

CHAPTER – 7
RESULTS

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7.0 RESULTS

Participant Selection and Demographics: By arrangement with authorities at Bhopal Central Jail, and after their agreement, 567 inmates were screened. 150 agreed to participate, but on learning details of trial requirements, 38 immediately withdrew, leaving 112 who agreed to complete the trial. Groups 1, 2, and 3 were assigned 38, 37 and 37 respectively. (See Figure 7.0.1 overleaf) Following this initial problem, no further attrition occurred from any group, a remarkable fact. Demographic details of the three groups are given in Table 7.0.1, which presents age, weight, height, and BMI means and SDs for each group and for all participants together. Table 7.0.2 presents pre- and post- means \pm SDs for all 15 biomedical parameters for the three groups, while Table 7.0.3 displays the resulting significances of within group changes as Students 't' test, and corresponding significance 'p' values. Each section also gives Group-Time Interaction results.

TABLE 7.0.1: PARTICIPANTS DEMOGRAPHIC DATA

GROUP → VARIABLE ↓	GROUP 1 (38 participants)	GROUP 2 (37 participants)	GROUP 3 (37 participants)	ALL (112)
Age (yrs)	38.2 \pm 10.3	40.7 \pm 10.86	41.9 \pm 12.	40.8 \pm 11.1
Weight (kg)	61.5 \pm 6.28	65.45 \pm 8.79	64.2 \pm 9.32	63.7 \pm 8.31
Height (cm)	165.4 \pm 5.17	165.7 \pm 4.27	164.82 \pm 5.91	165.3 \pm 5.13
BMI (kg / m²)	22.5 \pm 1.83	23.7 \pm 2.81	23.6 \pm 2.65	23.3 \pm 2.51

Table 7.0.1 Caption: Table 7.0.1 presents demographic parameters means / standard deviations of participants in the 2015 Bhopal Central Jail controlled trial of Yoga and diabetes. Units are years for age, kilograms for weight, centimetres for height, and kilograms per square meter for body mass index, BMI (bottom row). Numbers in each of the three groups are given under the Group heading in the top line.

Abbreviations Table 7.0.1- Demographic data, BMI- Body Mass Index.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

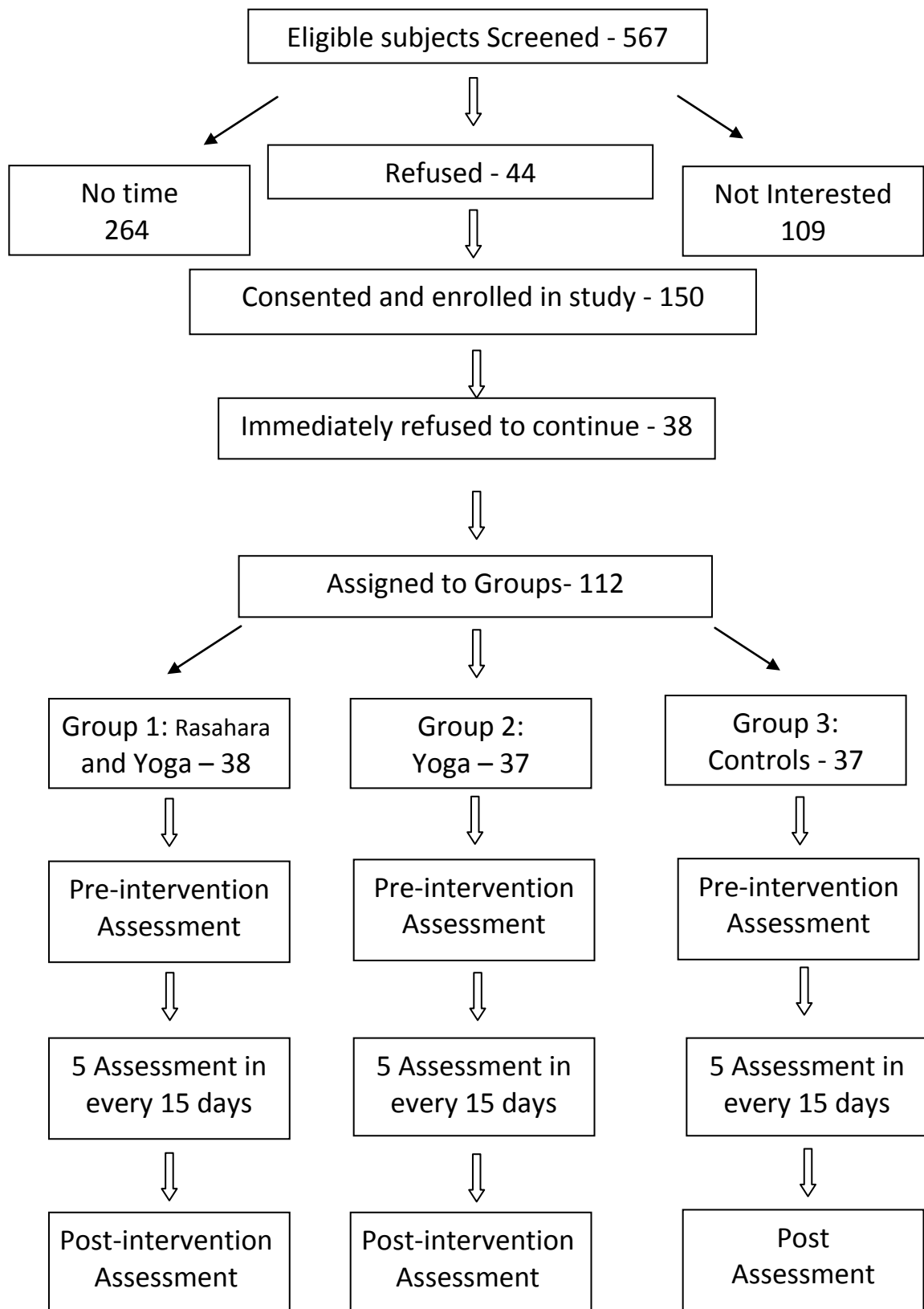
FIGURE 7.0.1: RECRUITMENT OF PARTICIPANTS:

TABLE 7.0.2 PRE-POST MEANS ± SDs FOR ALL 15 BIOMEDICAL VARIABLES						
Group	Group 1		Group 2		Group 3	
Variables ↓	Pre	Post	Pre	Post	Pre	Post
FBS	111.31 ± 12.68	90.18*** ± 21.41	121.45 ± 29.46	100.83*** ± 30.66	117.32 ± 20.52	142.83*** ± 42.01
PPBS	144.39 ± 29.56	129.36*** ± 35.76	146.78 ± 46.84	140.64 ± 50.00	146.81 ± 38.07	168.43*** ± 50.80
HbA1c	5.59 ± 0.52	5.56*** ± 0.51	5.88 ± 0.88	5.90 ± 0.71	5.58 ± 0.58	5.94*** ± 0.51
VLDL	28.77 ± 18.01	28.03 ± 14.22	34.36 ± 20.62	30.30 ± 17.50	32.36 ± 20.26	30.29 ± 17.5
LDL	103.78 ± 36.27	106.57 ± 27.50	107.99 ± 31.33	106.18 ± 28.26	97.89 ± 29.50	106.89* ± 28.26
HDL	39.68 ± 6.49	38.47 ± 8.02	38.85 ± 8.43	38.29 ± 9.09	40.63 ± 8.73	38.02* ± 7.03
Triglycerides	139.88 ± 76.39	143.50 ± 71.50	173.40 ± 106.87	143.62* ± 74.96	150.02 ± 78.05	149.94 ± 58.41
Total Cholesterol	157.55 ± 39.59	151.34 ± 31.01	162.93 ± 36.16	145.97*** ± 35.04	159.08 ± 38.63	159.35 ± 38.63
Creatinine	0.80 ± 0.12	0.65*** ± 0.10	0.83 ± 0.17	0.74*** ± 0.17	0.82 ± 0.14	0.94*** ± 0.27
SBP	124.05 ± 17.61	119.18 (*) ± 8.11	122.27 ± 13.34	118.51 (*) ± 7.58	121.27 ± 15.47	120.01 ± 14.91
DBP	79.36 ± 15.70	77.34 ± 7.05	75.82 ± 14.10	78.38 ± 4.72	79.81 ± 15.37	75.89* ± 11.37
Pulse Rate	81.63 ± 11.58	71.97*** ± 4.05	82.29 ± 10.40	73.48*** ± 5.40	76.94 ± 16.25	78.16 ± 13.59
Hb	13.13 ± 2.32	14.85*** ± 2.24	14.65 ± 2.06	14.56 ± 2.01	14.15 ± 2.22	13.92 ± 2.12
pH	6.01 ± 0.29	6.27*** ± 0.44	6.03 ± 0.31	6.09 ± 0.37	6.04 ± 0.36	6.03 ± 0.53
BHT	15.08 ± 3.06	20.10*** ± 4.13	14.65 ± 3.07	18.78*** ± 4.00	15.08 ± 2.77	14.62 ± 3.63

Table 7.0.2 Caption: Table 7.0.2 shows pre-post means and SDs of all 15 Biomedical parameters.

Abbreviations: FBS- Fasting Blood Sugar, PPBS- Post Prandial Blood Sugar, HbA1c- Glycated Haemoglobin, VLDL- Very Low Density Lipoprotein, LDL- Low Density Lipoprotein, HDL- High Density Lipoprotein, DBP- Diastolic Blood Pressure, SBP- Systolic Blood Pressure, pH- Blood Acidity / Alkalinity, Hb- Haemoglobin, BHT- Breath Holding Time.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

TABLE 7.0.3 SIGNIFICANCES OF WITHIN-GROUP CHANGES ON ALL VARIABLES						
Group →	Group 1		Group 2		Group 3	
Variables ↓	t-value	p-value	t-value	p-value	t-value	p-value
FBS	6.15	0.0001	3.83	0.0005	6.06	0.0001
PPBS	6.2	0.0001	0.2979	0.15	6.02	0.0001
HbA1c	6.2	0.0001	0.2979	0.15	6.02	0.0001
Creatinine	21.70	0.0001	2.27	0.025	2.40	0.02
VLDL	0.19	0.843	0.91	0.36	0.470	0.639
LDL	0.3779	0.7066	0.26	0.79	1.340	0.184
HDL	0.723	0.472	0.27	0.78	1.416	0.161
Triglycerides	0.21	0.8317	0.82	0.41	0.005	0.996
Total Chol	0.76	0.45	2.048	0.044	0.030	0.976
SBP	1.54	0.1258	1.49	0.14	0.356	0.722
DBP	0.72	0.47	1.04	0.29	0.183	0.985
Pulse Rate	4.85	0.0001	4.57	0.0001	0.457	0.65
Hb	3.28	0.001	0.19	0.85	0.455	0.65
pH	3.04	0.003	0.75	0.45	0.094	0.924
BHT	6.02	0.0001	4.98	0.0001	0.613	0.542

Table 7.0.3 Caption: Table 7.0.3 displays ‘t’ & ‘p’ values of all 15 Biomedical Parameters
Abbreviations Table 7.0.3: FBS- Fasting blood sugar, PPBS- Post Prandial blood sugar, HbA1c Glycated Haemoglobin, VLDL- Very Low Density Lipoprotein, LDL- Low Density Lipoprotein, HDL- High Density Lipoprotein, Total Chol- Total Cholesterol, SBP- Systolic Blood Pressure, DBP- Diastolic Blood Pressure, Hb- Haemoglobin, pH Acid/Alkaline Balance, BHT- Breath holding time.
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

7.1 RESULTS FOR DIABETES PARAMETERS

Pre-post changes in T2DM parameters, FBS, PPBS and HbA1c are presented in Table 7.1.1 and set out graphically in Figure 7.1.1 for FBS, Figure 7.1.2 for PPBS, and Figure 7.1.3 for HbA1c.

TABLE 7.1.1: PRE- AND POST- BLOOD SUGAR VALUES

MEASURE ↓	Group 1	Group 2	Group 3
FBS Pre	111.3±12.7	121.5±29.5	117.3±20.5
FBS Post	90.2±21.4	100.8±30.7	121.7±29.2
Significance p	< 0.0001	0.0005	NS
PPBS Pre	144.4±29.6	146.8±46.8	146.8±38.1
PPBS Post	129.36±35.8	140.65±50.0	159.81±40.1*
Significance p	< 0.0001	NS	0.011

Table 7.1.1 Caption: Table 7.1.1 presents pre- & post- FBS and PPBS values, but * post data anomalies led to the 75-day value being used. Even so Group 3 showed a significant, **p = 0.05**, *increase* in value.

Abbreviations: 7.1.1- FBS means Fasting Blood Sugar, PPBS means Post Prandial Blood Sugar.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga, Group 3- Control

Figures 7.1.1, 7.1.2 and 7.1.3 show how Group 1, *Rasāhāra* and Yoga, and Group 2, Yoga only, decreased values of FBS and PPBS during and at the end of the intervention, with Group 1 ending lowest ($p < 0.0001$), while Group 3 increased. However, Group-time interaction analysis found that the decrease in FBS for Group 1, from 113.3 to 90.2 (-21.1), was not significantly different from that for Group 2, from 121.4 to 100.8 (-20.6) ($p < 0.0001$). For PPBS, on the other hand, the Group 1 final value, 129.4, was significantly different from that of Group 2, 140.6. While Group 3's PPBS increased significantly (p value < 0.0001).

In the case of Group 3, gross anomalies in Day 90 FBS data for several group members indicated that fasting conditions were not uniformly observed for the last data point, with similar, smaller increases for PPBS. Day 75 data were therefore considered more appropriate

for Pre-Post estimates for the Group, especially as values had remained stable for a month. Groups changes attained significance for PPBS, an increase of 9.62 ± 21.83 , ($p=0.011$), but not for FBS, an increase of 4.36 ± 25.6 ($p = 0.307$).

Differences in initial values of FBS and PPBS were not significant; within group changes were given in Tables 7.0.2 and 7.0.3: Group 1 FBS, PPBS & Group 2 FBS, all 1-sample $p < 0.0001$; Group 2 PPBS and Group 3 FBS, Not Significant, $p > 0.05$; Group 3 PPBS showed a significant *increase* for (Day 75 - Day 1) changes, $p = 0.01$, used because of anomalies (outliers) in Group 3 Day 90, post, data.

FIGURE 7.1.1: PRE-POST CHANGES IN FBS FOR THE THREE GROUPS

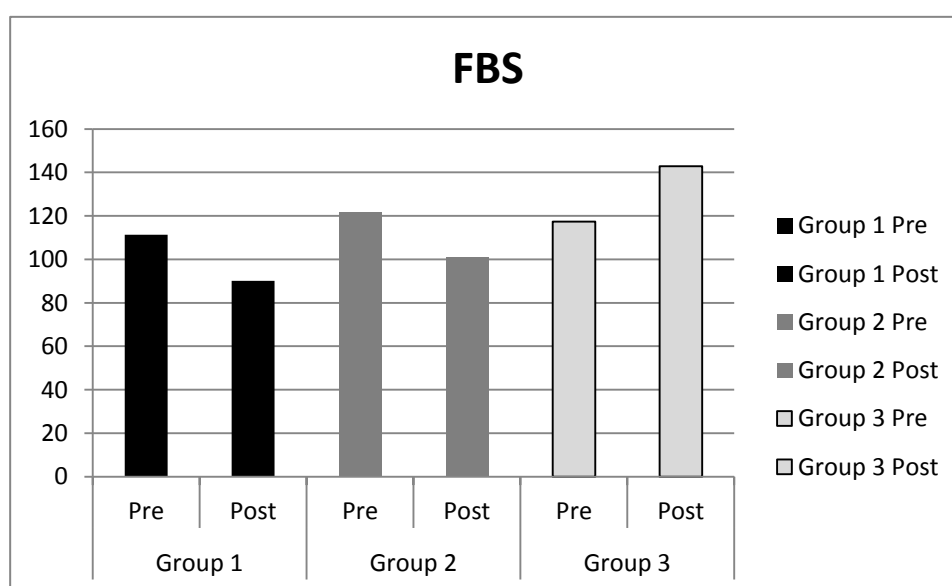
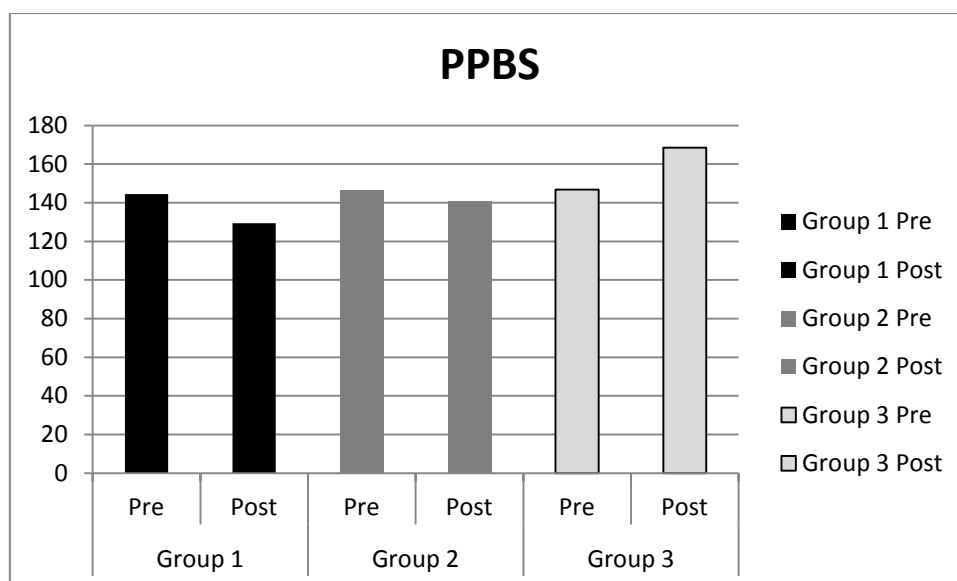
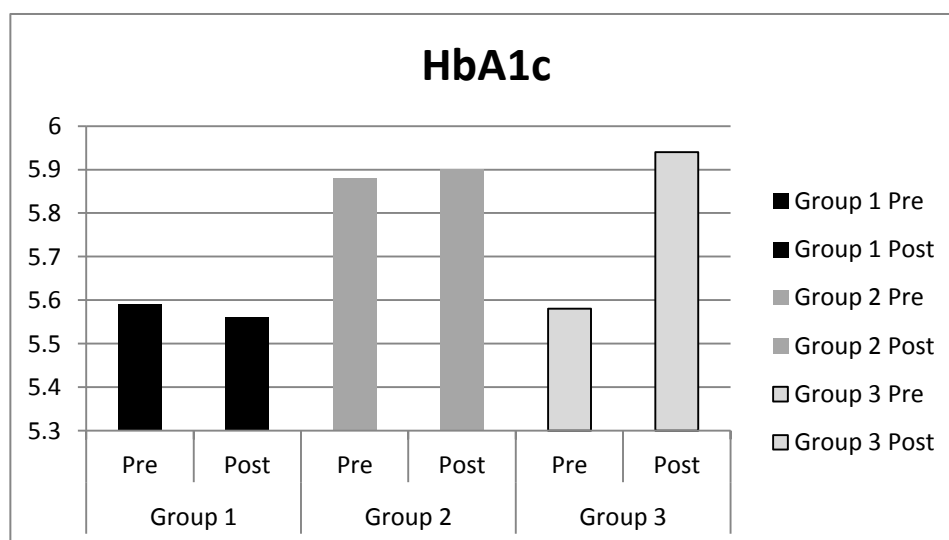


Figure 7.1.1 Caption: Comparative values of FBS for Groups 1, 2 and 3

Abbreviation: FBS- Fasting Blood Sugar

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.1.2: PRE-POST CHANGES IN PPBS FOR THE THREE GROUPS**Figure 7.1.2 Caption:** Comparative values of PPBS for Groups 1, 2 and 3**Abbreviation:** PPBS- Post Prandial Blood Sugar**Groups:** Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control**FIGURE 7.1.3: PRE- POST CHANGES IN HbA1c FOR THE THREE GROUPS****Figure 7.1.3 Caption:** Comparative Values of HbA1c for Groups 1, 2 and 3**Abbreviation:** HbA1c- Glycated Haemoglobin**Groups:** Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- ControlFor HbA1c, changes in Group 1 were -0.044 ± 0.059 , ($p=0.0002$), in Group 2, $+0.024 \pm 0.456$ (NS), and Group 3 $+0.365 \pm 0.369$ ($p<0.0001$) as set out in Table 7.1.3. While Group 1

changes in HbA1c were statistically significant, they are too small to be of immediate clinical value.

Table 7.1.4 sets out group-time interaction comparisons between the three groups. These attained significance for both Group 1 and Group 2 with respect to Group 3 on all variables, but not between Groups 1 and 2. They show that Group 1 HbA1c changes were clinically valuable compared to those for Group 3.

TABLE 7.1.4 GROUP-TIME INTERACTIONS FOR THE 3 DIABETES PARAMETERS

Parameter	FBS		PPBS		HbA1c	
	't'-value	p-value	't'-value	p-value	't'-value	p-value
1 and 2	1.42	0.15	0.08	0.93	0.87	0.38
1 and 3	8.51	0.0001	8.54	0.0001	6.78	0.0001
2 and 3	4.09	0.0001	6.75	0.0001	4.01	0.0001

Table 7.1.4 Caption: Table 7.1.4 presents statistical significances of the comparisons between within-group changes in mean values of the 3 blood sugar parameters, FBS, PPBS & HbA1c.

Abbreviations: FBS- Fasting Blood Sugar, PPBS- Post Prandial Blood Sugar, HbA1c- Glycated Haemoglobin

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

It is notable that Table 7.1.4 shows consistently higher 't' values between Groups 1 and 3 than those between Groups 2 and 3, suggesting that the *Rasahara* was having an effect that would have become significant with more numbers. This is also consistent with the small trend shown between Groups 1 and 2.

7.2 CHANGES IN DIABETES MARKERS ON CHANGE OF SEASON

Participants' FBS and PPBS values were taken every 15 days. Table 7.2.1 presents their values in standard units of mg/dl, while graphs of the means are presented in Figures 7.2.1 and 7.2.2 respectively. In both Figures, the graphs for all Groups show two different trend lines, with a distinct discontinuity after the third measurement. This striking aspect of the two figures was not hypothesized, its significance became clear from *post-hoc* analysis; it turns out to have a simple interpretation: The fourth of the seven sets of measurements, made on the 45th day, 23rd June, was taken three days after the onset of the 2015 monsoon, which arrived in Bhopal on 20th June, 2015. The discontinuities in FBS and PPBS data at that time (see Figures 7.2.1 and 7.2.2), representing increases in both variables for all three groups, can be attributed to the change in climate.

For Group 1, the change over the first four readings, from 144.4 to 106.1 (-38.3), was greater than the decrease for Group 2 over the same time period, 146.8 to 119.9 (-26.9) for Group 2. Group 2 pre-post decreases in FBS (20.6 ± 32.7) attained significance ($p = 0.0005$), but those for PPBS (6.13 ± 35.30) did not, although the Day 45 (3 days after start of the monsoon) decrease of -26.8 when Group 2 reached its lowest PPBS value of 119.9 ± 48.24 was significant, the decrease of -26.86 ± 37.61 yielding a one sample t value of $t = 4.34$, $p < 0.0001$.

TABLE 7.2.1: VALUES OF DIABETES PARAMETERS, FBS & PPBS, EVERY 15 DAYS						
	Group 1		Group 2		Group 3	
	FBS	PPBS	FBS	PPBS	FBS	PPBS
Day 1	111.316 ± 12.6835	144.395 ± 29.5603	121.459 ± 29.4615	146.784 ± 46.8414	117.324 ± 20.5251	146.811 ± 38.0722
Day 15	102.684 ±13.0303	120.842 ± 29.4127	115.730 ± 23.4232	131.027 ± 45.9417	116.243 ± 21.5644	146.324 ± 40.1995
Day 30	97.974 ± 14.4736	114.079 ± 30.0633	111.324 ± 23.7019	127.405 ± 44.0527	113.649 ± 21.3596	146.432 ± 41.2732
Day 45	103.026 ± 11.6607	106.132 ± 32.9915	114.514 ± 20.5056	119.919 ± 48.2444	124.541 ± 26.6527	151.838 ± 39.0046
Day 60	96.711 ± 11.6941	129.816 ± 19.7332	108.189 ± 19.1585	141.405 ± 43.1345	120.919 ± 23.6800	156.622 ± 40.0918
Day 75	88.474 ± 18.2827	129.816 ± 19.7332	102.243 ± 27.0959	141.405 ± 43.1345	121.676 ± 29.2347	156.622 ± 40.0918
Day 90	90.184 ± 21.4172	129.368 ± 35.7661	100.838 ± 30.6698	140.649 ±50.0079	142.838 ± 42.0195	168.432 ±50.8011
Pre-Post	21.13	14.97	20.62	6.14	-4.35	-9.81
1sample t p	0.0001	0.0001	0.0005	NS (0.30)	NS	0.0022

Table 7.2.1 caption: Table 7.2.1 presents the FBS and PPBS values taken every 15 days showing the discontinuities in the fourth reading on Day 45.

Abbreviation: 7.2.2- FBS means Fasting Blood Sugar, PPBS means Post Prandial Blood Sugar.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.2.1: CHANGES IN FBS EVERY 15 DAYS DURING THE INTERVENTION

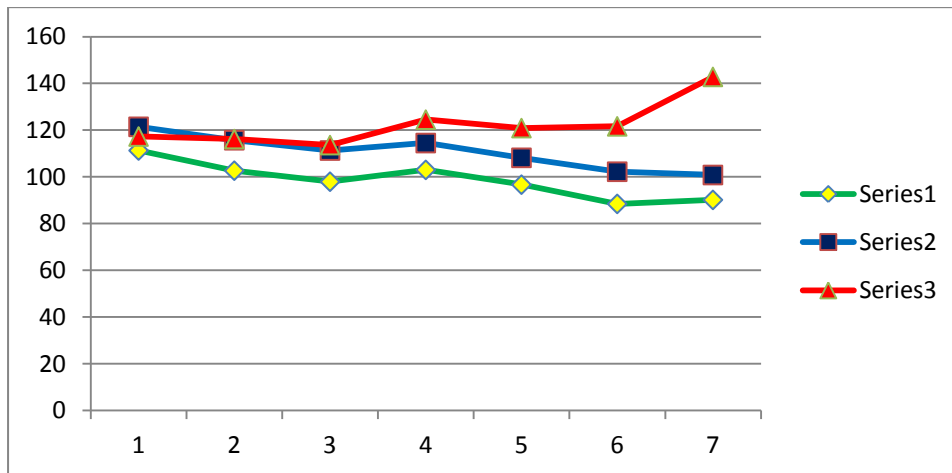


Figure 7.2.1 Caption: Figure 7.2.1 depicts Groups 1 to 3 FBS values every 15 days after the start of the intervention. Groups 1 and 2, indicated as Series 1 and Series 2 respectively, decrease steadily, increasing at point 4. Group 3 remains relatively flat compared to the other two, with a similar increase at point 4.

FIGURE 7.2.2: CHANGES IN PPBS EVERY 15 DAYS DURING INTERVENTION

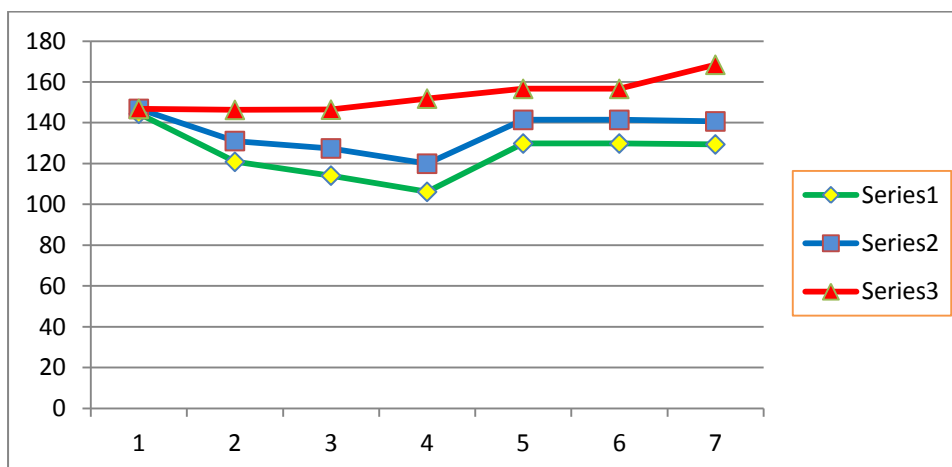


Figure 7.2.2 Caption: Figure 7.2.2 depicts PPBS values for Groups 1, 2 & 3 every 15 days from the start of the intervention. Groups 1 and 2, shown in Series 1 and Series 2 respectively, decrease increasing at point 5, and remaining flat thereafter. Group 3 remains quite flat increasing slightly from points 3 to 5.

7.3 LIPIDS

The five lipid variables, VLDL, LDL, HDL, Triglycerides and Total Cholesterol, were only assessed Pre-Post the intervention as set out in Table 7.0.2. Here they are given in Table 7.3.1.

Group →	Group 1		Group 2		Group 3	
Parameter ↓	Pre	Post	Pre	Post	Pre	Post
VLDL	28.77 ± 18.01	28.03 ± 14.22	34.36 ± 20.62	30.30 ± 17.50	32.36 ± 20.26	30.29 ± 17.5
LDL	103.78 ± 36.27	106.57 ± 27.50	107.99 ± 31.33	106.18 ± 28.26	97.89 ± 29.50	106.89* ± 28.26
HDL	39.68 ± 6.49	38.47 ± 8.02	38.85 ± 8.43	38.29 ± 9.09	40.63 ± 8.73	38.02* ± 7.03
Triglycerides	139.88 ± 76.39	143.50 ± 71.50	173.40 ± 106.87	143.62* ± 74.96	150.02 ± 78.05	149.94* ± 58.41
Total Cholesterol	157.55 ± 39.59	151.34 ± 31.01	162.93 ± 36.16	145.97*** ± 35.04	159.08 ± 38.63	159.35 ± 38.63

Table 7.3.1 Caption: Table 7.3.1 displays the means and SDs of the 5 Lipid Parameters
Abbreviations: VLDL- Very Low Density, LDL- Low Density & HDL- High Density Lipoprotein.
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

for which no significant changes were seen on individual values except for Triglycerides ($p < 0.05$) and Total Cholesterol ($p < 0.001$) in Group 2, both of which had anomalously high initial values, and HDL ($p < 0.05$) in Group 3. Other values in Groups 1 & 2 tended to move towards, or stay in, healthy ranges, while Group 3 did not. Table 7.3.2 sets out the significance of comparisons of within groups changes of each of these five lipid parameters, their Group-Time Interactions.

TABLE 7.3.2 GROUP-TIME INTERACTIONS FOR THE 5 LIPID VARIABLES										
Parameter Groups ↓	VLDL		LDL		HDL		Triglycerides		Total Cholest.	
	1 and 2	1.25	0.21	0.54	0.59	0.48	0.63	1.57	0.12	0.61
1 and 3	0.81	0.42	0.77	0.44	0.54	0.59	0.57	0.57	0.17	0.87
2 and 3	0.42	0.68	1.43	0.16	0.89	0.38	1.07	0.28	0.44	0.66

Table 7.3.2 Caption: Table 7.3.2 displays Group-Time Interactions for the five lipid parameters

Abbreviations: VLDL- Very Low Density Lipoprotein LDL- Low Density Lipoprotein, HDL- High Density Lipoprotein, Total Cholest.- Total Cholesterol.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

Figures 7.3.1 to 7.3.5 display Pre-Post changes for the various classes of lipids for Groups 1 to 3.

FIGURE 7.3.1: PRE- POST CHANGES IN VLDL FOR THE THREE GROUPS

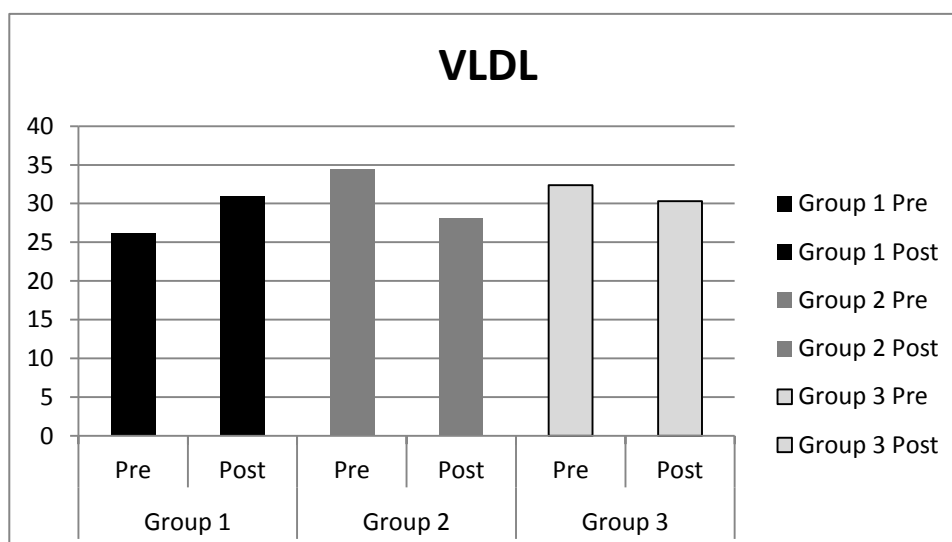


Figure 7.3.1 Caption: Figure 7.3.1 presents pre-post changes in VLDL in the three Groups

Abbreviation: VLDL- Very Low Density Lipoprotein

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.3.2: PRE- POST CHANGES IN LDL FOR THE THREE GROUPS

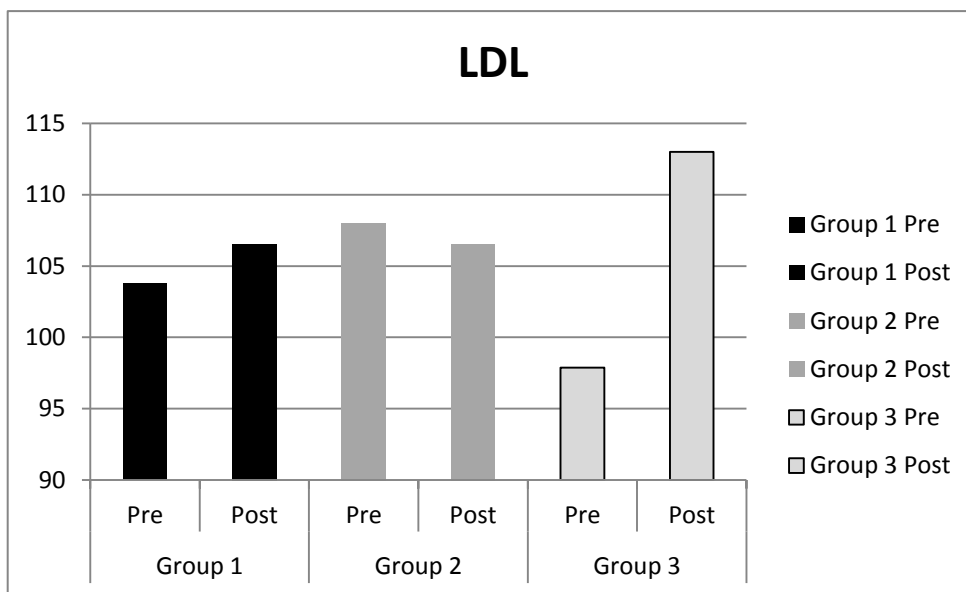


Figure 7.3.2 Caption: Figure 7.3.2 presents pre-post changes in LDL in the three Groups
Abbreviation: LDL- Low Density Lipoprotein
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.3.3: PRE- POST CHANGES IN HDL FOR THE THREE GROUPS

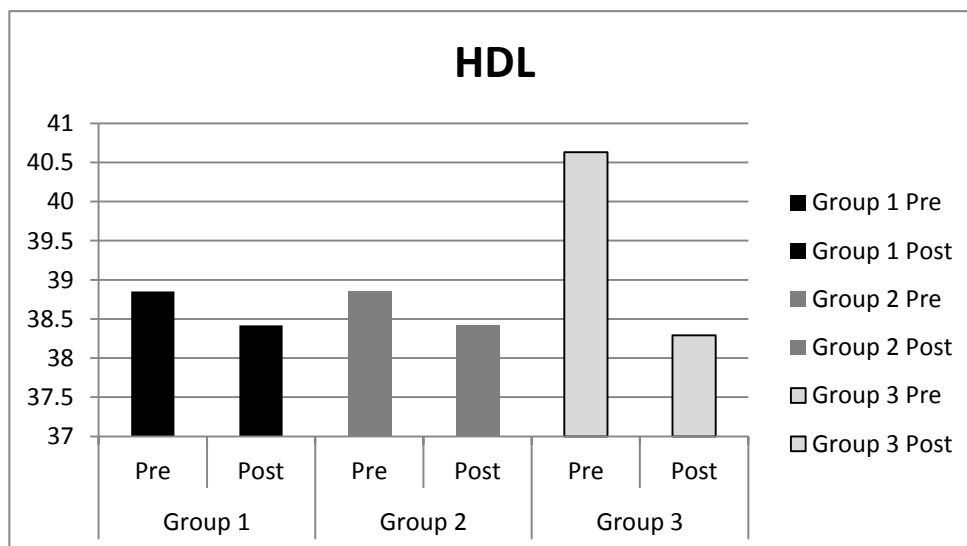


Figure 7.3.3 Caption: Figure 7.3.3 presents pre-post changes in VLDL in the three Groups
Abbreviation: HDL- High Density Lipoprotein
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

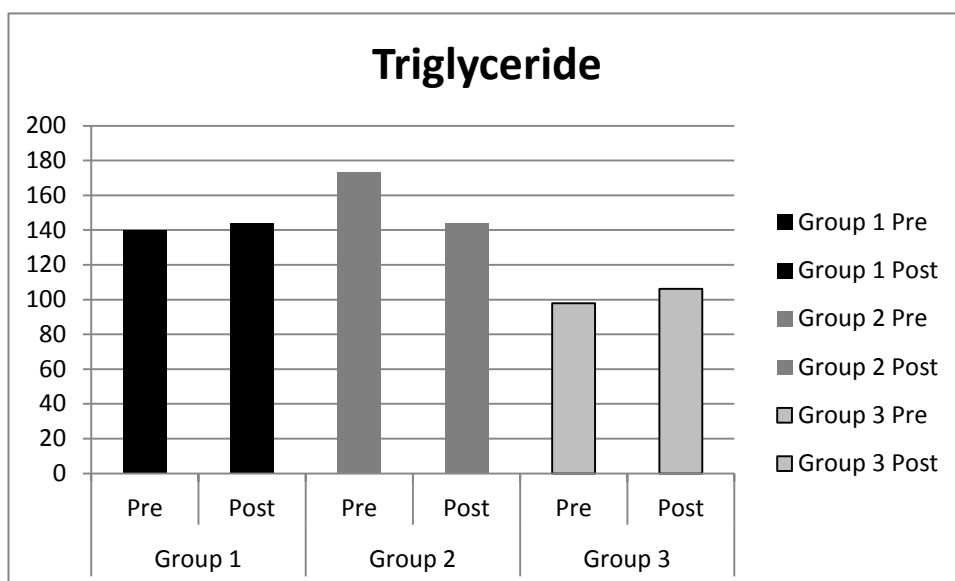
FIGURE 7.3.4: PRE- POST CHANGES IN TRIGLYCERIDES FOR THE 3 GROUPS

Figure 7.3.4 Caption: Figure 7.3.4 presents pre-post changes in Triglycerides in the three Groups
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

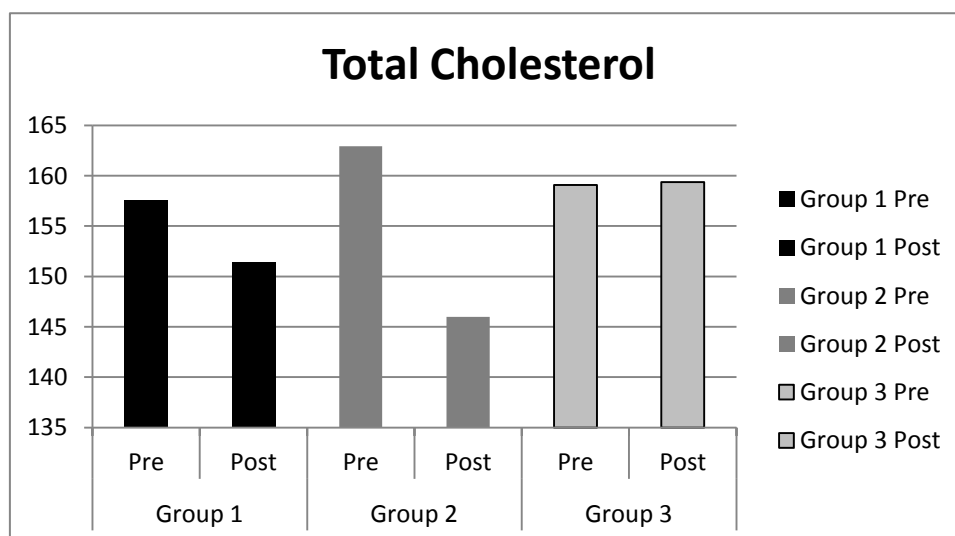
FIGURE 7.3.5: CHANGES IN TOTAL CHOLESTEROL FOR THE 3 GROUPS

Figure 7.3.5 Caption: Figure 7.3.5 presents pre-post changes in Total Cholesterol in the three Groups
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

Table 7.3.2 sets out the significance of comparisons of within groups changes of each of these five lipid parameters, their Group-Time Interactions. None reached significance.

TABLE 7.3.2 GROUP-TIME INTERACTIONS FOR THE 5 LIPID VARIABLES										
Parameter Groups ↓	VLDL		LDL		HDL		Triglycerides		Total Cholesterol	
	't'	'p'	't'	'p'	't'	'p'	't'	'p'	't'	'p'
1 and 2	1.25	0.21	0.54	0.59	0.48	0.63	1.57	0.12	0.61	0.54
1 and 3	0.81	0.42	0.77	0.44	0.54	0.59	0.57	0.57	0.17	0.87
2 and 3	0.42	0.68	1.43	0.16	0.89	0.38	1.07	0.28	0.44	0.66

Figure 7.3.2 Caption: Figure 7.3.2 displays Group-Time Interactions for the five lipid parameters
Abbreviations: VLDL- Very Low Density, LDL- Low Density, HDL- High Density Lipoprotein,
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

7.4 CREATININE

Pre- and Post- Creatinine levels and their differences are presented in Table 7.4.1. Both Group 1 (*Rasāhāra* Herbal Juices and Yoga) and Group 2 (Yoga only) decreased in creatinine levels, the first by 0.15 ± 0.06 and the second by 0.09 ± 0.06 (Mean \pm 2SE's), with $p < 0.0001$ for both. In Group 3, creatinine level increased by 0.12 ± 0.07 , also with good significance. All statistics are one sample t tests).

TABLE 7.4.1: CHANGES IN CREATININE LEVELS FOR THE 3 GROUPS

Group → Parameter ↓	Group 1		Group 2		Group 3	
	Pre	Post	Pre	Post	Pre	Post
Mean Creatinine	0.80	0.65	0.83	0.74	0.82	0.94
SD	± 0.12	± 0.10	± 0.17	± 0.16	± 0.14	± 0.27
Change	0.152 ± 0.10		0.091 ± 0.106		$+0.124 \pm 0.12$	
Significance: t / p	9.4 / 0.0001		5.09 / 0.0001		2.55 / 0.0013	

Table 7.4.1 Caption: Table 7.4.1 shows mean SD and p/t values of Creatinine
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

Results of tests for Group-Time Interaction differences are given in Table 7.4.2. The three groups all differed significantly from each other as reflected in the good statistical significances obtained.

TABLE 7.4.2: GROUP-TIME INTERACTIONS FOR CREATININE SIGNIFICANCES OF BETWEEN GROUP DIFFERENCES

Group	't'-value	p-value
1 and 2	2.55	0.0128
1 and 3	10.83	< 0.0001
2 and 3	8.17	< 0.0001

Figure 7.4.2 Caption: Figure 7.4.2 displays Group-Time Interactions for Creatinine
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

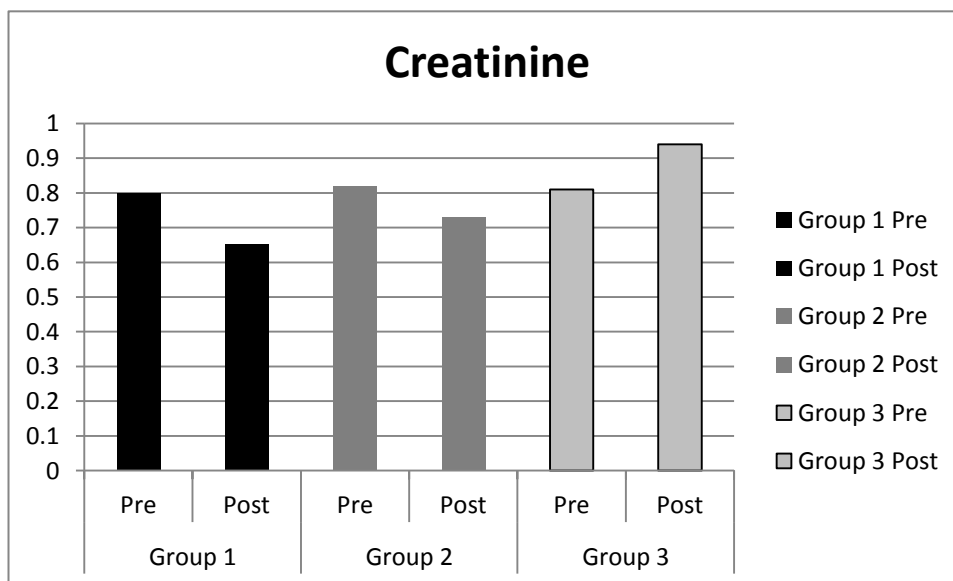
FIGURE 7.4.1: CHANGES IN CREATININE FOR THE THREE GROUPS

Figure 7.4.1 Caption: Figure 7.4.1 presents pre-post changes in Creatinine for the three Groups

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

7.5 BLOOD PRESSURE AND PULSE RATE VARIABLES

Group → Parameter ↓	Group 1		Group 2		Group 3	
	Pre	Post	Pre	Post	Pre	Post
SBP	124.05 ± 17.61	119.18 (*) ± 8.11 [^]	122.27 ± 13.34	118.51 (*) ± 7.58 ^{***}	121.27 ± 15.47	120.01 ± 14.91
DBP	79.36 ± 15.70	77.34 ± 7.05 [^]	75.82 ± 14.10	78.38 ± 4.72 [^]	79.81 ± 15.37	75.89* ± 11.37
Pulse Rate	81.63 ± 11.58	71.97 ^{***} ± 4.05 [^]	82.29 ± 10.40	73.48 ^{***} ± 5.40 [^]	76.91 ± 16.23	78.16 ± 13.58

Table 7.5.1 Caption: Table 7.5.1 presents Pre-Post values of Systolic and Diastolic Blood Pressure and Pulse Rate. Significant changes in means and standard deviations are denoted * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, and, for reductions in standard deviation using Fisher's 'F' test, for which Groups 1 and 2 highly significant changes, $p < 0.0001$, are of particular interest, and indicated by [^]. **Abbreviations:** SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; Hb1Ac, Glycosylated Hb.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control.

Significant changes in both variable means and variances were observed. Systolic blood pressure (SBP) changed from 124.05 ± 17.61 to $119.18^* \pm 8.11^{\wedge}$ for Group 1, with * by the second mean indicating $p < 0.05$ on a one sample t test, while the [^] by the second standard deviation indicates $p < 0.0001$ for the F test); Group 2 changed from 122.27 ± 13.34 to $118.51^* \pm 7.58^{\wedge}$ with the same significances indicated; Group 3 changes did not reach significance. Diastolic blood pressure (DBP) changes for Group 1 were 79.36 ± 15.70 to $77.34 \pm 7.05^{\wedge}$, with the same significances; for Group 2, 75.82 ± 14.10 to $78.38 \pm 4.72^{\wedge}$; and Group 3 from 80.58 ± 14.84 to $76.11^* \pm 11.45$ with the surprising $p < 0.05$ significance for change of mean. Group 1 Pulse Rate decreased from 81.63 ± 11.58 to $71.97^{***} \pm 4.05^{\wedge}$, (same significance meanings); Group 2, from 82.29 ± 10.40 to $73.48^{***} \pm 5.40^{\wedge}$; but Group 3 changes were not significant. These changes are graphically portrayed in Figure 7.5.1, depicting pre-post changes in SBP, Figure 7.5.2, depicting pre-post changes in DBP, and Figure 7.5.3 depicting pre-post changes in Pulse Rate.

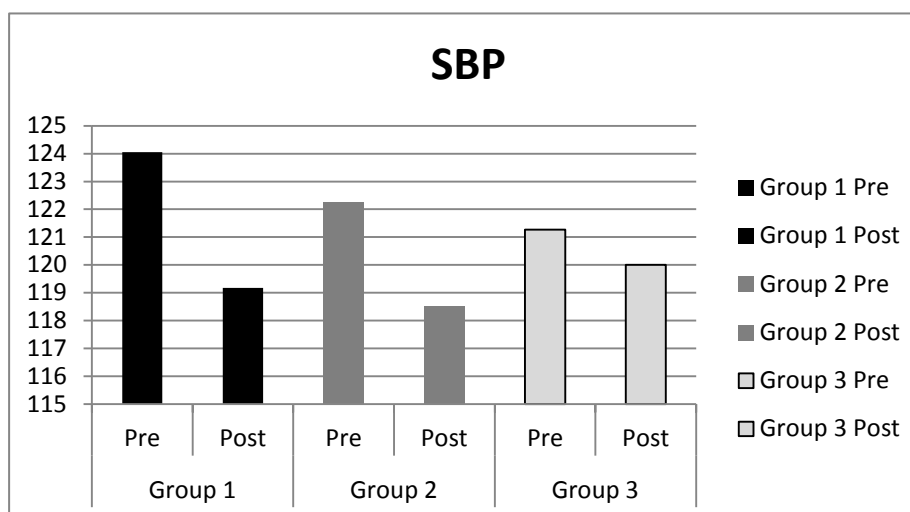
FIGURE 7.5.1: PRE- POST CHANGES IN SBP FOR THE THREE GROUPS

Figure 7.5.1 Caption: Figure 7.5.1 presents pre-post changes in Systolic Blood Pressure for the 3 Groups

Abbreviation: SBP- Systolic Blood Pressure

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

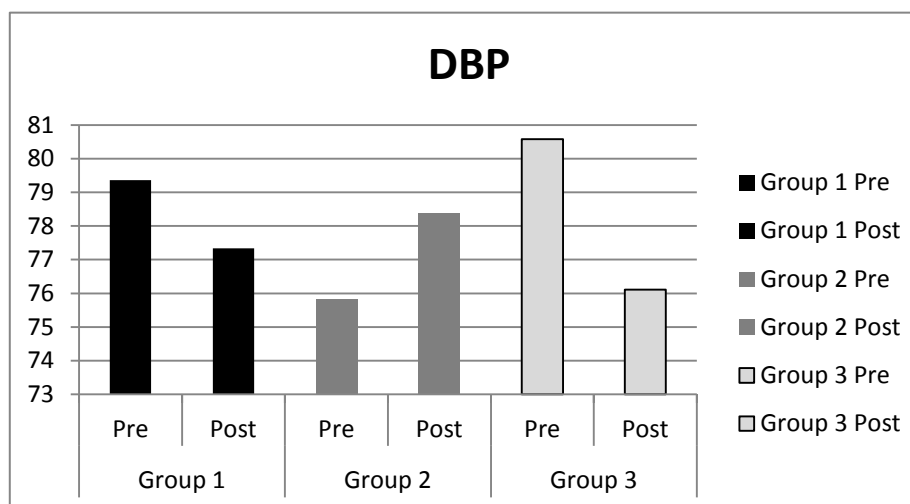
FIGURE 7.5.2: PRE- POST CHANGES IN DBP FOR THE THREE GROUPS

Figure 7.5.2 Caption: Figure 7.5.2 presents pre-post changes in Diastolic Blood Pressure in the 3 Groups

Abbreviation: DBP- Diastolic Blood Pressure

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.5.3: CHANGES IN SBP EVERY 15 DAYS DURING THE INTERVENTION

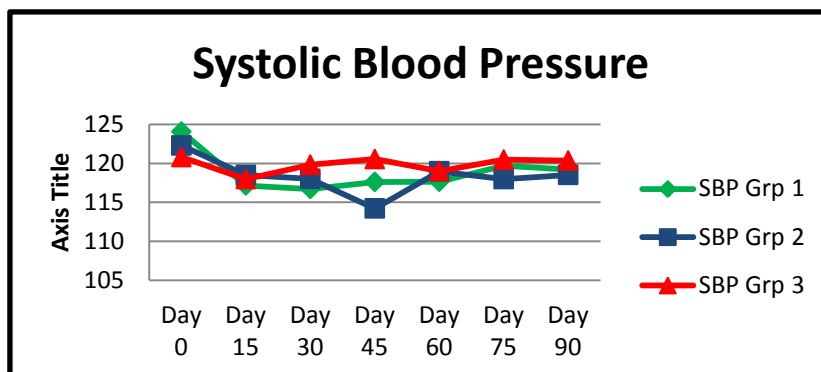


Figure 7.5.3 Caption: Figure 7.5.3 depicts Systolic Blood Pressure values of Groups 1 to 3 every 15 days during the intervention, indicated respectively as Group 1 (Green), Group 2 (Blue) and Group 3 (Red).

Abbreviation: SBP- Systolic Blood Pressure

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control Figure 7.5.3, indicates SBP values of Groups 1, 2 and 3, by SBP Grp1 (Green), SBP Grp 2 (Blue), and SBP Grp 3 (Red). Graphs are similar, but there is greater decrease for Groups 1 & 2.

FIGURE 7.5.4: CHANGES IN DBP EVERY 15 DAYS DURING THE INTERVENTION

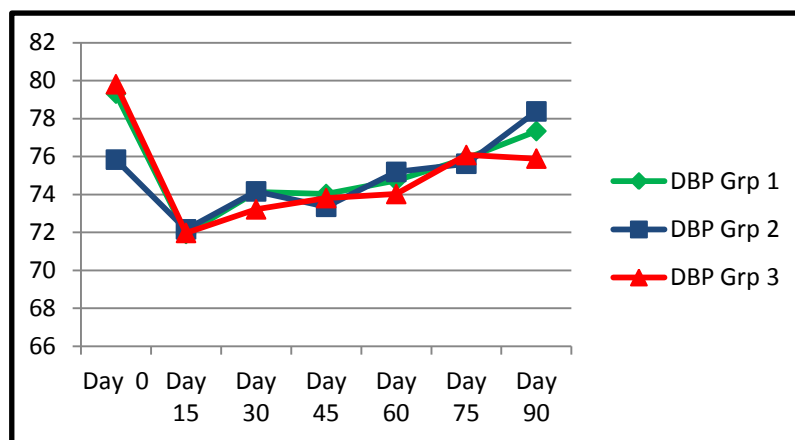


Figure 7.5.4 Caption: Figure 7.5.4 depicts DBP values of Groups 1 to 3 every 15 days during the intervention, indicated respectively as Group 1 (Green), Group 2 (Blue) and Group 3 (Red).

Abbreviation: DBP- Diastolic Blood Pressure

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

Figure 7.5.4, indicates DBP values of Groups 1, 2 and 3, by DBP Grp1 (Green), DBP Grp 2 (Blue), and DBP Grp 3 (Red), respectively. After a strong dip to the second measure at day 15, rebounding a little at day 30, DBP values remained fairly flat, with an increase at point 7 for Groups 1 and 2.

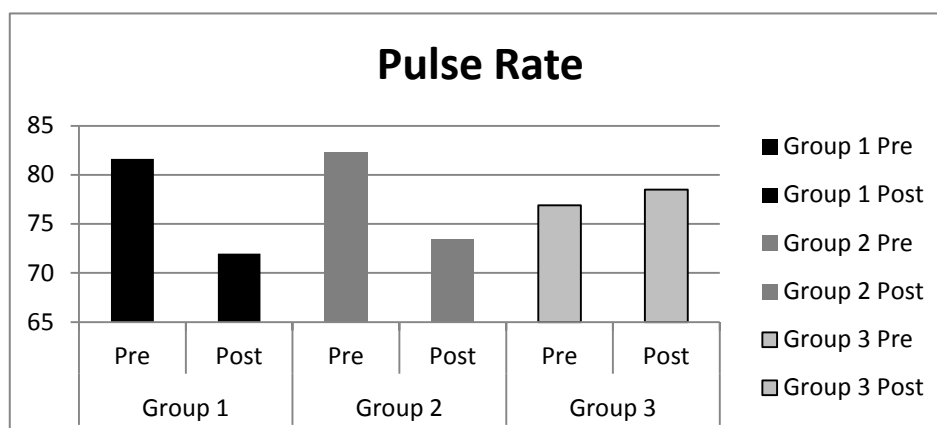
FIGURE 7.5.5: PRE- POST CHANGES IN PULSE RATE FOR THE 3 GROUPS

Figure 7.5.5 Caption: Figure 7.5.5 presents pre-post changes in Pulse Rate in the three Groups
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga, Group 3- Control

TABLE 7.5.2 GROUP-TIME INTERACTIONS FOR THE 3 BLOOD PARAMETERS						
Parameter Group ↓	SBP		DBP		PULSE RATE	
Group 1	4.86 ± 18.18		1.97 ± 16.00		-9.65 ± 10.12	
Group 2	3.75 ± 13.06		2.54 ± 13.46		- 8.81± 9.21	
Group 3	0.43 ± 10.34		3.92 ± 11.17		1.18 ± 11.63	
	GROUP		TIME		INTERACTIONS	
Groups ↓	't'-value	p-value	't'-value	p-value	't'-value	p-value
1 and 2	0.303	0.76	0.17	0.87	0.38	0.71
1 and 3	1.29	0.20	0.61	0.54	4.31	< 0.0001
2 and 3	1.21	0.23	0.48	0.63	4.10	0.0001

Table 7.5.2 Caption: Table 7.5.2 presents Group-Time Interactions of the Blood Physiology Parameters, SBP, DBP & Pulse Rate.

Abbreviations: SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga, Group 3- Control

7.6 HAEMOGLOBIN (Hb) AND ACIDITY (pH)

Haemoglobin was measured Pre and Post the intervention, on Days 0 and 90 only. Pre-Post values for Groups 1, 2, and 3, were given in Table 7.0.2, and their one-sample, Students ‘t’ test values, and corresponding significance ‘p’ values were presented in Table 7.0.3. Here we present that data again for convenience, first displayed in a bar graph in Figure 7.5.1, and then in Table 7.5.1.

FIGURE 7.6.1: CHANGES IN HEMOGLOBIN FOR THE THREE GROUPS

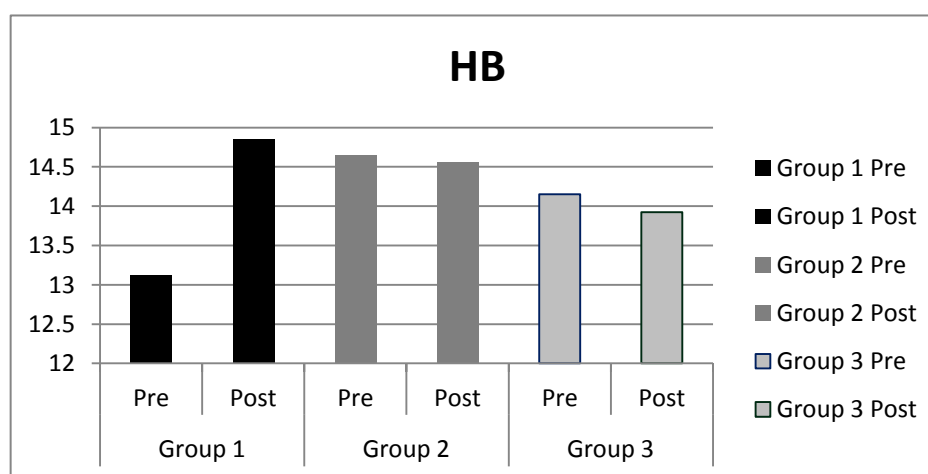


Figure 7.6.1 Caption: Figure 7.6.1 presents pre-post changes in Haemoglobin in the 3 Groups **Abbreviation:** HB- Haemoglobin

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

The findings on haemoglobin have import implications, because the only group with a significant increasing trend was the *Rasāhāra* group, Group 1, for which one of the four herbs Wheatgrass (*Triticum Aestivum*) is well known to have good available iron content, and for which the porphyrin ring in the chlorophyll can be used to help by transforming it into the haeme ring in haemoglobin. As shown in Table 7.5.1 below, the results for Group 1, the *Rasāhāra* and yoga group, were highly significant both statistically and clinically. In some situations, such as antenatal care, a reliable biological source of iron could save large numbers of lives, especially in rural India.

TABLE 7.6.1: CHANGES IN HAEMOGLOBIN FOR THE THREE GROUPS						
Group →	Group 1		Group 2		Group 3	
Measure ↓	Pre	Post	Pre	Post	Pre	Post
Mean	13.13	14.85**	14.65	14.56	14.15	13.92
St Dev	2.32	±2.24	±2.06	±2.01	±2.22	±2.12
Change	+ 1.725 ± 1.47		- 0.094 ± 1.14		- 0.225 ± 0.92	
Significance	t = 3.017	p = 0.0035	t = - 0.21	p = 0.83 NS	t = - 0.45	p = 0.64 NS

Table 7.6.1 Caption: Table 7.6.1 displays Pre-Post Haemoglobin Means and SDs for the three groups.

Group 1 showed a significant increase in haemoglobin, $t = 3.017$, $p = 0.0035$, while Group 2 showed effectively no change, $t = - 0.21$, $p = 0.83$. In Group 3, the haemoglobin change was not significant either, $t = - 0.45$, $p = 0.64$. Both Groups 2 and 3 showed tiny, if insignificant decreases, and combining them yielded means of 14.40 (Pre) and 14.23 (Post), and $t = 3.79$, $p = 0.0002$. Group Time Interactions between the three groups, (Table 7.6.2), showed that Group 1 performed significantly better than Group 2 or Group 3. Data therefore supports the hypothesis that the combined effects of *Rasahara* (herbal juices and a Yoga intervention, can increase levels of haemoglobin in pre-diabetes patients.

TABLE 7.6.2: GROUP-TIME INTERACTIONS FOR HAEMOGLOBIN SIGNIFICANCES OF BETWEEN GROUP DIFFERENCES

Groups	't'-value	p-value
1 and 2	6.11	< 0.0001
1 and 3	7.01	< 0.0001
2 and 3	1.325	0.189

Table 7.6.2 Caption: Table 7.6.2 displays Group-Time Interactions for Hb

Abbreviation: Hb- Haemoglobin

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

Similarly, data on Acidity (pH) levels in the three groups pre- and post- the intervention was also presented in the pre-post data summary Table 7.0.2, with their t values and significances

of the changes in Table 7.0.3. That data is reproduced in Table 7.6.3 below, together with a bar graph representation in Figure 7.6.2.

TABLE 7.6.3: CHANGES IN ACIDITY (pH) FOR THE THREE GROUPS						
Group →	Group 1		Group 2		Group 3	
Measure ↓	Pre	Post	Pre	Post	Pre	Post
Mean	6.01	6.27	6.03	6.09	6.04	6.03
St Dev	±0.29	±0.44	±0.31	±0.37	±0.36	±0.53
Change	0.26±0.53		0.06±0.457		- 0.01±0.65	
Significance	t = 3.04	p = 0.003	t = 0.75	p = 0.45 ns	t = - 0.094.	p = 0.92 ns

Table 7.6.3 Caption: Table 7.6.3 displays changes in Acidity measurements for the Three Groups
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.6.2: CHANGES IN ACIDITY (PH) FOR THE THREE GROUPS

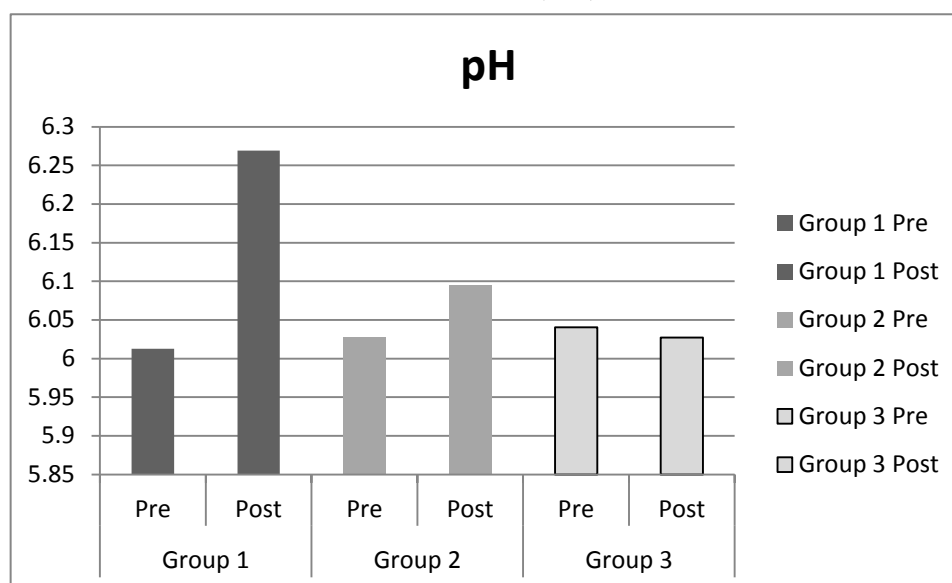


Figure 7.6.2 Caption: Figure 7.6.2 presents Pre-Post changes in Blood pH for the three Groups
Abbreviation: pH- Blood pH, i.e. Acidity / Alkalinity of Blood Plasma
Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

TABLE 7.6.4: GROUP-TIME INTERACTIONS FOR BLOOD ACIDITY (PH) SIGNIFICANCES OF BETWEEN GROUP DIFFERENCES

Groups	't'-value	p-value
1 and 2	2.24	0.0278
1 and 3	2.99	0.011
2 and 3	1.18	0.2411

Table 7.6.4 Caption: Table 7.6.4 displays Group-Time Interactions for pH

Abbreviation: pH- Blood Acidity / Alkaline Balance

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

7.7 BREATH HOLDING TIME

Pre- and Post- Breath Holding Time means and SDs for the three groups are presented in Table 7.7.1. BHT increased in Groups 1 (*Rasāhāra* and Yoga), and Group 2 (Yoga only), by 5.02 ± 1.7 and 4.13 ± 0.93 respectively (significance excellent for both), while they decreased in Group 3 by -0.46 ± 0.86 (all units are cycles/minute), also with good significance (all one sample t tests). Changes are illustrated in the Bar Graph, Figure 7.7.1, while Group-Time Interactions are shown in Table 7.7.2.

TABLE 7.7.1: CHANGES IN BREATH HOLDING TIME FOR THE THREE GROUPS

Group → Parameter ↓	Group 1		Group 2		Group 3	
	Pre	Post	Pre	Post	Pre	Post
Mean BHT	15.08	20.10***	14.65	18.78***	15.08	14.62 NS
SD	± 3.06	± 4.13	± 3.07	± 4.00	± 2.77	± 3.63
Increase	5.02 ± 1.7		4.13 ± 0.93		-0.46 ± 0.86	
Significance: t / p	18.20 / < 0.0001		27.0 / < 0.0001		3.25 / 0.0025	

Table 7.7.1 Caption: 7.8.1 Table shows Group Means and SDs for Breath Holding Time

Abbreviation: BHT- Breath Holding Time.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

Results of t tests for group-time interaction differences are given in Table 7.7.2. The three groups all differed significantly from each other with good statistical significance.

TABLE 7.7.2: GROUP-TIME INTERACTIONS FOR BREATH HOLDING TIME SIGNIFICANCES OF BETWEEN GROUP DIFFERENCES

Groups	't'-value	p-value
1 and 2	2.80	0.0065
1 and 3	17.54	< 0.0001
2 and 3	22.0	< 0.0001

Table 7.7.2 Caption: Table 7.7.2 displays Group-Time Interactions for BHT

Abbreviation: BHT- Breath Holding Time.

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

FIGURE 7.7.1: CHANGES IN BREATH HOLDING TIME FOR THE THREE GROUPS

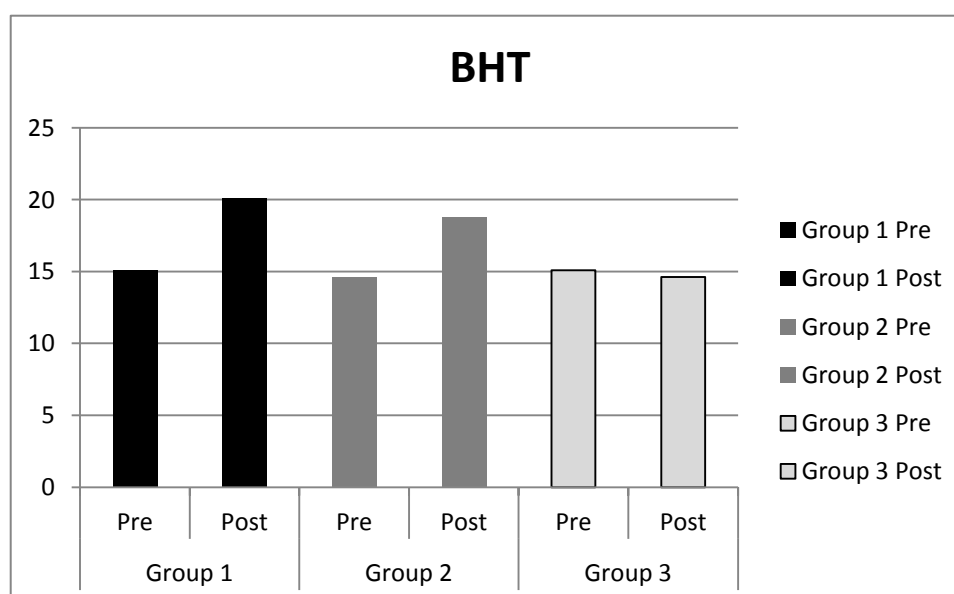


Figure 7.7.1 Caption: Figure 7.7.1 presents pre-post changes in BHT for the three Groups

Abbreviations: BHT- Breath Holding Time

Groups: Group 1- *Rasāhāra* and Yoga, Group 2- Yoga only, Group 3- Control

7.8 VĀTA, PĪTTA, AND KĀPHA BALAS

Results are presented in Table 7.8.1 for *Vāta Doša Balas*, Table 7.8.2 for *Pitta Doša Balas*, and Table 7.8.3 for *Kapha Doša Balas*. In these tables, scores 2 and 3 are considered balanced levels of *Došas*, while the others are considered states of imbalance. Scores of 1 may be considered low, while 4 and 5 may be considered high. The results can therefore be summarized as follows:

- In the *Rasāhāra* and Yoga group, Group 1, all *Vāta* and *Pitta Doša Balas* became more balanced, i.e. more group members scoring 2 or 3, but a high overall reduction in *Kapha Doša* saw 12 move out of high imbalance, score 4, and 15 move to score 1.
- In the Yoga only group, Group 2, *Doša* balas became more balanced in *Vāta* and *Kapha* but less so, and slightly less balanced for *Pitta*.
- In controls, Group 3, numbers with balanced *Doša* balas reduced for all *Doša* s. For *Kapha* this reduction was extreme: 25 in balance reducing to 20 in balance.

With regard to high and low levels:

- *Vāta* high to low reduced in Groups 1 and 2 but remained the same for controls;
- *Pitta* high to low reduced greatly for Groups 1 and 2, but only slightly for controls;
- *Kapha* high to low reduced from 24:14 to 6:32 for Group 1; from 20:17 to 5:32 for Group 2; and increased from 16:21 to 21:16 for controls, Group 3.

TABLE 7.8.1: INITIAL AND FINAL VĀTA BALA SCORES

Initial Vāta Bala Scores						
Bala → Group ↓	1	2	3	4	5	Mean
Group 1	8	16	9	4	1	2.75
Group 2	9	15	10	1	2	2.24
Group 3	7	15	13	1	1	2.29
Final Vāta Bala Scores						
Group 1	7	21	8	2	0	2.13
Group 2	10	17	7	3	0	2.08
Group 3	6	16	10	5	0	2.37

Table 7.8.1 Caption: Table 7.8.1 records scores of *Vāta Bala* displayed as numbers in each group with given *Vāta Bala* pre- and post- the intervention.

Both experimental groups decreased mean scores of *Vāta Bala*, while mean score for controls, Group 3, increased very slightly.

TABLE 7.8.2: INITIAL AND FINAL PITTA BALA SCORES

Initial Pitta Bala Scores						
Bala → Group ↓	1	2	3	4	5	Mean
Group 1	0	9	21	8	0	2.97
Group 2	2	7	20	8	0	2.91
Group 3	1	7	21	8	0	2.97
Final Pitta Bala Scores						
Group 1	2	18	16	2	0	2.47
Group 2	1	17	15	4	0	2.59
Group 3	3	9	17	8	0	2.81

Table 7.8.2 Caption: Table 7.8.2 records scores of *Pitta Bala* displayed as numbers in each group with given *Pitta Bala* pre- and post- the intervention.

Both Groups decreased mean scores of *Pitta Bala*, while mean score for controls, as did Group 3, but not to the same extent.

TABLE 7.8.3: INITIAL AND FINAL KAPHA BALA SCORES

Initial <i>Kapha Bala</i> Scores						
Bala → Group ↓	1	2	3	4	5	Mean
Group 1	2	12	11	13	0	2.92
Group 2	2	15	10	9	1	2.94
Group 3	3	9	17	7	0	2.70
Final <i>Kapha Bala</i> Scores						
Group 1	17	15	5	1	0	1.73
Group 2	7	25	5	0	0	1.94
Group 3	5	11	9	12	0	2.75

TABLE 7.8.3 Caption: Table 7.8.3 records scores of *Kapha Bala* displayed as numbers in each group with given *Kapha Bala* pre- and post- the intervention. Both experimental groups decreased mean scores of *Kapha Bala*, 1.19 and 1.00, while that for controls, Group 3, increased by 0.05.