CHAPTER 4

DATA COLLECTING AND PROCESSING

This chapter describes about results' processing and will be shown in figures, tables and graphics that explain research analysis.

4.1   Data Collection

4.1.1   Respondent Profile

The experiment of this study was conducted by involving 12 respondents as shown on Table 4.1 below:

Table 4.1 Respondent Profile

Respondent	Age (years old)	Gender	In a medication	Having Historical/Current Leg Injury
1	3	Female	-	-
2	3	Female	-	-
3	3	Female	-	-
4	4	Female	-	-
5	4	Female	-	-
6	4	Female	-	-
7	4	Male	-	-
8	3	Male	-	-
9	3	Male	-	-
10	4	Male	-	-
11	3	Male	-	-
12	4	Male	-	-

Based on the table, respondents' age are in the range of 3-4 years old. All of the respondents are free from medication and have not historical leg injury that will impact to the variances in EMG signal recording and blood pressure test.

4.1.2 EMG signal interpretation

The EMG signal is collected by using logger pro software that shows outputs recorded by the EMG tools such as raw signal and RMS signal. In recording the muscle contraction activity, the EMG recording is set to frequency 500 Hz in continous mode for 1 hour. The frequency of 500 Hz means that EMG would record 500 electric signal in a second and recorded 1800000 electric signal in an hour.

4.1.2.1 Raw EMG signal

Raw signal is a raw EMG signal obtained from data recording that has positive and negative peaks and directly interpreted by EMG supporting software, which is Logger pro. Raw signals also have the possibility of a lot of noise or other unexpected signals in the system. Here is the raw signal interpretation of one respondent in two conditions (off-machine and on-machine conditions):

a.   **Off-machine condition**

After 1 hour recordings on a off-machine motorcycle, a record of raw signal records is shown on figure 4.1 below:
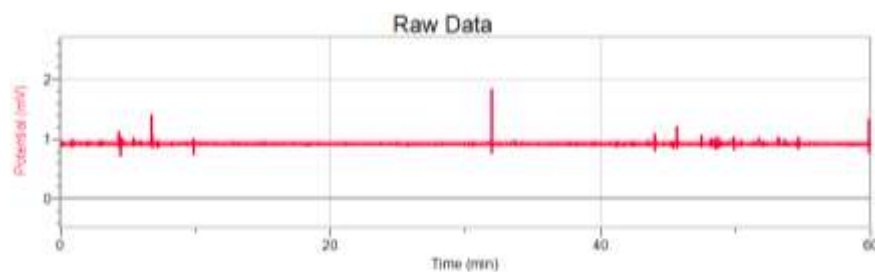

Figure 4.1 EMG raw signal in off-machine condition

b.   On-machine condition

After 1 hour recordings on a off-machine motorcycle, a record of raw signal
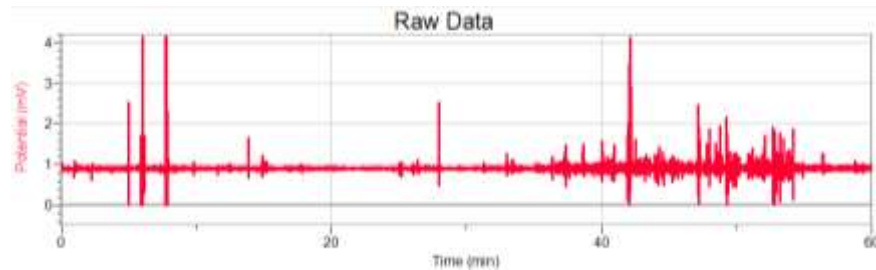records is shown on figure 4.2 below:

Figure 4.2 EMG raw signal in on-machine condition

4.1.2.2   RMS EMG signal

a.   Off-machine condition

RMS signal or the square root of raw signal data of the respondent during in off-
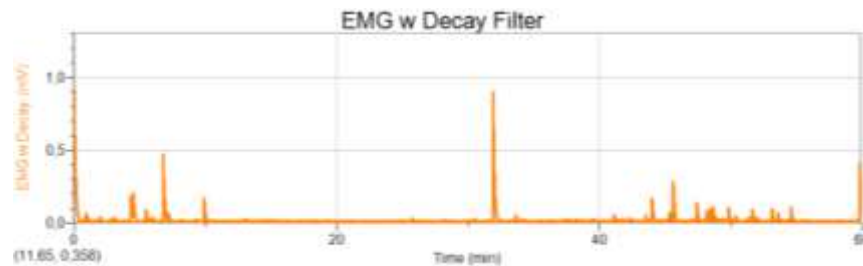machine condition is shown on Figure 4.3 below:

Figure 4.3 RMS in off-machine condition

The figure above shown muscle activity of a respondents during off-machine
condition experiment.

b.   On-machine condition

RMS signal or the square root of raw signal data of the respondent during in on-
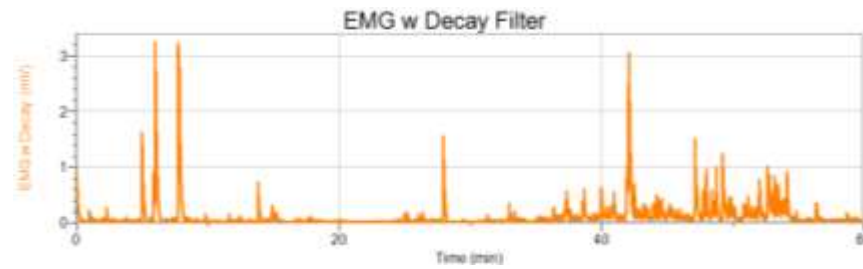machine condition is shown on Figure 4.4 below:

Figure 4.4 EMG raw signal in on-machine condition

The figure above shown muscle activity that has been filtered using filter with decay parameter of a respondents during off-machine condition experiment.

4.1.2.3 Basic Results RMS EMG

To get the mean muscle activity of the respondent on each condition, the calculation is derived from the RMS graph. The Table 4.2 Recapitulation of mean muscle activity that is shown below describes the mean muscle activity value of the respondent when off-machine condition and on-machine condition:

Table 4.2 Recapitulation of mean muscle activity

Respondent	Motor Condition	
	Off	On
1	0,04675	0,16820
2	0,03335	0,12807
3	0,04293	0,16706
4	0,05507	0,18235
5	0,06693	0,22090
6	0,05841	0,19589
7	0,10901	0,83026
8	0,10355	0,77997
9	0,08658	0,22713
10	0,11353	0,95265
11	0,09461	0,25153
12	0,09867	0,39333

4.1.2.4 Muscle Fatigue Risk of EMG Signal

Based on the data of RMS signal, it is shown as the identification of the muscle fatigue. The muscle fatigue could be compared to identify the fatigue comparison between the activity exposed or not exposed to the vibration. Below is the comparison graph of both conditions:
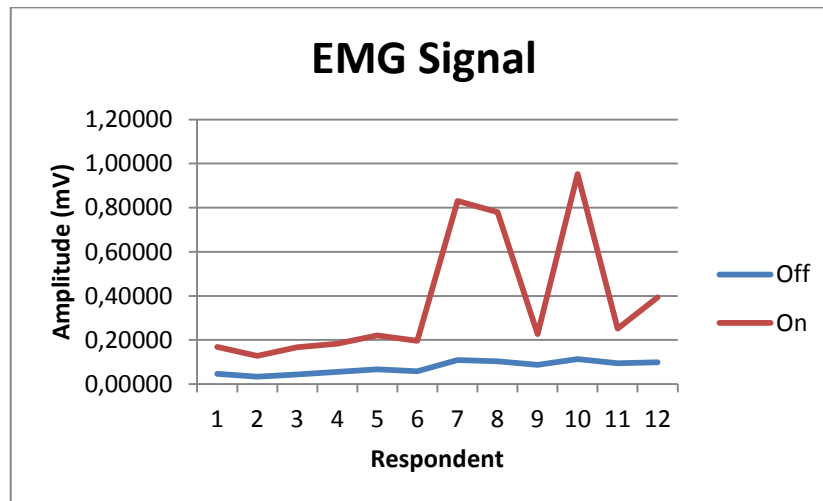

Figure 4.5 Comparison of mean muscle activity between both condition

Based on Figure 4.5, the graph shows the mean muscle activity from 12 respondents with the red color for on-machine condition and the blue color is shown as the activity of off-machine condition. The y axis of the graph shows the mean amplitude of the muscle electrical signal while the x axis represents the partcipant.

4.1.3 Blood Rate Interpretation

The heart rate and blood pressures (systolic and diastolic) of each respondents were measured before and after the experiment using oscillometric blood pressure device to identify the blood flow. The blood pressure of the respondents is shown on Table 4.3 below:

Table 4.3 Blood Pressure Measurement

No	Gender	Condition	Mean Systolic		Mean Diastolic	
			Before	After	Before	After
1	Female	On	88,33	76,67	65	63,33

No	Gender	Condition	Mean Systolic		Mean Diastolic	
			Before	**After**	**Before**	**After**
		Off	85	80	68,33	61,67
2	Male	On	95	78,33	61,67	66,67
		Off	88,33	76,67	71,67	61,67

4.2   Data Processing

4.2.1   EMG Signal Statistical Test Result

In this statistical test, the data are processed using parametric test. It is T test to compare each data whether the mean of population of each group has significance difference. This test is also chosen as the data ratio scale and the data is normal which was involving less than 30 respondents of this research . There are 2 groups of test to compare 2 explanations. Comparing each condition towards respondent's gender by using independent t test and comparing each gender towards machine condition by using paired t test.

4.2.1.1   Independent T Test

Independent T Test is used for 2 different groups to be compared between each other. The data compared in this research is conditions and gender. It would compare the data distribution of the EMG test result on condition of male and female respondents. The significance value from the SPSS calculation is shown below:

a.   On Condition towards Gender

This test is comparing the recording EMG signal on the on-machine condition between female and male respondents. The result of the test is shown on Table 4.4 below:

Table 4.4 Independent T Test for comparison between on condition towards gender

Each gender towards on condition	
Asymp. Sig. (2 tailed)	0,014

The T Test of Ho indicates that both data are not significant different, while H1 indicates that both data are significant different. Based on the table above, the significance value is 0,014 or it is < 0,05. It means that Ho is rejected shown that in an experiment during on-machine are significant different between male and female respondent.

b.   Off Condition towards Gender

This test is comparing the experiment of recording EMG signal in off-machine condition with female and male respondent. The result of the test shown on Table 4.5 below:

Table 4.5 Independent T Test for comparison between off condition towards gender

Each gender towards off condition	
Asymp. Sig. (2 tailed)	0,000018

The T Test of Ho indicates that both data are not significant different, while H1 indicates that both data are significant different. Based on the table above, the significance value is 0,000018 or it is < 0,05. It means that Ho is rejected shown that in an experiment during on-machine are significant different between male and female respondent.

4.2.1.2   Paired T Test

Paired T Test is used for the same group to compare each other. The data compared in this research is between male and female respondent with each condition. It would

compare how is the data distribution of the EMG test result of male and female respondents towards on and off experiments. The significance value from the SPSS calculation is shown below:

a.   Male respondent towards each conditions

This test is comparing the experiment of recording EMG signal in on and off-machine condition with male respondent. The result of the test shown on Table 4.6 below:

Table 4.6 Paired T Test for comparing male respondent towards each conditions

Male respondents towards both conditions	
Asymp. Sig. (2 tailed)	0,028

The T Test of Ho indicates that both data are not significant different, while H1 indicates that both data are significant different. Based on the table above, the significance value is 0,028 or it is < 0,05. It means that Ho is rejected shown that in an experiment during on-machine are significant different between male and female respondent.

b.   Female respondent towards each conditions

This test is comparing the experiment of recording EMG signal in on and off-machine condition with female respondent. The result of the test shown on Table 4.7 below:

Table 4.7 Paired T Test for comparing female respondent towards each conditions

Female respondents towards both conditions	
Asymp. Sig. (2 tailed)	0,000012

The T Test of Ho indicates that both data are not significant different, while H1 indicates that both data are significant different. Based on the table above, the significance value is 0,000012 or it is < 0,05. It means that Ho is rejected shown that in an experiment during on-machine are significant different between male and female respondent.

4.2.2 Blood Pressure Statistical Test Result

Statistical method used in this section is descriptive statistics. Descriptive statistics is the brief descriptive coefficients that summarize a given data set, which can be either a representation of the entire population or a sample of it. Descriptive statistics is broken down into measures of central tendency and measures of variability, or spread.

Table 4.8 Descriptive statistics of blood pressure results
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Value	96	60	100	75,00	11,050
Valid N (listwise)	96				

Table 4.8 above shows that the minimum value of all systolic and diastolic blood pressure is 60 and its maximum value is 100. All data have mean value of 75 and standard deviation of 11,050. The value of standard deviation is less than mean or 11,050 < 75. It means that all the blood pressure data have no outlier data.

4.2.2.1 Blood pressure comparison between before and after experiment of each conditions

This section is presented the descriptive statistics of the comparation between the blood pressure of respondent during EMG recording before and after experiment, both at the on and off machine condition. This comparison is purposed to know whether the experiment will increase or decrease systolic and diastolic blood pressure. Each of comparison described below:

a.   Systolic blood pressure comparison between before and after experiment in on condition

This section shows the histogram of the difference between male and female respondents' systolic before and after experiment in on-machine condition.
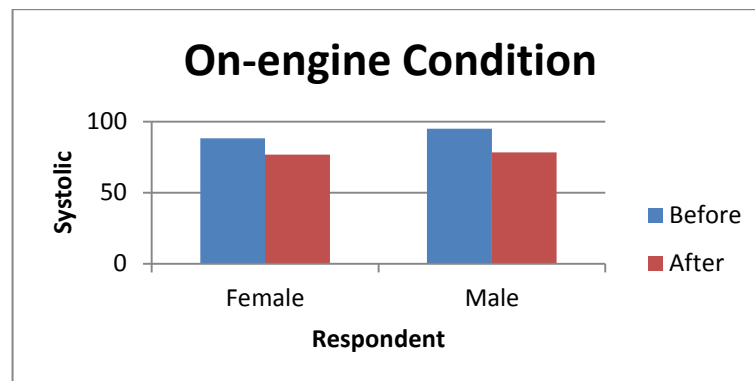

Figure 4.6 Systolic blood pressure comparison between before and after experiment in on condition

From the Figure 4.7 above, it is shown that in on-machine condition systolic blood pressure of female respondent before the experiment is in average of 88,33 mmHg and decrease to 76,67 mmHg after the experiment. While, systolic blood pressure of male respondent before the experiment is in average of 95 mmHg and decrease to 78,33 mmHg after the experiment. Above graph also shows that the male respondents' systolic is higher in both before and after experiment then female respondents'.

b.   Systolic blood pressure comparison between before and after experiment in off condition

This section is showing the histogram of the difference between male and female respondents' systolic before and after experiment in off-machine condition.
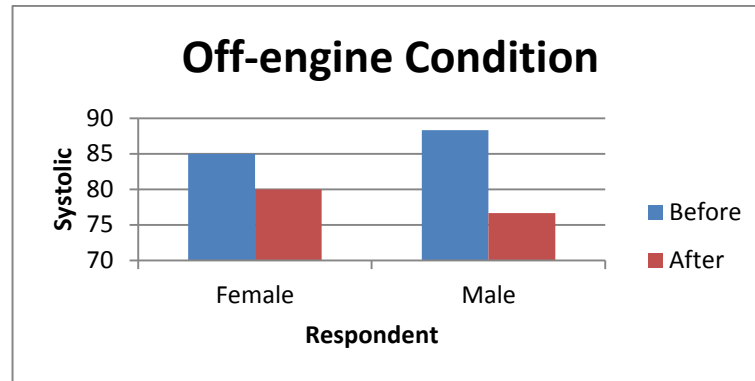
Figure 4.7 Systolic blood pressure comparison between before and after experiment in off condition

From Figure 4.7 above, shown that in off-machine condition systolic blood pressure of female respondent before the experiment is in average 85 mmHg and decrease to 80 mmHg after the experiment and systolic blood pressure of male respondent before the experiment is in average 88,33 mmHg and decrease to 76,67 mmHg after the experiment. From the above graph also shown that the male respondents' systolic is higher in both before and after experiment then female respondents'.

c.   Diastolic blood pressure comparison between before and after experiment in on condition

This section is showing the histogram of the difference between male and female respondents' diastolic before and after experiment in on-machine condition.
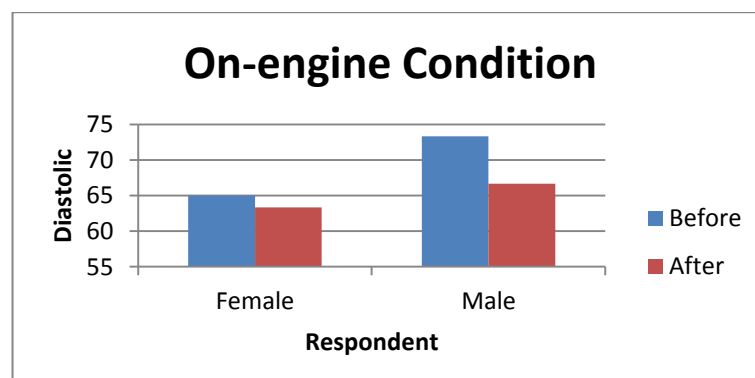

Figure 4.8 Diastolic blood pressure comparison between before and after experiment in on condition

From Figure 4.8 above, shown that in on-machine condition diastolic blood pressure of female respondent before the experiment is in average 65 mmHg and decrease to 63,33 mmHg after the experiment and diastolic blood pressure of male respondent before the experiment is in average 73,33 mmHg and decrease to 66,67 mmHg after the experiment. From the above graph also shown that the male respondents' diastolic is higher in both before and after experiment then female respondents'.

d.   Diastolic blood pressure comparison between before and after experiment in off condition

This section is showing the histogram of the difference between male and female respondents' diastolic before and after experiment in off-machine condition.
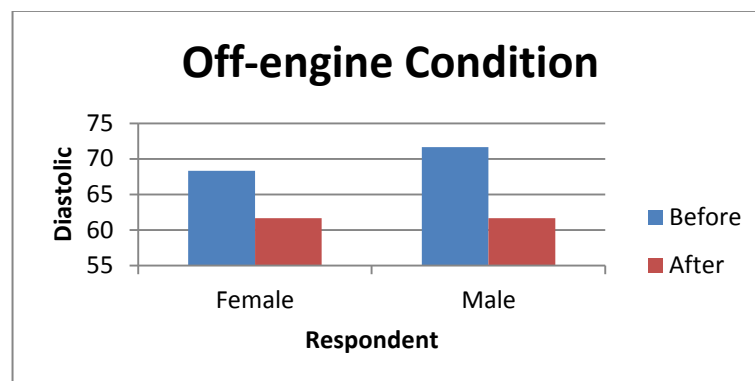

Figure 4.9 Diastolic blood pressure comparison between before and after experiment in off condition

From Figure 4.9 above, shown that in off-machine condition diastolic blood pressure of female respondent before the experiment is in average 68,33 mmHg and decrease to 61,67 mmHg after the experiment and diastolic blood pressure of male respondent before the experiment is in average 71,67 mmHg and decrease to 61,67 mmHg after the experiment. From the above graph also shown that the male respondents' diastolic is higher in before experiment then female respondents' and has same value of the after experiment average diastolic value.

4.2.2.2 Blood pressure comparison between conditions of before and after experiment

This section is descriptive statistics of the comparation between the blood pressure of respondent before and after experiment EMG recording in both on and off machine condition. This comparison is purposed to know whether the experiment of the machine condition difference (on machine produce vibration during the experiment) will increase or decrease systolic and diastolic blood pressure. Each of comparison described below:

a. Systolic blood pressure comparison of respondent between on and off condition before the experiment

This section is showing the histogram of the difference between male and female respondents' systolic in on and off-machine condition before experiment.
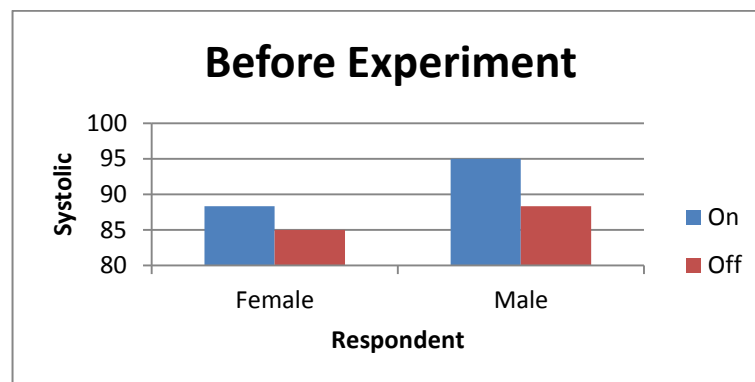

Figure 4.10 Systolic blood pressure comparison of respondent between on and off condition before the experiment

From Figure 4.10 above, shown that systolic blood pressure of female respondent before the experiment is in average 88,33 mmHg in on-machine condition and 85 mmHg in off-machine condition and systolic blood pressure of male respondent before the experiment is in average 95 mmHg in on-machine condition and 88,33 mmHg in off-machine condition. From the above graph also shown that the male respondents' systolic is higher in both on and off-machine condition then female respondents'.

b.   Diastolic blood pressure comparison of male and female respondent between on and off condition before the experiment

This section is showing the histogram of the difference between male and female respondents' diastolic in on and off-machine condition before experiment.
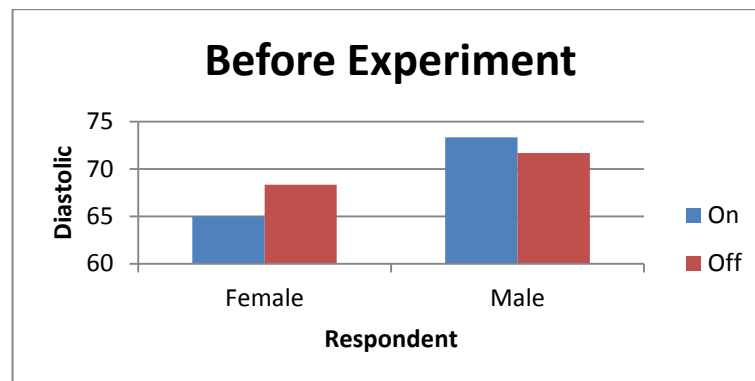

Figure 4.11 Diastolic blood pressure comparison of male and female respondent between on and off condition before the experiment

From Figure 4.11 above, shown that diastolic blood pressure of female respondent before the experiment is in average 65 mmHg in on-machine condition and 68,33 mmHg in off-machine condition and diastolic blood pressure of male respondent before the experiment is in average 73,33 mmHg in on-machine condition and 71,67 mmHg in off-machine condition. From the above graph also shown that the male respondents' diastolic is higher in both on and off-machine condition then female respondents'.

c.   Systolic blood pressure comparison of male and female respondent between on and off condition after the experiment

This section is showing the histogram of the difference between male and female respondents' systolic in on and off-machine condition after experiment.
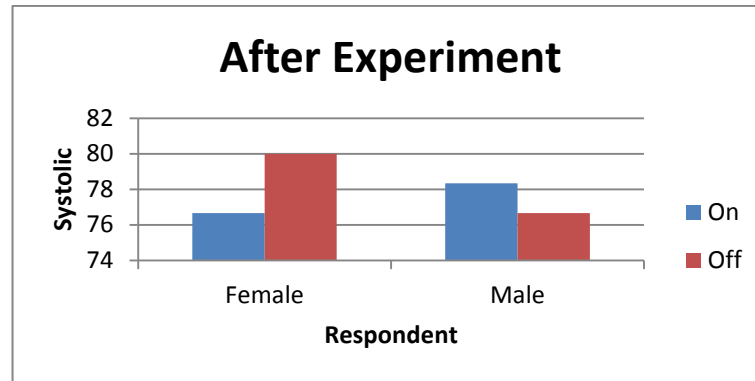
Figure 4.12 Systolic blood pressure comparison of male and female respondent between on and off condition after the experiment

From Figure 4.12 above, shown that systolic blood pressure of female respondent after the experiment is in average 76,67 mmHg in on-machine condition and 80 mmHg in off-machine condition and systolic blood pressure of male respondent before the experiment is in average 78,33 mmHg in on-machine condition and 76,67 mmHg in off-machine condition. From the above graph also shown that the male respondents' systolic is higher in both on and off-machine condition then female respondents'.

d. Diastolic blood pressure comparison of male and female respondent between on and off condition after the experiment

This section is showing the histogram of the difference between male and female respondents' diastolic in on and off-machine condition after experiment.
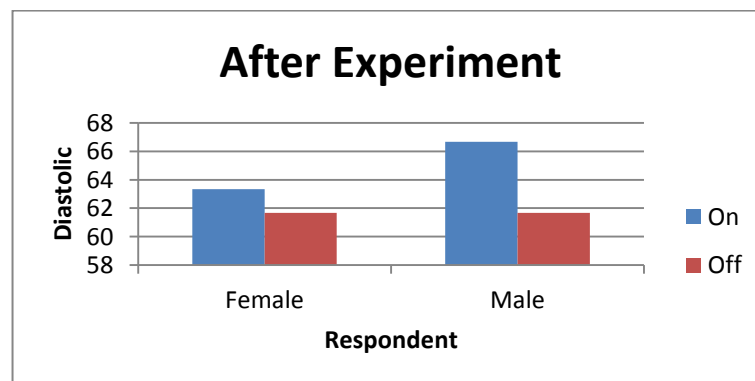

Figure 4.13 Diastolic blood pressure comparison of male and female respondent between on and off condition after the experiment

From Figure 4.13 above, shown that diastolic blood pressure of female respondent after the experiment is in average 63,33 mmHg in on-machine condition and 61,67 mmHg in off-machine condition and diastolic blood pressure of male respondent before the experiment is in average 66,67 mmHg in on-machine condition and 61,67 mmHg in off-machine condition. From the above graph also shown that the male respondents' diastolic is higher in on-machine condition then female respondents' and has same value of the average diastolic in off-machine condition.