatterjee *et al.*, (2011) decline in potassium level were associated with decline in insulin release in response to hyperglycemia. The potassium depletion was associated with a decrease in pancreatic  $\beta$ -cell sensitivity to hyperglycemia with a reduction in insulin release.

In line with the above statements, the decrease in the FBG level at the end of the dietary intervention among the experimental groups in the present study might be due to the cumulative effect of increased intake of potassium in the form of supplement and low glycemic effect of incorporated pulses in the supplement consumed by the experimental groups. Hence, the dietary supplement was seen to delay the onset of diabetes and further complications in hypertensives.

## **2. Post Prandial Blood Glucose (PPBG) level**

Table –LXIII and Figure -33 illustrate the impact of dietary intervention on Postprandial Blood Glucose level.

TABLE – LXIII IMPACT OF DIETARY INTERVENTION ON PPBG LEVEL

Experiment groups				Control groups				EX vs CT (t-value)		
Groups	Mean (mg/dl) ± SD			t-value	Groups	Mean (mg/dl) ± SD			t-value	
	Initial	Final	Mean Diff.			Initial	Final			Mean Diff.
<b>DIM (n=30)</b>	132.70 +6.29	123.33 +7.41	-9.37 +2.86	17.95**	<b>CTM (n=30)</b>	136.0 +9.88	135.63 +10.79	0.37 +3.86	0.52 <sup>NS</sup>	10.26**
<b>DIW (n=30)</b>	129.55 +9.29	120.58 +9.20	-8.97 +2.04	24.51**	<b>CTW (n=30)</b>	129.90 +11.76	130.63 +11.86	-0.73 +2.53	1.51 <sup>NS</sup>	16.39**

\*\*Significant at (p≤0.01) level    NS – Not Significant    EX- Experimental    CT- Control

According to the table, both experiment and control groups recorded PPBG level below the base line at the beginning of the intervention. The dietary

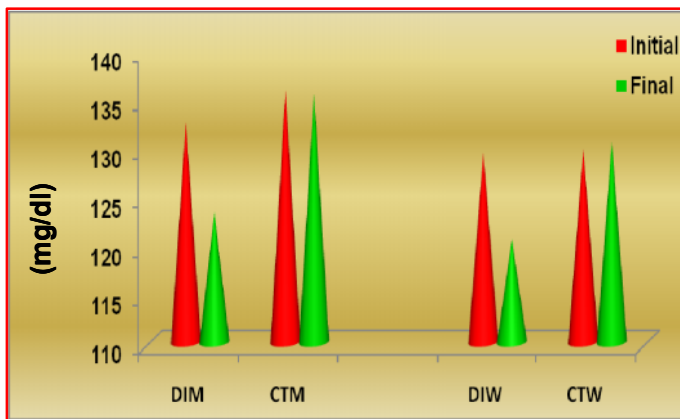


FIGURE -33 IMPACT OF DIETARY INTERVENTION ON PPBG LEVEL

intervention had brought significant reduction in the PPBG level in both the experimental groups further. Group DIM recorded 132.7 mg/dl and 123.33 mg/dl before and after intervention respectively and the group DIW showed 129.55 mg/dl and 120.58 mg/dl at the beginning and at the end of intervention

respectively. The reduction was observed to be 9.37 mg/dl in group DIM and 8.97 mg/dl in group DIW.

The control group CTW showed slight decrease and group CTM recorded negligible increase in PPBG level at the end. Even though decrease in postprandial glucose level was noticed in one of the control groups, it was found to be very less compared to experimental groups and not found to be significant. Oboh *et al.*, (2010) stated that the components present in legumes, particularly the soluble dietary fiber and the nature of the starch can influence postprandial rise of blood glucose levels. Thus, it can be stated that the beneficial results seen in

experimental groups might be due to the influence of pulses rich dietary supplement consumed regularly by them.

### 3. Glycosylated Haemoglobin (HbA1c)

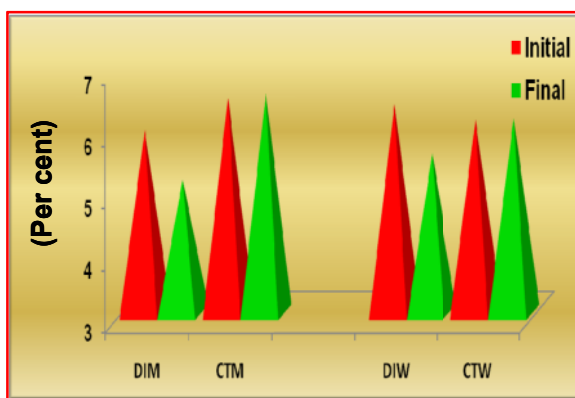
Table –LXIV and Figure -34 provide the impact of dietary intervention on glycosylated haemoglobin (HbA1c).

**TABLE – LXIV IMPACT OF DIETARY INTERVENTION ON GLYCOSYLATED HAEMOGLOBIN**

Experiment groups					Control groups					EX vs CT (t-value)
Groups	Mean (%) ± SD			t-value	Groups	Mean (%) ± SD			t-value	
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.		
<b>DIM</b> (n=30)	5.94 ±0.46	5.14 ±0.46	0.80 ±0.31	14.26**	<b>CTM</b> (n=30)	6.46 ±0.64	6.53 ±0.61	0.07 ±0.27	1.35 <sup>NS</sup>	11.59**
<b>DIW</b> (n=30)	6.36 ±0.61	5.56 ±0.61	0.80 ±0.23	19.30**	<b>CTW</b> (n=30)	6.11 ±0.43	6.13 ±0.45	0.02 ±0.09	1.61 <sup>NS</sup>	18.54**

\*\*Significant at (p<0.01) level    NS – Not Significant    EX- Experimental    CT- Control

According to Bower *et al.*, (2012), individuals with elevated HbA1c even without a prior diabetes diagnosis, were at increased risk of hypertension. Analyses of present study data described that the levels of HbA1c among the experimental groups and control groups were found to be below the base line value initially and it was found to decrease from 5.94 per cent to 5.14 per cent by 0.80 per cent in group DIM and in group DIW, depletion was noted from 6.36 per cent to 5.56 per cent by 0.80 per cent.



**FIGURE -34 IMPACT OF DIETARY INTERVENTION ON HbA1c LEVEL**

There was not much difference noticed in the reduction of HbA1c between the experimental groups. On contrast, the control groups who did not receive any food supplement were not shown any significant reduction in HbA1c, moreover slight increment of 0.07 per cent in group CTM and 0.02 per cent in group CTW was observed at the end of intervention period.

Compared to control groups, the experimental groups who consumed the supplement daily showed the beneficial effect with respect to HbA1c. Recent meta-analysis of randomized controlled longer term experimental trials found that eating pulses significantly lowered FBG and insulin levels. In studies where treatments were bean-containing high-fibre or low-glycemic diets, HbA1c was significantly lowered. ([www.beaninstitute.com](http://www.beaninstitute.com) ). Therefore, the declined value might be due to low glycemic value of pulses consumed in the form of supplement for a period of 180 days.

#### **4. Lipid profile**

Table - LXV and Figure -35 illustrates the impact of dietary intervention on serum lipid profile

Jani *et al.*, (2014) stated that prehypertension was associated with significantly higher total cholesterol, LDL, VLDL and triglyceride levels as compare to normal. HDL cholesterol value was significantly lower in prehypertensives than normal. The present results were accord with the above observation and observed elevated levels of lipid profile among the experimental and control groups initially.

From the Table - LXV, it was observed that total cholesterol level of the experimental group DIM and group DIW was recorded as 172.14 mg/dl and 158.60 mg/dl and the control group CTM and group CTW displayed as 162.73 mg/dl and 156.80 mg/dl respectively. At the end of dietary intervention total cholesterol level in the experimental groups were found to decrease by 14.10 mg/dl in group DIM and 12.80 mg/dl in group DIW whereas the control groups showed negligible changes in group CTM and group CTW. The depletion in the experimental groups was found to be statistically significant where as it was not significant in control groups.

TABLE – LXV IMPACT OF DIETARY INTERVENTION ON SERUM LIPID PROFILE

Blood lipid profile (mg/dl)*	Experiment groups						Control groups						EX Vs CT (t-value)	
	Group DIM (n=30)			Group DIW (n=30)			Group CTM (n=30)			Group CTW (n=30)			DIM vs CTM	DIW vs CTW
	Mean (mg/dl) ± SD						Mean (mg/dl) ± SD							
	Initial	Final	t-value	Initial	Final	t-value	Initial	Final	t-value	Initial	Final	t-value		
<b>Total Cholesterol</b> DL: <200	172.14 ±9.20	158.04 ±10.70	17.16**	158.60 ±9.50	145.80 ±9.21	20.82**	162.72 ±16.67	163.55 ±17.02	1.39 <sup>NS</sup>	156.80 ±12.87	156.65 ±13.57	0.42 <sup>NS</sup>	1.39 <sup>NS</sup>	5.04**
<b>LDL</b> DL:<130	94.31 ±11.85	81.74 ±13.66	15.34**	76.52 ±11.92	64.77 ±12.15	18.56**	87.83 ±17.86	88.97 ±18.45	1.50 <sup>NS</sup>	77.62 ±9.68	77.35 ±9.32	0.39 <sup>NS</sup>	1.67 <sup>NS</sup>	5.81**
<b>HDL</b> DL: >50	45.87 5.52	46.69 ±5.40	12.39**	52.36 ±6.82	53.46 ±6.59	6.77**	44.39 ±5.84	43.92 ±6.06	1.48 <sup>NS</sup>	47.91 ±5.63	47.84 ±5.69	0.24 <sup>NS</sup>	1.87 <sup>NS</sup>	6.14**
<b>Triglyceride</b> DL:<150	159.81 ±11.14	148.05 ±11.59	15.58**	148.59 ±12.46	137.87 ±10.75	15.59**	152.50 ±14.19	153.30 ±15.34	1.20 <sup>NS</sup>	156.33 ±12.87	157.32 ±13.57	1.89 <sup>NS</sup>	1.49 <sup>NS</sup>	6.16**
<b>VLDL</b> DL:<30	31.96 ±2.23	29.61 ±2.32	15.58**	29.72 ±2.49	27.57 ±2.11	15.59**	30.50 ±2.84	30.66 ±3.07	1.20 <sup>NS</sup>	31.27 ±2.57	31.46 ±2.71	1.89 <sup>NS</sup>	1.49 <sup>NS</sup>	6.16**

\*NCEP, 2012

EX- Experimental

CT- Control

\*\*Significant (p&lt;0.01) level

NS- not significant

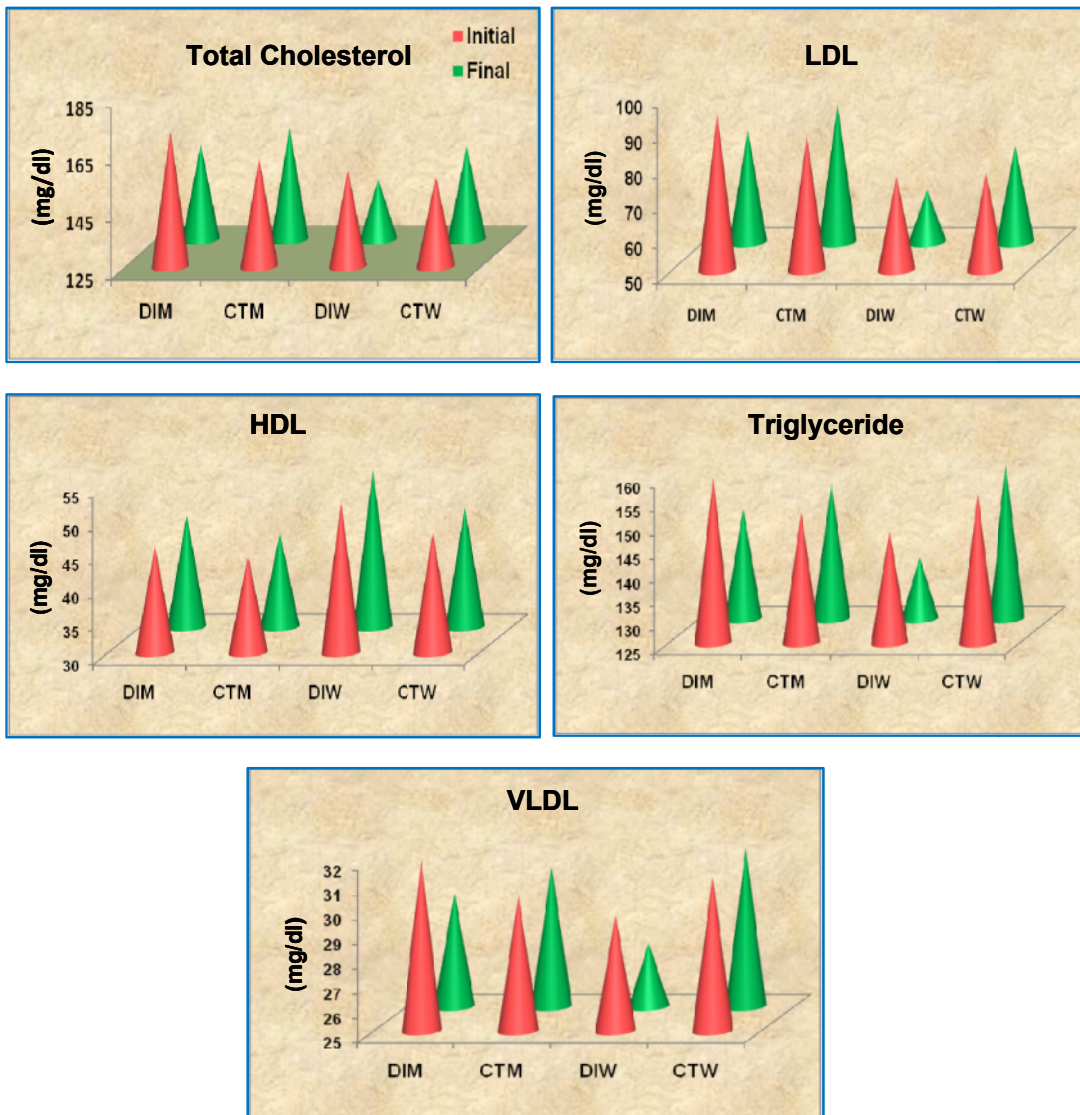


FIGURE -35 IMPACT OF DIETARY INTERVENTION ON SERUM LIPID PROFILE

With respect to triglycerides, group DIM showed a significant decrease from 159.81 mg/dl to 148.05 mg/dl by 11.76 mg/dl and group DIW recorded a significant reduction from 148.59 mg/dl to 137.87 mg/dl by 10.72 mg/dl at the end of dietary intervention. The reduction was more in group DIM in comparison with the group DIW. The control groups showed an increase which was not found to be significant.

Initially the HDL cholesterol was observed to be below the base line value in group DIM (45.87 mg/dl) and observed in desirable level in group DIW (52.36 mg/dl). After the intervention, the HDL level was increased to 46.69 mg/dl in group DIM and was elevated to 53.46 mg/dl in group DIW. The increase was greater in group DIW (1.1 mg/dl) than in group DIM (0.82 mg/dl).

The VLDL and LDL levels in experimental groups also showed a significant reduction at the end of dietary intervention. The decrease in VLDL was 2.35 mg/dl and 2.15 mg/dl in group DIM and group DIM and depletion in LDL level was 12.57 mg/dl and 11.75 mg/dl in group DIM and group DIW respectively. The control groups showed increment in total cholesterol, triglyceride, VLDL and LDL levels and slight decrease in HDL level at the end. The experimental groups showed statistically significant change where as it was not significant in control groups.

Zhang *et al.*, (2010) observed that incorporating legumes in the moderate-fat diet improved lipid profiles, thus potentially lowered CVD risk. Similar to the above findings the beneficial effect of experimental groups in the present study might be due to the incorporated pulses in the supplement and diet changes in the experimental groups brought through nutrition education programme.

### 5. Serum sodium

Table - LXVI and Figure - 36 predict the impact of dietary intervention on serum sodium.

**TABLE – LXVI IMPACT OF DIETARY INTERVENTION ON SERUM SODIUM**

Experiment groups (N=60)					Control groups (N=60)					EX vs CT (t-value)
Groups	Initial	Final	Mean Diff.	t-value	Groups	Initial	Final	Mean Diff.	t-value	
	Mean (mEq/L) ± SD					Mean (mEq/L) ± SD				
<b>DIM (n=30)</b>	144.0 ±2.46	136.91 ±1.66	-7.09 ±2.77	14.00**	<b>CTM (n=30)</b>	139.66 ±3.58	140.28 ±3.32	0.62 ±1.76	0.89 <sup>NS</sup>	12.62**
<b>DIW (n=30)</b>	141.62 ±4.12	135.34 ±3.55	-6.28 ±1.56	22.09**	<b>CTW (n=30)</b>	141.57 ±3.79	142.07 ±3.37	0.50 ±2.49	1.10 <sup>NS</sup>	12.86**

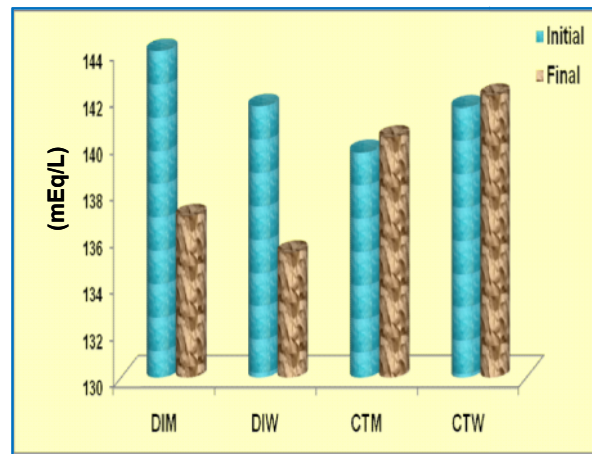
Desirable level (Walker *et al.*, 1990): 135 mEq/L – 145 mEq/L

\*\*Significant at (p<0.01) level

NS – Not Significant

Larger epidemiological studies had confirmed that blood pressure among societies correlates with sodium consumption. Studies stated that populations with a high sodium intake, the relation between blood pressure and age was steeper than in populations with a low sodium intake: (Priyanka *et al.*, 2014).

According to Table -LXVI and Figure -36, all the selected groups recorded high normal serum sodium levels at the initial stage of dietary intervention. The group DIM recorded serum sodium level as 144.0 mEq/L and found to be the highest value among the selected groups. This was succeeded by group DIW (141.62 mEq/L), control group CTM (141.57 mEq/L) and group CTW (139.66 mEq/L).



**FIGURE -36 IMPACT OF DIETARY INTERVENTION ON SERUM SODIUM**

On completion of dietary intervention, the experimental groups were observed to have significant reduction in serum sodium level whereas slight increment was noted in the control groups. The experimental group DIM showed a reduction of 7.09 mEq /L and group DIW displayed a decrease of 6.28 mEq /L. In contradictory to experimental groups, the control group CTM and group CTW showed an increment of 0.62 mEq /L and 0.50 mEq /L in serum sodium level.

It was pleasing to note that at the end, the experimental groups showed significant reduction whereas it was not seen in control groups. In the present study, intensive nutrition awareness programme was implemented together with dietary supplement to experimental groups alone. It was good to note that it had brought a favourable transformation in the diet pattern and salt intake level of experimental groups and subsequent reduction in serum sodium level. Studies have reported that the daily NaCl reduction should be at least 3.1 g to achieve a reduction of 4 to 5 mm Hg in SBP and 2 to 3 mm Hg in DBP in hypertensive

subjects (Sarkkinen *et al.*, 2011). Hence the reduction noted in serum sodium level might decrease the blood pressure level in the experimental groups.

The favorable outcome brought in the reduced sodium intake pattern during the intervention period was expected to follow even after the intervention. This might help to prevent the transformation of prehypertensives to hypertensives and the consequent severity.

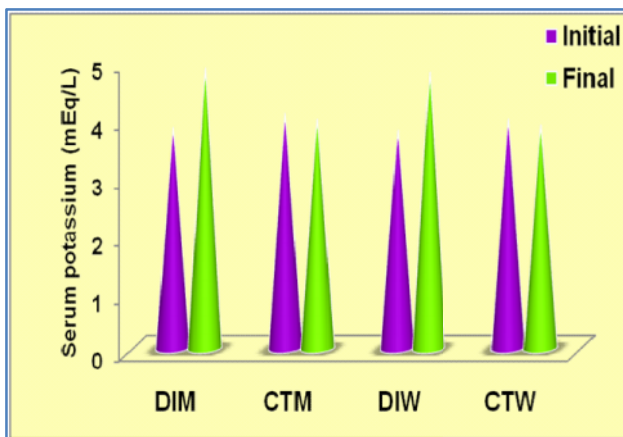
**6. Serum Potassium**

Table - LXVII and Figure - 37 illustrate the Impact of dietary intervention on serum potassium.

**TABLE – LXVII IMPACT OF DIETARY INTERVENTION ON SERUM POTASSIUM**

Experiment groups					Control groups					EX Vs CT (t-value)
Groups	Initial	Final	Mean Difference	t-value	Groups	Initial	Final	Mean Difference	t-value	
	Mean (mEq/L) ± SD					Mean (mEq/L) ± SD				
<b>DIM (n=30)</b>	3.83 ±0.13	4.85 ±0.17	1.02 ±0.19	27.91**	<b>CTM (n=30)</b>	4.06 ±0.79	3.97 ±0.30	-0.09 ±0.34	1.49 <sup>NS</sup>	14.98**
<b>DIW (n=30)</b>	3.78 ±0.16	4.78 0.21	1.0 ±0.21		<b>CTW (n=30)</b>	3.97 ±0.34	3.87 ±0.25	-0.10 ±2.90		

Desirable level (Walker *et al.*, 1990): 3.5 mEq/L – 5.5 mEq/L  
 \*\*Significant at (p≤0.01) level      NS – Not Significant



**FIGURE - 37 IMPACT OF DIETARY INTERVENTION ON SERUM POTASSIUM**

Blood pressure was influenced by the dietary potassium intake, both in normal subjects and hypertensive subjects. The effect varied with the direction (low potassium intake raised the blood pressure and high potassium intake lowered the blood pressure) and magnitude of change in potassium intake (Kalpana and Mount, 2015).

Table - LXVII and Figure – 37 described that the serum potassium level of both the experimental and control groups were recorded in the range of reference value but the values were observed to be nearer to the low normal end. The experimental group DIM and group DIW recorded serum potassium level as 3.83 mEq/L and 3.78 mEq /L at the beginning. The control groups levels were noted as 4.06 mEq /L in group CTM and 3.97 mEq /L in group CTW. The lower level of serum potassium among the hypertensives might be due to their inadequate intake of potassium rich foods which was observed in their food and nutrient intake pattern.

Priyanka *et al.*, (2014) also showed that serum sodium was higher and serum potassium was lower in hypertensive group and it was recorded as 146.9 and 3.77 respectively in hypertensive group. Serum sodium was significantly more among hypertensive group and correlated positively with blood pressure unlike serum potassium which was lower and correlated negatively with blood pressure. The present study result was concordant with the above study.

After the dietary intervention, the serum potassium level was found to increase to 4.85 mEq/L by 1.02 mEq/L in group DIM where as it was elevated to 4.78 mEq /L by 1.0 mEq/L in group DIW. Both the experimental groups had shown a significant similar increment in serum potassium level at the end.

On contradictory to the results in experimental groups, the control groups showed a decrease in serum potassium level at the end of dietary intervention. Group CTW and group CTM recorded 3.97 mEq /L and 3.87 mEq /L respectively. The changes were not found to be statistically significant in control groups where as it was noted to be statistically significant in experimental groups.

The positive results in the experimental groups might be due to the inclusion of potassium rich supplement regularly in the diet. In the present study, in addition to their regular intake, dietary supplement supplied 25 per cent of their daily requirement and the experimental groups consumed the supplement regularly. A consistent body of evidence from observational studies, clinical trials

and meta analyses indicated that high dietary intake of potassium was associated with lower blood pressure (Houston, 2011). Hence the elevation of serum potassium in the experimental group might be due to the dietary supplement and it might in turn favour the blood pressure reduction.

**J. Impact of lifestyle Intervention on the selected hypertensives**

Many studies revealed that physical inactivity, stress and dietary pattern were main risk factors for hypertension. Hence the lifestyle intervention was planned systematically by including yoga asanas, meditation, breathing exercises, laughing therapy and nutrition education intended to increase the physical exercise, reduce the stress and improve the dietary pattern of hypertensives. Experimental groups received all the above strategies and practiced the same for 120 days regularly. The impact of the lifestyle intervention was analysed and discussed under the following headings.

**a. Anthropometric measurements**

**1. Weight**

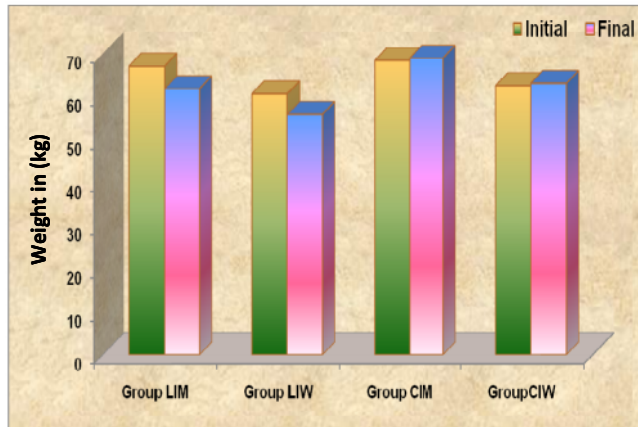
Impact of lifestyle intervention on body weight is given in the Table - LXVIII and Figure - 38.

**TABLE – LXVIII IMPACT OF LIFESTYLE INTERVENTION ON BODY WEIGHT**

Experiment groups				Control groups					
Groups	Mean (kg) ± SD			t-value	Groups	Mean (kg) ± SD			t-value
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.	
<b>LIM (n=30)</b>	67.10 +4.92	61.83 +4.90	-5.27 +1.00	28.45**	<b>CTM (n=30)</b>	68.42 +7.13	68.94 +6.72	0.52 +1.78	1.63 <sup>NS</sup>
<b>LW (n=30)</b>	60.67 +9.72	55.87 +9.54	-4.80 +0.80	32.66**	<b>CTW (n=30)</b>	62.53 +5.29	63.07 +5.08	0.54 +1.79	1.63 <sup>NS</sup>

\*\*Significant at (p<0.01) level      NS – Not Significant      LIM – Lifestyle Intervention Men  
 LIW- Lifestyle Intervention Women      CTM-Control Men      CTW- Control Women

Yoga was a physical practice that was accessible to almost anyone, even over weight individuals. In a sedentary person, yoga was the gateway to other, more vigorous physical activities. Yoga cultivated commitment and discipline, which were helpful when making long term lifestyle changes.



**FIGURE -38 IMPACT OF LIFESTYLE INTERVENTION**

The weight of the both experimental and control groups recorded more than their reference value before the lifestyle intervention. The weight showed by group LIM was 67.10 kg and the group LW was 60.67 kg. The control group recorded weight as 68.42 kg and 62.53 kg by group CTM and group CTW respectively.

After the intervention period, it was good to note that the experimental groups who were under lifestyle intervention showed a significant decrease in weight whereas it was not seen in control groups who were not followed any lifestyle modification strategies. The weight reduction in the experimental groups was found to be 5.27 kg in group LIM and 4.80 kg in group LIW. In converse with the experimental groups, the control groups recorded an increment of 0.52 kg and 0.54 kg in group CTM and group CTW.

Several intervention studies showed that yoga practice was effective in reducing body weight. A study by Schmidt and colleagues stated that healthy adults lost an average of 5.7 kg after three months of yoga practice (Yang, 2007). On par with the above study, the present study also showed significant weight reduction in the groups who practiced yoga for a period of 120 days.

Hence the reduction might be due to the lifestyle intervention given to experimental groups. The yoga exercises might have increased their physical activity and helped to burn their calories. The meditation and laughing therapy added in the lifestyle intervention might have reduced their stress induced eating pattern. Studies showed that weight reduction was expected factor for blood pressure reduction. Hence, it can be stated that the lifestyle intervention had brought beneficial impact towards blood pressure reduction.

## 2. Body Mass Index (BMI)

Impact of lifestyle intervention on Body Mass Index is presented in Table – LXIX.

**TABLE – LXIX IMPACT OF LIFESTYLE INTERVENTION ON BODY MASS INDEX**

Experiment groups (N=60)					Control groups (N=60)				
Groups	Mean $\pm$ SD			t-value	Groups	Mean $\pm$ SD			t-value
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.	
<b>LIM</b> (n=30)	23.74 $\pm$ 1.74	21.89 $\pm$ 1.71	-1.85 $\pm$ 0.04	27.41**	<b>CTM</b> (n=30)	24.64 $\pm$ 2.91	24.83 $\pm$ 2.81	0.19 $\pm$ 0.64	1.61 <sup>NS</sup>
<b>LIW</b> (n=30)	25.91 $\pm$ 3.93	23.82 $\pm$ 3.92	-2.09 $\pm$ 0.39		<b>CTW</b> (n=30)	26.83 $\pm$ 3.09	27.05 $\pm$ 2.89	0.22 $\pm$ 0.76	

\*\*Significant at ( $p \leq 0.01$ ) level

NS – Not Significant LIM – Lifestyle Intervention Men

LIW- Lifestyle Intervention Women

CTM-Control Men

CTW- Control Women

The Table – LXIX expressed that BMI of all the groups was found to be more than normal value and observed to be at obesity stage –I before the intervention. It was recorded by the experimental group LIM and group LIW recorded BMI as 23.74 and 25.91 respectively and the control group CTM and group CTW as 24.64 and 26.83.

At the end of intervention, noteworthy significant reduction of 1.85 in group LIM and 2.09 in group LIW was noticed whereas in control groups increment of 0.19 in group CTM and elevation of 0.22 in group CTW was recorded. Even though the reduction in BMI was more in group LIW when compared to group LIM, it was good to note that BMI of group LIM was returned to normal range at the end. The changes in control groups were not statically significant.

## 2. Prevalence of Overall Obesity

Impact of lifestyle intervention on prevalence of overall obesity is elucidated in Table –LXX and Figure -39.

TABLE – LXX IMPACT OF LIFESTYLE INTERVENTION ON PREVALENCE OF OVERALL OBESITY

Body Mass Index	Experimental groups				Control groups			
	Group LIM (n=30)		Group LIW (n=30)		Group CTM (n=30)		Group CTW (n=30)	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
	%	%	%	%	%	%	%	%
Normal (18.5 to 22.9)	23	56	Nil	Nil	7	Nil	10	10
At risk of obesity (23 to 24.9)	27	7	23	80	33	40	67	70
Obesity stage –I (25 to 29.9)	27	30	64	17	37	37	13	10
Obesity stage –II (>30)	23	7	13	3	23	23	10	10

According to Table LXX, in all groups except group CTW, obesity stage -I was more prevalent. In group LIM similar prevalence of 27 per cent was noted in obesity stage -I and at risk of obesity. In group LIM 64 per cent were in obesity stage -I, 23 per cent were in at risk of obesity and 13 per cent were in obesity stage - II at the initial stage of intervention.

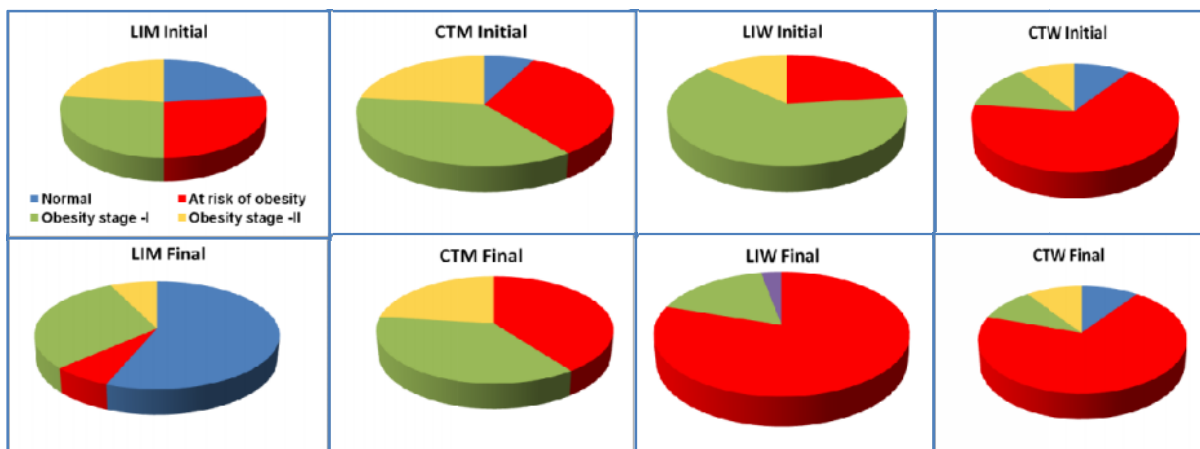


FIGURE - 39 IMPACT OF LIFESTYLE INTERVENTION ON PREVALENCE OF OVERALL OBESITY

Nearly one quarter of group LIM were observed to have normal BMI whereas no one was in that category in group LIW. Control group CTM recorded 37 per cent in obesity stage -I, 33 per cent in at risk of obesity and 23 per cent in obesity stage -II. Group CTW showed more prevalence of at risk of obesity (67 per cent) than all other groups and registered 13 per cent in obesity stage -I and 10 per cent in obesity stage -II. Both control groups had seven to ten per cent hypertensives with normal BMI.

After intervention, it was pleasant to note that severity of obesity was found to be decreased in the experimental groups. In groups LIM, hypertensives with normal BMI was increased to 56 per cent and obesity stage-I and at risk of obesity was reduced to 7 per cent. It might be due to the migration of obesity -II and at risk of obesity towards their subsequent lower risk groups at the end. Even the elevation in obesity stage -I might be due to the conversion of notable per cent of obesity stage-II into obesity stage -I at the end of intervention.

The Figure -39 evidently depicted that remarkable per cent on obesity stage II and obesity stage I had migrated to at risk of obesity in group LIW on completion of intervention.

Even though shift was noticed in the prevalence percentage of obesity categories in control groups, it was found to be negligible compared to experimental groups. The beneficial changes in the experimental groups showed the potential impact of intervention on blood pressure associated risk factors.

#### **4. Waist to Hip Ratio (WHR)**

Impact of lifestyle intervention on Waist Hip Ratio is given in Table -LXXI.

WHR appeared to be the most sensitive indicators of obesity followed by waist circumference and body mass index respectively as it indicated over weight and obesity four times as compared to other indicators (Kaur and Walia, 2007). From Table -LXXI, it was observed that group LIM and group CTM registered WHR below base line value and group LIW and group CTW recorded WHR above the base line value at beginning of intervention.

TABLE –LXXI IMPACT OF LIFESTYLE INTERVENTION ON WAIST HIP RATIO

Experiment groups					Control groups				
Groups	Mean $\pm$ SD			t-value	Groups	Mean $\pm$ SD			t-value
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.	
<b>LIM</b> <b>(n=30)</b>	0.891 $\pm$ 0.033	0.859 $\pm$ 0.003	-0.032 $\pm$ 0.021	7.95**	<b>CTM</b> <b>(n=30)</b>	0.889 $\pm$ 0.031	0.891 $\pm$ 0.031	0.002 $\pm$ 0.006	1.84 <sup>NS</sup>
<b>LIW</b> <b>(n=30)</b>	0.835 $\pm$ 0.041	0.810 $\pm$ 0.041	-0.025 $\pm$ 0.017	7.55**	<b>CTW</b> <b>(n=30)</b>	0.829 $\pm$ 0.038	0.833 $\pm$ 0.035	0.004 $\pm$ 0.008	1.07 <sup>NS</sup>

\*\*Significant at ( $p \leq 0.01$ ) level

LIW- Lifestyle Intervention Women

NS – Not Significant

CTM-Control Men

LIM – Lifestyle Intervention Men

CTW- Control Women

The WHR in experimental group was found to be 0.891 in group LIM and 0.835 in group LIW whereas control groups showed 0.889 in group CTM and 0.829 in group CTW.

At the end of life style intervention, group LIM showed a reduction of 0.032 and group LIW displayed a decrease of 0.025 in WHR but in control group CTM and group CTW, a increase was observed. The depletion in the experimental groups was found to be statistically significant at ( $p < 0.01$ ) level whereas it was not significant in control groups.

The present study results were coincided with the results given by Annapoorna *et al.*, (2014). The study observed 3 months yoga training resulted in a significant reduction in all body weight measures such as decrease in BMI, WHR and in physiological measures such as Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP). Kumari *et al.*, (2011) also observed that yoga therapy was beneficial in maintaining good health by regulating BMI, oxidative status by improving the biochemical functions of the body and helpful to overcome the complications of obesity and hypertension. The present study also agreed the same.

## 5. Waist Height Ratio (WHtR)

Impact of lifestyle modification on Waist Height Ratio is illustrated in Table –LXXII

TABLE –LXXII IMPACT OF LIFESTYLE INTERVENTION ON WHtR

Experiment groups					Control groups				
Groups	Initial	Final	Mean Diff.	t-value	Groups	Initial	Final	Mean Diff.	t-value
	Mean $\pm$ SD					Mean $\pm$ SD			
<b>LIM (n=30)</b>	0.547 $\pm 0.038$	0.518 $\pm 0.035$	-0.029 $\pm 0.008$	17.99**	<b>CTM (n=30)</b>	0.535 $\pm 0.037$	0.536 $\pm 0.037$	0.001 $\pm 0.004$	1.81 <sup>NS</sup>
<b>LIW (n=30)</b>	0.534 $\pm 0.044$	0.508 $\pm 0.039$	-0.026 $\pm 0.009$		<b>CTW (n=30)</b>	0.545 $\pm 0.048$	0.547 $\pm 0.046$	0.002 $\pm 0.005$	

\*\*Significant at ( $p \leq 0.01$ ) level

NS – Not Significant

LIM – Lifestyle Intervention Men

LIW- Lifestyle Intervention Women

CTM-Control Men

CTW- Control Women

Waist circumference was independently associated with a five-fold risk in hypertension compared to other anthropometric measurements (Warren *et al.*, 2012). Ashwell *et al.*, (2012) showed WHtR was better than waist circumference to predict diabetes, hypertension, CVD and all outcomes. In present study WHtR was found to be more than normal in group LIM, group LIW and group CTW. It was found to be below base line value in group CTM at the beginning of lifestyle intervention.

It was favourable to note that the experimental groups who received lifestyle intervention had shown a significant decrease in WHtR from 0.547 to 0.518 by 0.029 in group LIM and depletion from 0.534 to 0.508 by 0.026 in group LIW at the end of life style intervention. With respect to control groups, meager increment was noticed in both the groups at the end and it was not found to be significant.

Recent studies revealed that WHtR was the relevant predictor of central obesity which was directly associated with blood pressure. Hence reduction in WHtR on completion of lifestyle intervention obviously showed the beneficial impact of intervention programme towards blood pressure reduction.

### b. Blood Pressure

Impact of lifestyle intervention on blood pressure level is depicted in Table –LXXIII and Figure -40.

TABLE –LXXIII IMPACT OF LIFESTYLE INTERVENTION ON BLOOD PRESSURE LEVEL

Experiment groups					Control groups					
Blood pressure (mm Hg)	Mean (mm Hg) + SD			t-value	Blood pressure (mm Hg)	Mean (mm Hg) + SD			t-value	EX vs CT (t-value)
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.		
	LIM (n=30)					CTM (n=30)				
<b>SBP</b>	130.63 ±4.02	122.33 ±3.67	-8.3 ±1.29	35.23**	<b>SBP</b>	134.50 ±3.68	135.03 ±3.71	0.53 ±1.91	1.62 <sup>NS</sup>	21.10**
<b>DBP</b>	83.5 ±2.71	79.03 ±2.28	-4.47 ±1.25	19.54**	<b>DBP</b>	83.97 ±2.26	84.27 ±2.42	0.30 ±1.24	1.33 <sup>NS</sup>	14.84**
LIW (n=30)					CTW (n=30)					
<b>SBP</b>	129.50 ±5.16	120.90 ±4.67	-8.60 ±1.38	34.14**	<b>SBP</b>	131.87 ±5.22	132.57 ±5.32	0.70 ±2.72	1.41 <sup>NS</sup>	16.71**
<b>DBP</b>	83.50 ±3.62	79.37 ±3.76	4.13 ±1.31	17.33**	<b>DBP</b>	82.67 ±3.30	83.07 ±3.64	0.40 ±1.38	1.59 <sup>NS</sup>	13.07**

\*\*Significant at (p<0.01) level NS –Not Significant EX- Experimental CT- Control

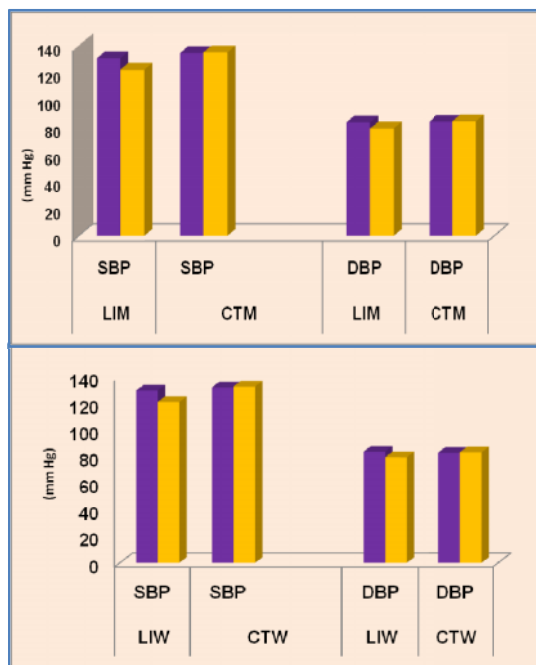


FIGURE -40 IMPACT OF LIFESTYLE INTERVENTION ON BLOOD PRESSURE LEVEL

LIM showed greater decrease (4.47 mm Hg) in comparison with group LIW (4.13 mm Hg).

At initial stage, the highest SBP/DBP was recorded by the control group CTM compared to other groups. At the end of lifestyle interventions, the experimental group LIM showed a decrease in SBP from 130.63 mm Hg to 122.33 mm Hg and reduction in DBP from 83.5 mm Hg to 79.03 mm Hg.

In group LIW, the depletion was from 129.5 mm Hg to 120.90 mm Hg in SBP and from 83.50 mm Hg to 79.37 in DBP. The decrease was found to be more in group LIW (8.60 mm Hg) when compared to group LIM (8.3 mm Hg). But with respect to DBP, group

In control group CTM, elevation of 0.53 mm Hg was noticed in SBP level and increase of 0.30 mm Hg was recorded in DBP level and in group CTW, increment of 0.70 mm Hg in SBP and 0.40 mm Hg in DBP was recorded at the end. The changes were found to be not significant in control groups where as the changes in the experimental groups was noticed to be statistically significant.

In a prospective cohort study involving subjects with and without established coronary artery disease subjected to a course in yoga and meditation showed significant reductions in blood pressure, heart rate and body mass index. Interventional studies showed beneficial effects of pranayama and meditation practice for 15 days and 12 weeks in reducing systolic blood pressure, diastolic blood pressure irrespective of age, gender and BMI in normal individuals (Ankad *et al.*, 2011).

On par with the above statements, the favourable reduction in the experimental groups might be due to the cumulative effect of life style intervention strategies. The stress and stress induced disorders like hypertension and angina were fast growing epidemics and bane of modern society. Regular practice of yoga, meditation, laughing therapy and nutrition education might have brought beneficial changes in the physical as well as mental health of experimental groups.

The holistic science of yoga was the best method for prevention as well as management hypertension. It was also highlighted in the present study and can be concluded that lifestyle intervention had potential impact on blood pressure reduction and its associated risk factors. Hence, it could be adopted as one of the best alternative strategy to treat blood pressure irrespective of the age and sex.

### **c. Biochemical parameters**

#### **1. Fasting Blood Glucose (FBG) level**

Impact of lifestyle intervention on Fasting Blood Glucose (FBG) is elucidated in Table –LXXIV.

Table –LXXIV illustrated that at the beginning of intervention, all the groups had recorded FBG within the normal range. It was recorded as 94.83 mg/dl and 93.80 mg/dl in group LIM and group LIW respectively. The control group CTM showed 86.61 mg/dl and group CTW displayed 90.72 mg/dl.

**TABLE – LXXIV IMPACT OF LIFESTYLE INTERVENTION ON FBG LEVEL**

Experiment groups				Control groups				EX vs CT (t- value)		
Groups	Mean (mg/dl) ± SD			t-value	Groups	Mean (mg/dl) ± SD			t-value	
	Initial	Final	Mean Diff,			Initial	Final			Mean Diff,
<b>LIM (n=30)</b>	94.83 ±9.56	87.94 ±9.27	-6.89 ±2.99	12.63**	<b>CTM (n=30)</b>	86.61 ±9.54	87.5 ±8.97	0.89 ±2.88	1.69 <sup>NS</sup>	10.27**
<b>LIW (n=30)</b>	93.80 ±9.22	85.82 ±8.28	-7.98 ±1.63	25.60**	<b>CTW (n=30)</b>	90.72 ±9.34	91.81 ±9.26	1.09 ±3.16	1.88 <sup>NS</sup>	13.40**

**\*\*Significant at (p≤0.01) level    NS – Not Significant    EX- Experimental    CT- Control**

At the end of intervention, experimental groups showed statistically significant reduction in the FBG level at (p≤0.01) level where as elevation was recorded in the control groups which was not significant. In the experimental group LIM, the fasting blood glucose level was decreased from by 6.89 mg/dl and in group LIW, it was reduced by 7.98 mg/dl at the end. Among the experimental groups, decrease in the FBG level in group LIW was greater when compared to group LIM. In control group CTM and group CTW, an increment of 0.89 mg/dl and 1.09 mg/dl was observed at the end.

When compared to control groups, the experimental groups who practiced yoga exercises, meditation and laughing therapy regularly for three months showed significant beneficial results with respect to FBG level. This present study results was in line with the result given by Chimkode *et al.*, (2015) who showed highly significant reduction in the fasting and post prandial blood glucose due to yoga practice at the end of three months. The reduction in the present study was lesser than the results given by Amita *et al.*, (2009), who observed a fall of 21.3 mg/dl in fasting blood glucose by practicing yoga for 3 months.

Studies revealed that yogic exercises caused the muscles to absorb the excess glucose in the blood, thereby reduced the blood sugar level. Asanas helped in rejuvenating the pancreatic cells, thereby assisted insulin secretion. The muscular movements also helped in bringing down the blood sugar levels. (Medindia, 2015). Hence the reduction in the experimental groups might be due to the above yoga mechanism on blood glucose level. The outcome evident the potential impact of lifestyle intervention in preventing further complications in hypertensives.

**2. Postprandial Blood Glucose (PPBG)**

Impact of lifestyle intervention on Postprandial Blood Glucose is shown in Table –LXXV

**TABLE –LXXV IMPACT OF LIFESTYLE INTERVENTION ON PPBG LEVEL**

Experiment groups					Control groups					EX vs CT (t-value)
Groups	Mean (mg/dl) ± SD			t-value	Groups	Mean (mg/dl) ± SD			t-value	
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.		
<b>LIM (n=30)</b>	138.22 ±7.40	129.75 ±8.68	-8.47 ±3.79	12.25**	<b>CTM (n=30)</b>	136.0 ±9.88	135.63 ±10.79	-0.37 ±3.86	0.52 <sup>NS</sup>	8.20**
<b>LIW (n=30)</b>	131.63 ±5.29	122.22 ±5.16	-9.41 ±1.36		<b>CTW (n=30)</b>	129.90 ±11.76	130.63 ±11.86	0.73 ±2.53		

**\*\*Significant at (p≤0.01) level    NS – Not Significant    EX- Experimental    CT- Control**

Initially, both the experimental and control groups were found to have PPBG level within the reference value and among all, PPBG level of group LIM was found to be more. The PPBG level in group LIM and group LIW was 138.22 mg/dl and 131.63 mg/dl respectively and the control group CTM and group CTW recorded 130.0 mg/dl and 129.90 mg/dl correspondingly.

On completion of lifestyle modification strategies, statistically significant fall of 8.47mg/dl and 9.41mg/dl was noted in the experimental group LIM and group LIW respectively. With respect to control groups, non significant changes were noted in the PPBG levels at the end.

The significant reduction of PPBG level in both the experimental groups indicated the potential role of lifestyle modification strategies. Hence, lifeintervention strategies can be considered as a cost-effective and non-invasive adjuvant therapy for hypertensives to delay the progression of disease process.

### 3. Glycosylated Hameoglobin (HbA1c)

Impact of lifestyle intervention on glycosylated heamoglobin is presented in Table –LXXVI.

**TABLE – LXXVI IMPACT OF LIFESTYLE INTERVENTION ON GLYCOSYLATED HEAMOGLOBIN**

Experiment groups					Control groups					Ex Vs CT
Groups	Mean (%) $\pm$ SD			t-value	Groups	Mean (%) $\pm$ SD			t-value	
	Initial	Final	Mean Diff.			Initial	Final	Mean Diff.		
<b>LIM</b> (n=30)	6.47 $\pm$ 0.29	5.69 $\pm$ 0.17	-0.78 $\pm$ 0.22	18.91**	<b>CTM</b> (n=30)	6.46 $\pm$ 0.64	6.53 $\pm$ 0.61	0.07 $\pm$ 0.27	1.35 <sup>NS</sup>	13.06**
<b>LIW</b> (n=30)	6.59 $\pm$ 0.51	5.72 $\pm$ 0.52	-0.87 $\pm$ 0.15	30.19**	<b>CTW</b> (n=30)	6.11 $\pm$ 0.43	6.13 $\pm$ 0.45	0.02 $\pm$ 0.09	1.61 <sup>NS</sup>	27.02**

\*\*Significant at ( $p \leq 0.01$ ) level    NS – Not Significant    EX- Experimental    CT- Control

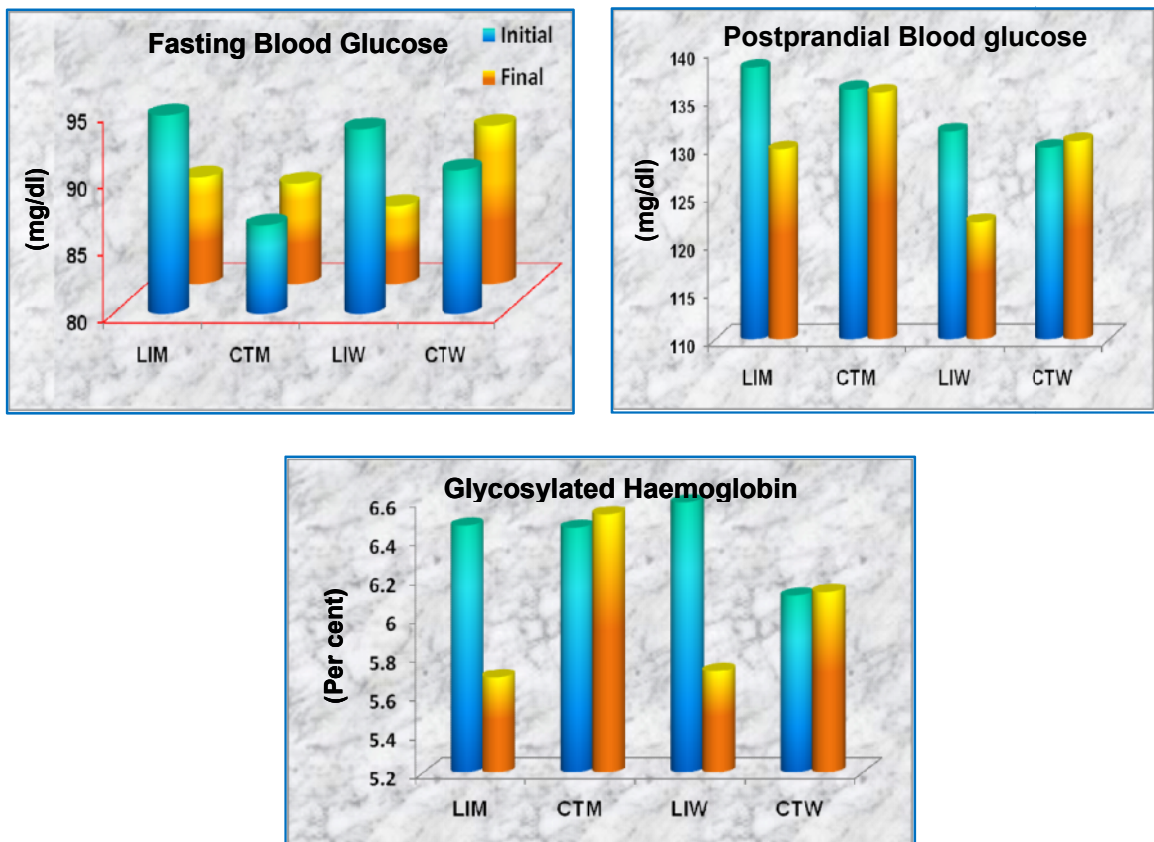
The glycosylated haemoglobin of both experimental and control groups were found to be normal at the initial stage. It was recorded as 6.47 per cent, 6.59 per cent, 6.46 per cent and 6.11 per cent in group LIM, group LIW, group CTM and group CTW respectively.

On completion, significant reduction was noticed in HbA1c of experimental groups from initial value to 5.69 per cent by 0.78 per cent in group LIM and fall to 5.72 per cent by 0.87 per cent in group LIW, whereas control group CTM showed an increment of 0.07 per cent and group CTW displayed an elevation of 0.02 per cent. The changes in the control groups were not found to be statistically significant.

Compared to control groups, the outcome in experimental groups was beneficial and it might be due to the regular practice of life style intervention

strategies. Naik *et al.*, (2015) also found significant reduction of HbA1c after 40 days of yoga practice. The reduction was found to be 1.59 per cent and it was more when compared to present study results.

The regular practice of yoga brought changes in hematologic parameters related to diabetic. Same way this study results concluded that definite glycemic control can be obtained from cumulative impact of yoga, meditation and laughing therapy when it was practiced regularly.



**FIGURE - 41 IMPACT OF LIFESTYLE INTERVENTION ON BLOOD GLUCOSE LEVELS**

#### 4. Lipid Profile

Impact of lifestyle modification on serum lipid profile is described in Table –LXXVII and Figure -41.

TABLE - LXXVII IMPACT OF LIFESTYLE INTERVENTION ON SERUM LIPID PROFILE

Blood lipid profile (mg/dl)*	Experimental groups						Control groups						EX Vs CT (t-value)	
	Group LIM (n=30)			Group LIW (n=30)			Group CTM (n=30)			Group CTW (n=30)			LIM vs CTM	LIW vs CTW
	Mean (mg/dl) $\pm$ SD						Mean (mg/dl) $\pm$ SD							
	Initial	Final	t-value	Initial	Final	t-value	Initial	Final	t-value	Initial	Final	t-value		
<b>Total Cholesterol</b> DL: <200	175.25 $\pm$ 14.10	158.17 $\pm$ 13.98	49.18**	166.39 $\pm$ 5.79	147.74 $\pm$ 5.65	28.47**	162.73 $\pm$ 16.67	163.55 $\pm$ 17.02	1.39 <sup>NS</sup>	156.80 $\pm$ 12.87	157.65 $\pm$ 13.57	0.42 <sup>NS</sup>	1.24 <sup>NS</sup>	5.26**
<b>LDL</b> DL:<130	96.44 $\pm$ 15.14	77.80 $\pm$ 14.50	48.27**	86.96 $\pm$ 6.53	67.02 $\pm$ 5.50	30.02**	87.83 $\pm$ 17.86	88.97 $\pm$ 18.45	1.50 <sup>NS</sup>	77.62 $\pm$ 9.68	77.35 $\pm$ 9.32	0.39 <sup>NS</sup>	2.54**	6.94**
<b>HDL</b> DL: >50	46.71 $\pm$ 5.12	51.30 $\pm$ 4.96	24.86**	49.22 $\pm$ 3.25	54.58 $\pm$ 2.68	25.47**	44.39 $\pm$ 5.84	43.92 $\pm$ 6.06	1.48 <sup>NS</sup>	47.91 $\pm$ 5.63	47.84 $\pm$ 5.69	0.24 <sup>NS</sup>	5.16**	9.55**
<b>Triglyceride</b> DL:<150	160.5 $\pm$ 25.18	145.36 $\pm$ 25.00	39.35**	151.06 $\pm$ 7.36	130.66 $\pm$ 6.29	33.41**	152.50 $\pm$ 14.19	153.30 $\pm$ 15.34	1.20 <sup>NS</sup>	156.33 $\pm$ 12.87	157.32 $\pm$ 13.57	1.89 <sup>NS</sup>	1.48 <sup>NS</sup>	9.77**
<b>VLDL</b> DL:<30	32.1 $\pm$ 5.04	29.07 $\pm$ 5.00	39.35**	30.21 $\pm$ 1.47	26.13 $\pm$ 1.26	33.41**	30.50 $\pm$ 2.84	30.66 $\pm$ 3.07	1.20 <sup>NS</sup>	31.27 $\pm$ 2.57	31.46 $\pm$ 2.71	1.89 <sup>NS</sup>	1.48 <sup>NS</sup>	9.77**

\*NCEP, 2012 \*\*Significant at ( $p \leq 0.01$ ) level NS – Not Significant

EX- Experimental CT- Control

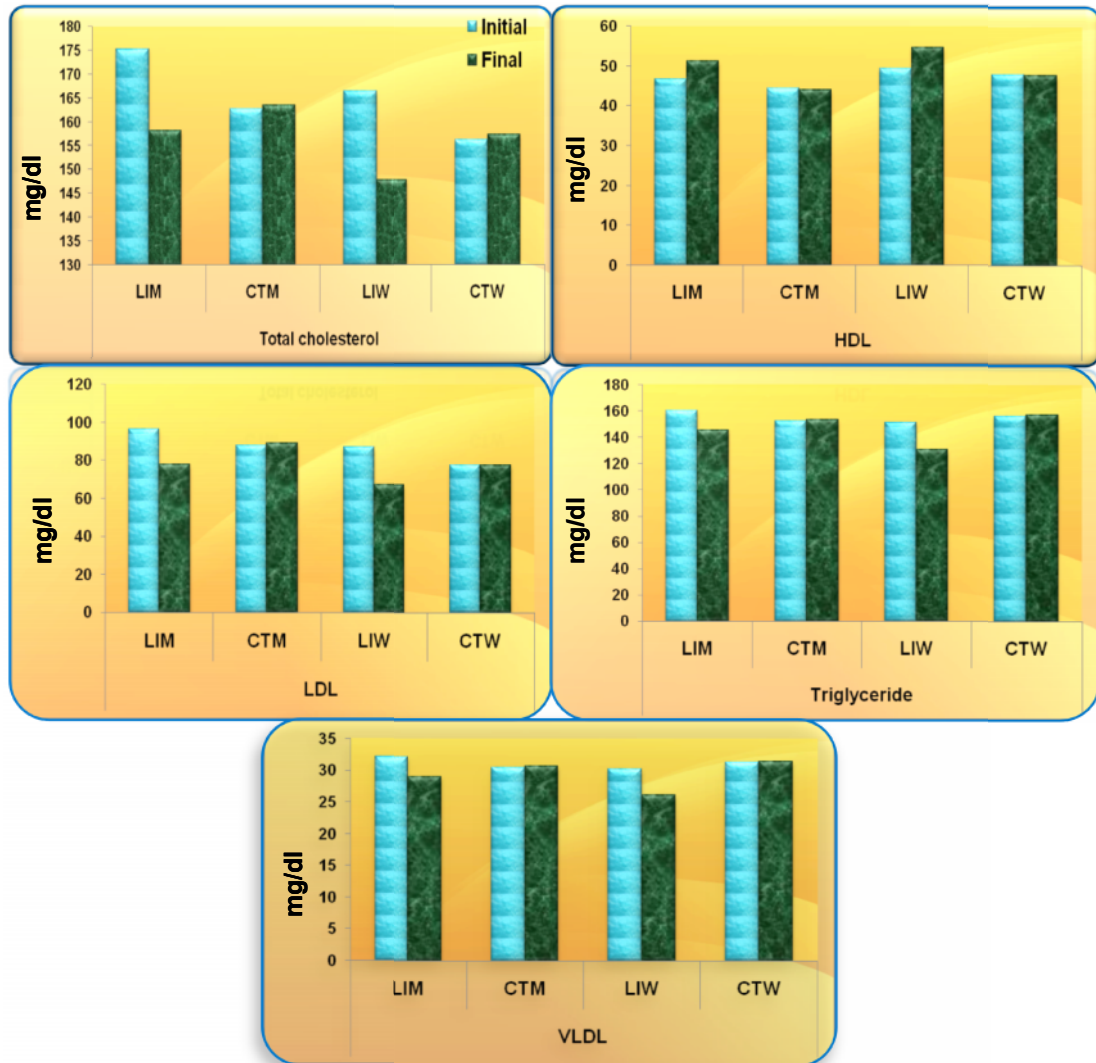


FIGURE - 42 IMPACT OF LIFESTYLE INTERVENTION ON SERUM LIPID PROFILE

Many researches showed that hypertension and hypercholesterolemia aggravated the cardiovascular disease in individuals. Observation of the table revealed that the total cholesterol level of both the experimental and control group was noted within the reference value but nearer to the upper limit. Among the groups, group LIM recorded the highest value (175.25 mg/dl), followed by group LIW (166.39mg/dl), group CTM (162.73 mg/dl) and group CTW (156.80 mg/dl).

After the intervention period, the experimental groups recorded a reduction in the serum total cholesterol level whereas the control groups showed an increase. The experimental groups showed reduction by 17.08 mg/dl by group

LIM and 18.65 mg/dl by group LIW. The fall was higher in group LIW in comparison with group LIM and both the groups reduction were found to be statistically significant at ( $p \leq 0.01$ ) level.

The control groups showed an increase of 0.82 mg/dl and 0.85 mg/dl in group CTM and group CTW respectively. It was not statistically significant. The decrease in lipid profile seen in this present study was in agreement with the earlier studies results which showed a significant reduction in free fatty acids, LDL and an increase in HDL due to regular yoga practise. (Vaishali *et al.*, 2012).

The triglyceride levels of group LIM and group LIW was observed as 160.5 mg/dl and 151.06 mg/dl respectively and the corresponding values of control group CTM and CTW was seen as 152.50 mg/dl and 156.33 mg/dl. Among all the groups, group LIM showed the highest triglyceride level.

On completion of life style modification strategies, experimental groups showed a significant reduction in triglycerides levels at ( $p \leq 0.01$ ) level. Triglyceride levels depleted to 145.36 mg/dl in group LIM and decreased to 130.66 mg/dl in group LIW. The fall in the triglyceride level was greater in group LIW (20.4 mg/dl) when compared to group LIM (15.14 mg/dl) at the end.

The control group CTM and group CTW recorded 153.30 mg/dl by increasing 0.80 mg/dl and 157.32 mg/dl by elevating 0.99 mg/dl on completion of lifestyle intervention.

Initially, HDL level in all the groups was found to be lower than the reference value. On completion of intervention trial, the HDL level in group LIM increased from 46.71 mg/dl to 51.30 mg/dl and in group LIW, it was elevated from 49.22 mg/dl to 54.58 mg/dl where as in control group CTM and group CTW, negligible depletion was noted. Among the experimental groups, group LIW showed more increment in comparison with group LIM. The changes in the experimental group was statistically significant at ( $p \leq 0.01$ ) level. But it was not significant in control groups.

With respect to VLDL level, significant decrease was noticed in both the experimental groups and it was found to be 3.03 mg/dl and 4.08 mg/dl in group

LIM and group LIW respectively. The LDL level also decreased from 96.44 mg/dl to 77.80 mg/dl in group LIM and depleted from 86.96 mg/dl to 67.02 mg/dl in group LIW.

The experimental groups showed significant reduction in VLDL and LDL levels where as the control group showed non significant increment at the end. It can be concluded that the experimental groups who received lifestyle modification strategies showed a decrease in total cholesterol, triglyceride, VLDL, LDL and increase in HDL level whereas the control groups who were devoid of the intervention strategies did not show any favourable outcomes with respect to lipid profile.

Padyal and Sharma (2014) also showed significant reduction in the lipid profile at the end 12 weeks yoga practice. In recent times yoga was being accepted broadly worldwide to achieve desired fitness levels and a disease free lifestyle. Physical exercises in yoga had become popular as a kind of low-impact physical exercise, and were used for therapeutic purposes. The present study results supported the above conclusion and recommended regular yoga practice for hypertensives to overcome the associated complications.

### 5. Serum Sodium

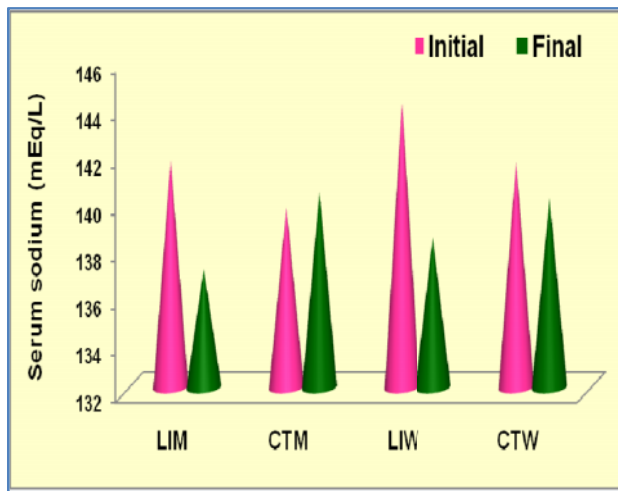
Impact of lifestyle intervention on serum sodium is shown in Table –LXXVIII and Figure – 42

**TABLE –LXXVIII IMPACT OF LIFESTYLE INTERVENTION ON SERUM SODIUM**

Experiment groups					Control groups					EX vs CT (t-value)
Groups	Mean (mEq/L) ± SD				Groups	Mean (mEq/L) ± SD				
	Initial	Final	Mean Diff.	t-value		Initial	Final	Mean Diff.	t-value	
LIM (n=30)	141.64 ±3.21	137.03 ±3.78	-4.61 ±1.98	12.74**	CTM (n=30)	139.66 ±3.58	140.28 ±3.32	0.62 ±1.76	0.89 <sup>NS</sup>	10.81**
Group LIW (n=30)	144.11 ±1.68	138.38 ±1.38	-5.73 ±1.68	18.65**	Group CTW (n=30)	141.57 ±3.79	142.07 ±3.37	0.50 ±2.49	1.10 <sup>NS</sup>	11.33**

Desirable level (Walker et al., 1990): 135 mEq/L – 145 mEq/L \*Significant at (p≤0.01) level  
NS – Not significant EX- Experimental CT- Control

The table stated that at the beginning of intervention, the serum sodium levels recorded by group LIM was 141.64 mEq/L and group LIW was 144.11 mEq/L. The control group CTM and CTW showed serum sodium level as 139.66 mEq/L and 141.57 mEq/L.



**FIGURE - 43 IMPACT OF LIFESTYLE INTERVENTION ON SERUM SODIUM**

At the end of lifestyle intervention, the experimental groups recorded a statistically significant reduction of 4.61 mEq/L and 5.73 mEq/L in groups LIM and LIW respectively. The decrease was observed to be greater when compared to group

LIM. With respect to control groups CTW and CTM recorded an increment of 0.50 mEq/L and 0.62 mEq/L at the end. The changes in the control group were observed to be not significant.

The significant favourable reduction in serum sodium level of experimental groups might be due to the transformation of lifestyle and food pattern facilitated by intervention strategies. The nutrition education and health food habits insisted in yoga therapy might have reduced the intake of sodium rich foods, especially salt. Similar results was given by Jagadesan *et al.*, (2015) with respect to serum sodium level after yoga practice.

The present study observed that ignorance of complications was one of the reasons for increasing prevalence and inadequate control of hypertension. As part of the intervention programme the experimental groups had received education on hypertension complications and other associated risk factors. The acquired knowledge might have simulated the desirable changes in their lifestyle and diet pattern. Hence the depletion noted in the serum sodium of experimental groups might be due to the cumulative effect of entire lifestyle intervention strategies.

6. Serum potassium

Impact of lifestyle intervention on serum potassium is described in Table –LXXIX and Figure -43.

TABLE – LXXIX IMPACT OF LIFE STYLE INTERVENTION ON SERUM POTASSIUM

Experiment groups (N=60)					Control groups (N=60)					EX vs CT (t-value)
Groups	Mean (mEq/L) ± SD				Groups	Mean (mEq/L) ± SD				
	Initial	Final	Mean Diff.	t-value		Initial	Final	Mean Diff.	t-value	
LIM (n=30)	3.83 ±0.24	4.41 ±0.18	0.57 ±0.19	16.54**	CTM (n=30)	4.06 ±0.79	3.97 ±0.30	-0.09 ±0.34	1.49 <sup>NS</sup>	9.44**
LIW (n=30)	3.89 ±0.14	4.54 ±0.14	0.65 ±0.16	22.67**	CTW (n=30)	3.97 ±0.34	3.87 ±0.25	-0.10 ±2.90	1.78 <sup>NS</sup>	9.85**

Desirable level (Walker et al., 1990): 3.5 mEq/L – 5.5 mEq/L      \*\*Significant at (p≤0.01) level  
 NS – Not Significant    EX- Experimental    CT- Control

The above table stated that among the groups, the control group CTM recorded highest level of serum potassium as 4.06 mEq/L followed by group CTW (3.97 mEq/L), group LIW (3.89 mEq/L) and group LIM (3.83 mEq/L) at the beginning of intervention. Eventhough the serum potassium level was noted in the normal range in all the groups, it was closer to lower limit.

At the end of intervention, elevation of 0.57 mEq/L and 0.65 mEq/L was shown in group LIM and LIW. The elevation was observed to be similar in both the experimental groups. In contrast to the experimental groups, control groups recorded reduction in serum potassium level at the end.

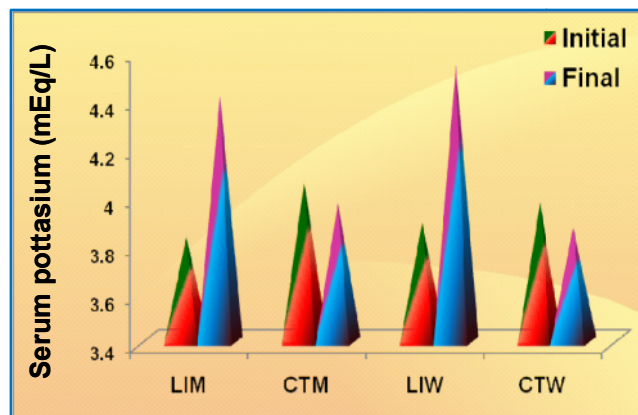


FIGURE -44 IMPACT OF LIFESTYLE INTERVENION ON SERUM POTASSIUM

The changes in the experimental groups were found to be statistically significant whereas it was not significant in the control groups. The beneficial changes brought in the serum potassium level of the experimental groups might be due to the potential changes in their diet pattern aroused by intervention strategies.

As part of the intervention, education programme was given to motivate the experimental groups to consume more hypotensive foods as part of their diet. Yoga also insisted healthy food choice for holistic health among them. Once they gained knowledge, hypertensives were very cooperative and followed the same regularly and it was well illustrated in the final outcome.

**K. Statistical appraisal of the data**

**a. Correlation analysis**

Table -LXXXX depicts the correlation analysis between Systolic Blood Pressure (SBP) /Diastolic Blood Pressure (DBP) and other parameters.

**Table – LXXXX CORRELATION BETWEEN SBP /DBP AND OTHER PARAMETERS**

Parameters	Correlation co-efficient							
	Dietary Intervention				Lifestyle Intervention			
	DIM		DIW		LIM		LIW	
	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP
Body weight	+0.040	+0.248	+0.035	+0.153	+0.361	+0.277	+0.197	+0.061
Body Mass Index	+0.143	+0.121	+0.284	+0.297	+0.399	+0.208	+0.042	+0.011
Weight Height Ratio	+0.188	+0.275	+0.257	+0.345	+0.191	+0.044	+0.010	+0.042
Fasting blood glucose	+0.107	+0.052	-0.163	+0.076	+0.229	+0.012	+0.015	+0.116
Postprandial blood glucose	+0.354	+0.073	+0.361	+0.200	+0.404	+0.116	+0.466	+0.420
HbA1c	+0.240	+0.352	+0.053	+0.212	+0.361	+0.505	+0.253	+0.032
Total cholesterol	+0.058	+0.351	+0.011	+0.156	+0.013	+0.162	+0.070	+0.034
Triglyceride	+0.029	+0.096	+0.055	+0.320	0.062	+0.149	+0.092	+0.055
HDL	-0.209	-0.268	-0.111	-0.186	-0.033	-0.120	-0.167	-0.017
LDL	+0.133	+0.184	+0.139	+0.039	+0.022	+0.062	+0.012	+0.084
VLDL	+0.029	+0.096	+0.055	+0.320	+0.062	+0.149	+0.092	+0.055
Serum sodium	+0.252	+0.184	+0.265	+0.023	+0.522	+0.441	+0.048	+0.222
Serum potassium	-0.333	-0.027	-0.458	-0.565	-0.146	-0.409	-0.177	-0.150

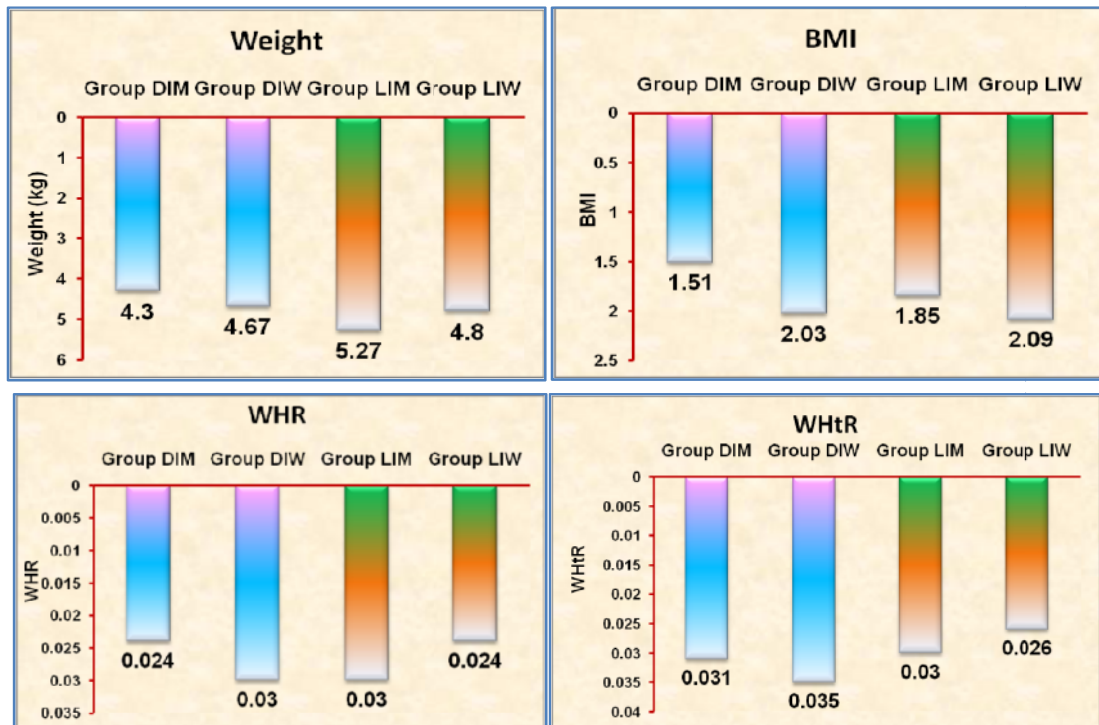
From the above table it was clear that Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) of the experimental groups DIM, DIW, LIM and LIW were positively correlated with body weight, body mass index, waist height ratio, fasting blood glucose level, postprandial glucose level, glycosylated haemoglobin, total cholesterol, triglyceride, LDL, VLDL and serum sodium levels. It was negatively correlated with HDL level and serum potassium level.

**L. Comparison of interventions**

The impact of dietary intervention and lifestyle intervention were compared and discussed under the following headings.

**a. Anthropometric measurements**

Various studies observed that significant reduction in weight, BMI, WHR and WHtR were positively associated with reduction in blood pressure. It was good to observe that both dietary intervention for a period of 180 days and lifestyle intervention for a period of 120 days had resulted in significant reduction in anthropometric measurements in the experimental groups.



**FIGURE – 45 COMPARISON OF MEAN DIFFERENCE IN ANTHROPOMETRIC MEASUREMENTS OF DIFFERENT GROUPS**

The Figure -45 clearly depicted that reduction in anthropometric measurements was found to be more in experimental groups of lifestyle intervention when compared to dietary intervention even though its duration was short in comparison with dietary intervention.

The reduction in weight was recorded as 5.27 kg and 4.80 kg in group LIM and group LIW and it was noted as 4.30 kg and 4.67 kg in group DIM and group DIW. The depletion in BMI was also greater in lifestyle intervention groups. The WHR reduction was similar in both intervention groups and the WHtR was found to be more in dietary intervention groups when compared to their counter parts.

It can be stated that in obese hypertensives, the weight reduction was the primary factor to achieve blood pressure control. Hence following lifestyle intervention might be helpful to achieve their goal in a short span of time. The reduction in weight might be more when it was followed for six months as dietary intervention but it was unpredictable. It might remain constant or might show depletion, it needed further studies to confirm the results.

However, it can be concluded that both dietary and lifestyle modification can be considered as a cost effective non pharmacological method to prevent hypertension associated risk factors and its further complications. Even combination of both can be suggested as alternative treatment method for hypertension prior to drug treatment.

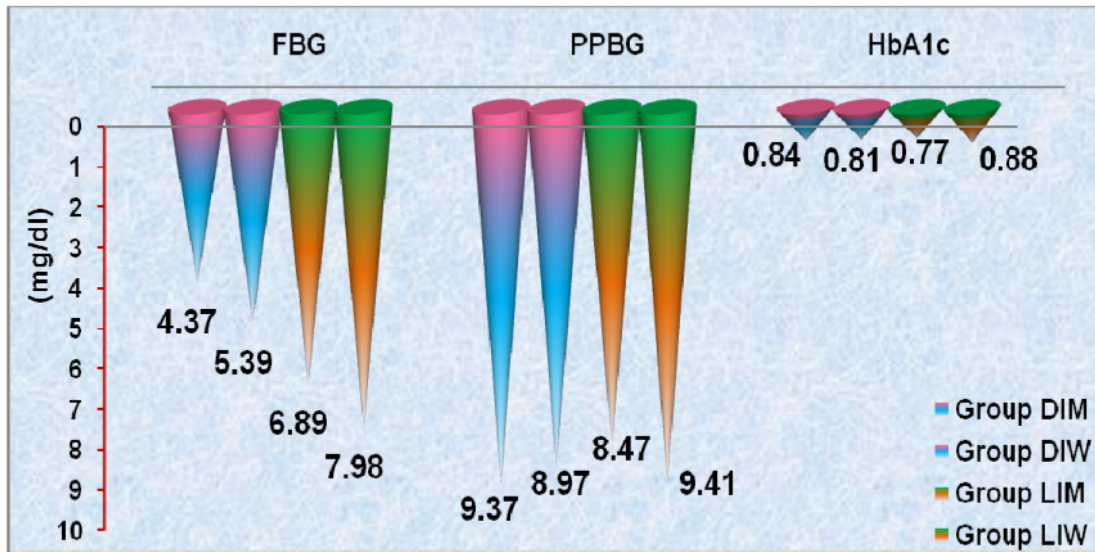
## **b. Biochemical parameters**

### **1. Blood glucose level**

Dietary and lifestyle intervention groups showed significant reduction in FBG, PPBG and HbA1c levels at the end. The decrease in FBG was greater in group LIM (7.98 mg/dl) and group LIW (6.89 mg/dl) when compared to group DIM (4.37 mg/dl) and group DIW (5.39 mg/dl).

With respect to PPBG and HbA1c, the reduction was similar in all the groups. Within groups, group LIW recorded the highest reduction of 9.41 mg/dl followed by group DIM with depletion of 9.37 mg/dl, group DIW with decrease of

8.97 mg/dl and group LIW with reduction of 8.47 mg/dl. In HbA1c, group LIM and LIW showed 0.77 per cent and 0.88 per cent reduction and group DIM and DIW recorded depletion of 0.84 per cent and 0.81 per cent at the end of intervention.



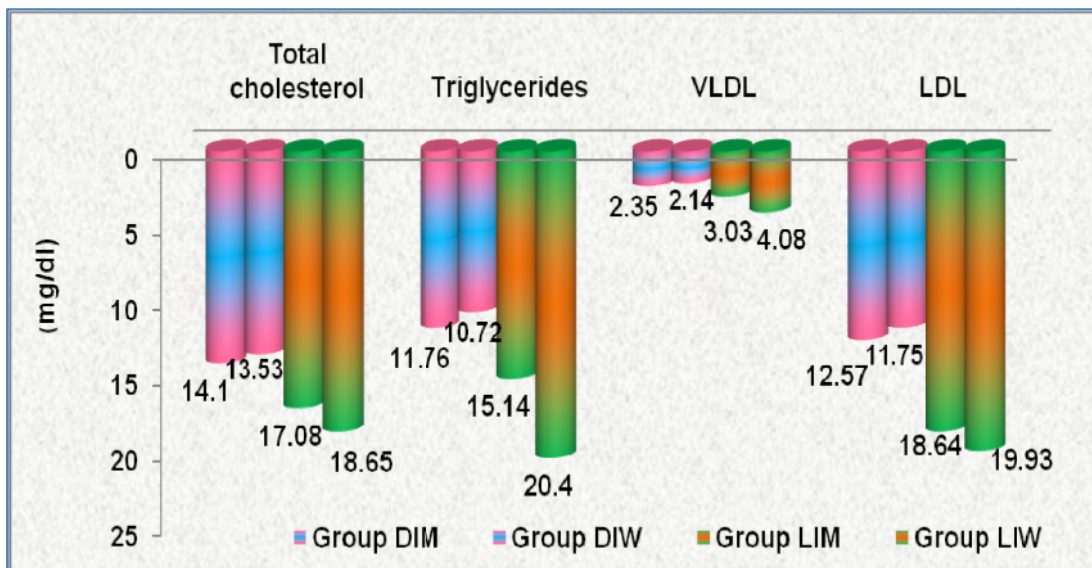
**FIGURE - 46 COMPARISON OF MEAN DIFFERENCE IN BLOOD GLUCOSE LEVEL BETWEEN GROUPS**

To prevent the growing prevalence of hypertension in middle income countries like India, locally feasible, cost effective strategies were needed to address the associated risk factors with higher priority. From the Figure -46 it was clear that regular intake of locally available potassium rich functional foods or by practicing yoga and laughing therapy might prevent the onset of diabetes in hypertensives. Integrating both these effective modification can bring sustainable diminution of associated risks and also prevent the migration of hypertensive towards high risk groups.

## **2. Lipid profile**

The Figure -47 illustrated that serum lipid reduction was greater in lifestyle intervention group compared to dietary intervention. Among all the groups, with respect to total cholesterol, group LIW recorded more of 18.65 mg/dl, followed by group LIM by recording 17.08 mg/dl and group DIM displaying 14.1 mg/dl. The group DIW was observed to have the least depletion of 13.53 mg/dl. Though the lifestyle intervention was given for shorter duration, almost 4-5 mg/dl greater

reduction in total cholesterol was noticed in its intervention groups compared to dietary intervention groups.



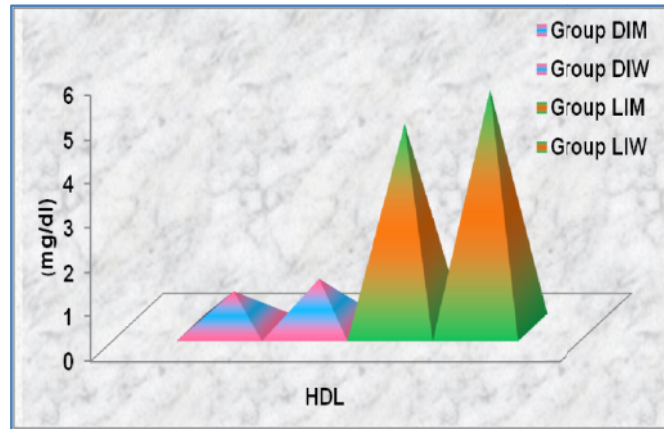
**FIGURE – 47 COMPARISON OF MEAN DIFFERENCE IN LIPID PROFILE OF DIFFERENT GROUPS**

Even though two interventions observed reduction in triglyceride at the end, decrease in lifestyle intervention group was greater when compared to its counter parts. Group LIW showed the greatest reduction of about 20.4 mg/dl and the lowest reduction was observed in group DIW (10.72). Almost 2 times reduction in triglyceride level was observed in lifestyle intervention groups.

With respect to LDL, group LIW recorded greater reduction (19.93 mg/dl) succeeded by group LIM (18.64 mg/dl) and group DIM (12.57 mg/dl). The group DIW recorded the least reduction of 11.75 mg/dl at the end of intervention. The VLDL level reduction in between the group LIW which recorded the highest value and group DIW which recorded the lowest value was almost 2 times.

The HDL level was increased by 5.36 mg/dl in group LIW, 4.59 mg/dl in group LIM, 1.1 mg/dl in group DIW and 0.82 mg/dl in group DIM. The difference in the HDL levels in the lifestyle intervention groups was almost 4.5 times.

Several studies, including the present, demonstrated that exercise raised HDL-cholesterol in the blood. Niaz *et al.*, (2012) quoted that some interventional studies had shown that inclusion of legumes in the diet did not reduce or cause more change in the HDL cholesterol concentrations. Sameway the



**FIGURE – 48 COMPARISON OF IMPACT ON HDL LEVEL BETWEEN GROUPS**

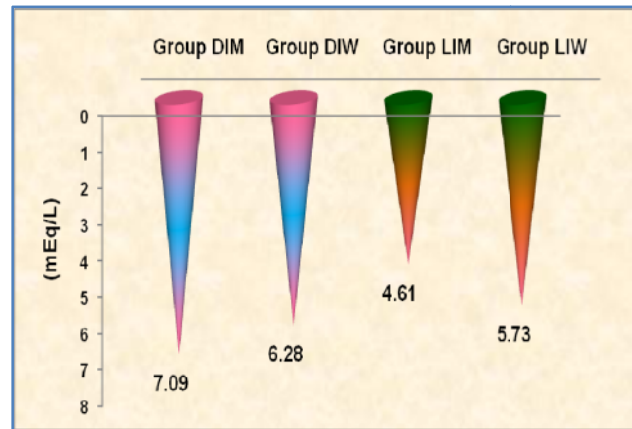
present study also observed only slight change in the HDL level at the end of dietary intervention. Investigators suggested that the way to increase HDL-cholesterol in dieting was to combine diet with exercise. This might translated to a reduction in the risk for developing atherosclerosis.

With respect to lipid profile, hypertensive women in group LIW showed more reduction in total cholesterol, triglyceride, VLDL and LDL and greater increment in HDL level when compared to group LIM. In dietary intervention, except in HDL, in all other lipid profile men in group DIM showed excess reduction when compared to women hypertensives in group DIW.

On the whole, serum lipid profile was concerned, the lifestyle intervention had brought greater favourable changes when compared to dietary intervention. The improvement in the lipid profile after yoga might be due to increased hepatic lipase and lipoprotein lipase at cellular level, which affected the metabolism of lipoprotein and thus increased uptake of triglycerides by adipose tissues (Mondal *et al.*, 2014). Even though the dietary intervention had brought favourable shift in serum lipid profile, it could be parallel with lifestyle intervention to bring extensive reduction.

### 3. Serum Sodium

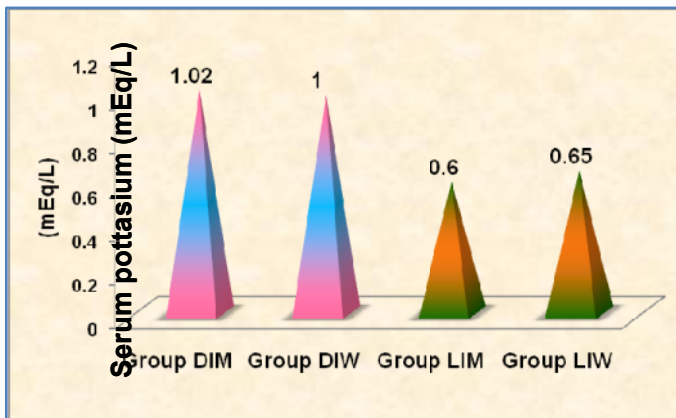
Figure - 49 illustrated that serum sodium reduction was more in dietary intervention groups when compare to lifestyle intervention groups. The highest reduction of 7.09 mEq/L was recorded by group DIW. The group DIM recorded 6.28 mEq/L, group LIM and group LIW displayed 4.61 mEq/L and 5.73 mEq/L respectively.



**FIGURE – 49 COMPARISON OF SERUM SODIUM BETWEEN GROUPS**

From the figure it was inferred that serum sodium level was greatly related to dietary intake and hence it recommended efforts to reduce the sodium intake in form of salt and other food products.

### 4. Serum potassium



**FIGURE – 50 COMPARISON OF SERUM POTASSIUM BETWEEN GROUPS**

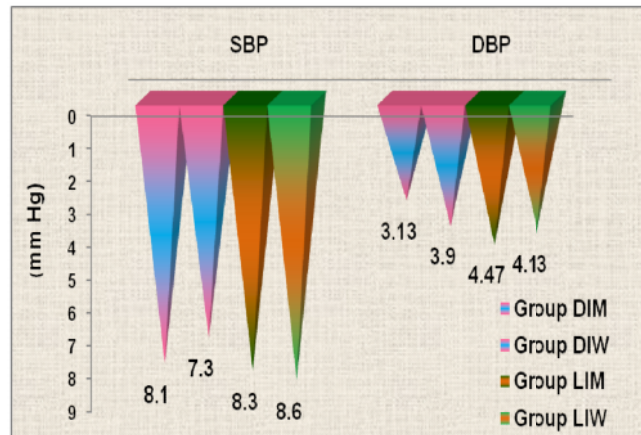
Even though both intervention groups recorded significant increment in serum potassium level, increment in dietary intervention was two times more when compared to lifestyle intervention. It might be due to the regular consumption of functional foods with hypotensive

component in the form of supplement by the dietary intervention groups, whereas in the lifestyle intervention, the experimental groups were motivated through nutrition education programme to consume hypotensive foods on their own. In lifestyle intervention the food intake might be restricted by the individual's economic and awareness level.

It can be concluded that serum potassium level was found to be depended on dietary intake, hence regular consumption of potassium rich diet helps to reduce the blood pressure and its associated risk factors.

**5. Blood pressure level**

The reduction in blood pressure was observed to be greater in lifestyle intervention groups when compared to dietary intervention groups. Similar result was obtained in a study conducted by Cohen *et al.*, (2011) which compared the dietary pattern and yoga practice on blood pressure level.



**FIGURE – 51 COMPARISON OF SBP/DBP REDUCTION BETWEEN GROUPS**

Among the lifestyle intervention groups, group LIW showed the highest reduction in SBP (8.6 mm Hg) and group LIM showed greater reduction in DBP (4.47 mm Hg) where as the in dietary intervention groups, SBP reduction was more in group DIM (8.1 mm Hg) and DBP depletion was more in group DIW (3.9 mm Hg).

Both the intervention groups had brought positive changes towards blood pressure reduction at the end. But single intervention alone for a long period might not bring holistic health. Integrating both interventions certainly bring sustainable reduction in hypertension and its associated risk factors. Hence, both dietary pattern and yoga intervention can be employed as a complementary therapy program to enhance the beneficial effects of standard medical management of hypertension.