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Analysis of Basic Fitness Parameters for Females at Workplace

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Abstract

This research analysis focuses on the varying task effects on physiological factors and cognitive response on female subjects. These varying tasksaffects i.e. heart rate and blood pressure as well as cognitive performance are taken to check the physical and mental at workplace for job allocation. A sample size of 30 female workers has been taken. Their blood pressure and heart rate were checked at 5 different times like at rest, after walking, 10mins after walking, after climbing 3 floors, 10mins after climbing. Immediately after takings these readings a Stroop test was conducted immediately after activity to find the cognitive response time in seconds.

Keywords: Heart Rate • Blood Pressure • Cognitive Response • Age • BMI

Introduction

Workplace exercise (WE) is an intervention with specific physical exercises for workers carried out at the work site, which aims to improve general outcomes, such as Quality of Life and occupational environment, as well as specific outcomes, such as muscle strength and flexibility. Analyses of general outcomes of the workers involve ample constructs, and are generally evaluated by questionnaires. In this way, they depend on the individual perception of each worker, which can overestimate the effects of the intervention to the detriment of the other hand, specific outcomes, such as strength, flexibility, and blood pressure may permanence in the health promotion program of the company. On be quantified with measuring instruments, thus diminishing the bias of the workers' perception subjectivity and contributing towards the true measure of the intervention.

Health promotion is a key issue of the WHO Health for All policy and it reached conceptual maturity in the Ottawa Charter for Health Promotion. Health promotion, as defined in the Charter, is the process of enabling people to increase control over, and to improve their health. The starting point is thus everyone's potential to do something to improve or maintain their own health. The settings approach to health promotion is designed to initiate and provide scientific and managerial advice on how to organize and maintain organizational and social changes at a given workplace.

Every employer/worker has to go through some basic physical fitness medical tests in order to qualify his /her working capability at any workplace. These are then analyzed and checked whether the worker is fit for the given job or not.Almost all the industries require female workers to do tasks like sitting at workplace, working at manufacturing unit or doing heavy tasks. Industries like software, automobile, chemical, medical hospitals, educational, building constructions, etc.

Literature Review

ROBERT S. FRASER, *et. al*. [9] attempts to follow changes in blood pressure induced by exercise, using indirect sphygmomanometer, have yielded conflicting results. In the following study, blood pressure measurements were made at rest (standing), during a standard treadmill work load, and during a six-minute recovery period, using a direct method and a suitably damped recording system. It was found that during exercise systolic pressure rises and that diastolic pressure falls, the net result being very little change in the mean pressure. In some subjects there is a secondary rise in all three items between 10 and 30 seconds after cessation of exercise. Changes in pulse rate during exercise and recovery are also discussed.

Hypertension affects 25% of the world's population and is considered a risk factor for cardiovascular disorders and other diseases. *Elizabeth Carpio-Rivera et.al.* [4] aim to examine the evidence regarding the acute effect of exercise on blood pressure (BP) using meta-analytic measures. The mean corrected global ES for exercise conditions were -0.56 (-4.80 mmHg) for systolic BP (sBP) and -0.44 (-3.19 mmHg) for diastolic BP (dBP; $z \neq 0$ for all; $p < 0.05$). A significant inverse correlation was found between age and BP ES, body mass index (BMI) and sBP ES, duration of the exercise's session and sBP ES, and between the number of sets performed in the resistance exercise program and sBP ES ($p < 0.05$). Regardless of the characteristics of the participants and exercise, there was a reduction in BP in the hours following an exercise session. However, the hypotensive effect was greater when the exercise was performed as a preventive strategy in those physically active and without antihypertensive medication.

C.L.M. Forja, et. al. [1] evaluate the effect of exercise intensity on post-exercise cardiovascular responses, 12 young normotensive subjects performed in a randomized order three cycle ergometer exercise bouts of 45 min at 30, 50 and 80% of VO2peak, and 12 subjects rested for 45 min in a non- exercise control trial. Blood pressure (BP) and heart rate (HR) were measured for 20 min prior to exercise (baseline) and at intervals of 5 to 30 (R5-30), 35 to 60 (R35-60) and 65 to 90 (R65-90) min after exercise. Systolic, mean, and diastolic BP after exercise were significantly lower than baseline, and there was no difference between the three exercise intensities. After exercise at 30% of VO2peak, HR was significantly decreased at R35-60 and R65-90. In contrast, after exercise at 50 and 80% of VO2peak, HR was significantly increased at R5-30 and R35-60, respectively. In conclusion, varying exercise intensity from 30 to 80% of VO2peak in young normotensive humans did not influence the magnitude of post-exercise hypotension. However, in contrast to exercise at 50 and 80% of VO2peak, exercise at 30% of VO2peak decreased post-exercise HR and RP.

Deuk-Ja Oh, *et. al*. [3] conducted a study to investigate the effects of strenuous exercises on resting heart rate, blood pressure, and maximal oxygen uptake. To achieve this total of 30 subjects were selected, including 15 people who performed continued regular exercises and 15 people as the control group. The difference of mean change between groups was verified through an independent *t*-test. As a result, there were significant differences

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in resting heart rate, maximal heart rate, maximal systolic blood pressure, and maximal oxygen uptake. However, the maxi-mal systolic blood pressure was found to be an exercise-induced high blood pressure.

Hypertension accelerates brain aging, resulting in cognitive dysfunction with advancing age. Wesley

K. Lefferts, et. al.[10] performed a study to compare the effects of acute aerobic exercise on cognitive function in 30 middle-aged hypertensive (HTN) and 30 age, sex, and body mass index (BMI)-matched non-HTN adults. Subjects underwent cognitive testing pre/post 30-min cycling. Behavioral data was analyzed using drift-diffusion modeling to examine underlying components of decision-making. Exercise elicited similar changes in cognitive function in both HTN and non-HTN groups. RT decreased for Flanker and memory recognition tasks and was driven by reductions in post-exercise non-decision time ($p<0.05$). Drift-diffusion modeling revealed that beneficial acceleration of cognitive processing post-exercise (RT) is driven by changes in non-decision components (encoding/motor response) rather than the decision-making process itself.

OSWALD S. LOWSLEY, et. al. [5] Conducted an experiment upon were all healthy men who were in the habit of exercising regularly. With the exception of a few individuals experimented upon in Group I of Part II, the subjects were young athletes in the midst of a training season. Records were taken at all times of the year, varying from the middle of summer (twenty-mile race) to the dead of winter. Several practices runs (thirteen miles, one hundred yards) and one hard race (ten miles) were made in very cold weather with snow on the ground. The records in Part I was made during exercise on the stationary bicycle. The normal pressures and heart rate for each individual were obtained by averaging a number of readings taken at different times; none of these readings were made within the twenty- four hours preceding a race, in order to avoid the stimulating effect of the excitement attendant upon such contests.

Previous works have shown that exaggerated blood pressure response to exercise is a valid risk marker for future hypertension, yet the use of an exercise test as a means of early prediction of hypertension still requires methodological development and confirmation. Nobuyuki Miyai*, et. al.* [8] undertook this study to determine abnormal ranges of blood pressure responses in relation to heart rate increase during exercise. Also to examine the clinical utility of exercise blood pressure measurement in evaluating individual risk for developing hypertension this study was used. They examined exercise test data from a population-based sample of 1033 non medicated normotensive men (mean age, 42.9_8.5 years; range, 20 to 59 years). 726 subjects were studied here. Progression to hypertension, defined as a blood pressure of _140/90 mm Hg, was found in 114 subjects (15.4%). Results of this study suggests that an exaggerated blood pressure response to heart rate during exercise is predictive of future hypertension independent of other important risk factors and lend further support to the concept that blood pressure measurement during exercise test is a valuable means of identifying normotensive individuals at high risk for developing hypertension.

Activation theory proposes that each person has an optimum level of arousal, one at which performance of a particular task is most efficient; and that changes in arousal level may affect changes in cognitive and behavioral performance. This study suggests that exercise of short duration raises the level of arousal to an optimum and maximum cognitive performance can be achieved, however, exercise of long duration raises arousal beyond the optimum to an excited level and cognitive performance decreases. The present study by DIANE H. CRAFT [7] investigated whether the inverted-U relationship occurs with young boys, instead of adults, who are tested individually using prior exercise with precise regulation of the work loads and duration of exercise. The study also investigated whether hyperactive boys' maximum cognitive performance occurs after a shorter duration of exercise than required for normal children, consistent with the hypothesis that hyperactive children are over aroused and after a longer duration of exercise indicating under arousal.

The effects of physical work (30% of VO, max), sleep loss (3-h nap during a 48-h operation), continuous work (CW), and time of day on cognitive performance were assessed (by ANOVA) in this repeated- measures study comparing two groups (exercise/non exercise) of healthy young men (N = 22). This study was performed by CARL E. ENGLUND, *et. al.* [2]. Treadmill walking did not accentuate or attenuate sleep-loss effects on performance; however, sleep loss alone did degrade visual vigilance and memory for words. Time-of-day fluctuations were found in choice reaction time, logical reasoning, and word memory. The findings indicate that exercise at 30% ervo, max does not compound sleep- loss effects in cognitive performance. Indeed, physical activity during video terminal monitoring may delay any sleep-loss decrement. Variability of many cognitive abilities throughout the day appeared to show a greater effect than the sleep-loss and exercise effects over 2 days.

Physical inactivity and low resting heart rate variability (HRV) are associated with increased coronary heart disease incidence. Kirsten L. Rennie**,** *et. al.* [6] performed five minute recordings of heart rate and HRV measures from 3,328 participants. Calculated was time domain (standard deviation of NN Intervals) and high-frequency-power measures as indicators of cardiac parasympathetic activity and low-frequency power of parasympathetic-sympathetic balance. Moderate and vigorous physical activities were associated with higher HRV and lower heart rate. For men, linear trends of higher low- frequency power with increasing quartile of vigorous activity and lower heart rate with increasing quartile of moderate activity were found. For men whose body mass index was >25 kg/m^2, vigorous activity was associated with HRV levels similar to those for normal-weight men who engaged in no vigorous activity. Vigorous activity was associated with higher HRV, representing a possible mechanism by which physical activity reduces coronary heart disease risk.

Methodology

The subjects were first asked to take rest and recover from any previous activity performed, the blood pressure (systolic and diastolic) and heart rate readings were taken. At this condition, the participants were given a Stroop test, were they had to identify 5 different colors (green, red, brown, purple and blue) and the time required for finding of each color was taken. Then, the participants were asked to walk at their own normal pace for about 500 meters, and immediately after the readings for heart rate, blood pressure and cognitive test were taken. Participants rested for a while (10 mins) and their heart rate and blood pressure was evaluated. The similar above steps (3 and 4) were done in case of climbing stairs activity.

Data Collection: 30 female subjects of varying ages and varying profession were taken for the experiment. The age group ranged from 21 years to 50 years (general working class). The data collected was the normal heart rate (bpm), blood pressure (mmHg) and cognitive ability. These different readings were taken at normal rest conditions, walking 500m activity (mild) and climbing staircases (mild). These data readings were collected by filling a physiological test form. Figure 1 and figure 2 below shows the sample data collected before and after activity measurements **(Figures 1 and 2)**.

Analyze the Data

From the various graphs computed from relation between

- Age with-Cognitive Heart rate Blood pressure
- BMI with Cognitive Heart rate Blood pressure

Interpret and Report: From the above graphs the following interpretations were drawn

Case 1: Variation in heart rate with increase in age

- Effect of walking on heart rate with age **(*Figure 3*).**
- **Effect of climbing on heart rate (Figure 4*).***

Case 2: Variation in blood pressure with increase in age.

- Effect of walking on systolic B.P. **(Figure 5).**

Before Activity								
Physiological heart rate	B.P.(mmHg)		Cognitive test time					Avg. cognitive response time
	sys	dia	Green	Red	Brown	Purple	Blue	
83	110	73	15	17	19	23	24	19.6
78	124	71	15	16	17	21	21	18
85	117	81	13	16	11	21	16	15.4
76	113	84	15	16	17	25	22	19
70	125	78	17	15	20	20	28	20
82	126	73	15	15	12	19	16	15.4
83	129	90	30	30	25	35	40	32
88	110	81	13	14	14	17	18	15.2
86	100	81	13	17	14	18	11	14.6
83	109	72	15	15	11	19	20	16
75	101	57	13	13	12	16	17	14.2
97	119	91	7	9	6	9	9	8
98	101	98	7	12	13	15	14	12.2
83	113	72	13	18	28	30	16	21
89	135	88	10	18	14	13	14	13.8
62	111	79	14	13	10	14	18	13.8
90	121	81	16	14	21	23	24	19.6
69	105	61	10	17	16	29	21	18.6
90	135	73	30	32	34	20	24	28

Demographic data										
sr no	Name	Age	Occupation	Address	Height(foot)	heiht in m	Weight (kg)	BMI	Health proble	curren tly on
					0.3048					
20	Shrutika Bibwe	21	student	bibwewadi	5.7	1.73736	57	18.8841	no	no
21	Karuna Kadam	21	student	bibwewadi	5.2	1.58496	57	22.6902	no	no
22	Siddhi Jadhav	21	student	bibwewadi	5.3	1.61544	49	18.7765	no	no
23	Nirmity Bomidwar	21	student	bibwewadi	5.1	1.55448	68	28.1409	no	no
24	Sneha Gaikwad	21	student	bibwewadi	5.2	1.58496	58	23.0883	no	no
25	Richa Bhide	21	student	kothrud	5.3	1.61544	59	22.6084	no	no
26	Snehal Gavade	21	student	bibwewadi	5	1.524	50	21.5278	no	no
10	Abhiruchi Heroli	23	design engineer	pokle vasti	5.6	1.70688	60	20.5942	no	no
11	Vaishnavi Thomre	23	sales engineer	pokle vasti	5.4	1.64592	49	18.0875	no	no
12	Shilpa Sonawane	26	catering service	bibwewadi	5.1	1.55448	55	22.7611	no	no
16	Jayshree Borade	27	catering service	bibwewadi	4.9	1.49352	41	18.3807	no	no
18	Vaidehi Pawar	28	catering service	bibwewadi	5.3	1.61544	55	21.0757	no	no
3	Pratiksha Sawant	29	housewife	pokle vasti	5.3	1.61544	50	19.1597	no	no
13	Rekha Avghade	30	catering service	bibwewadi	5	1.524	45	19.375	no	no
17	tritha Jadhav	30	catering service	bibwewadi	5.1	1.55448	60	24.8302	no	no
5	Sonali Gawali	34	housewife	pokle vasti	5.4	1.64592	78	28.7924	no	no
28	Tai Bhairat	34	Sweeper	bibwewadi	5.3	1.61544	60	22.9916	no	no
9	Suvarna Patil	37	teacher	katraj	5.1	1.55448	52	21.5195	no	no

Figure 1. Sample Data.

Immediate After 3 floors UP-DOWN									
heart rate	B.P.(mm		calories	Physiologic Green	Red	Cognitive Brown	(seconds Purple	Blue	Avg. cognitive response time
	sys	dia							
97	105	167	20	19	20	20	24	25	21.6
106	149	80	20	22	21	20	24	25	22.4
84	132	83	23	7	12	12	11	13	11
121	153	100	15	13	15	13	22	21	16.8
90	129	80	18	17	13	18	16	21	17
100	137	81	19	11	13	15	16	14	13.8
104	135	85	17	28	27	30	50	45	36
106	149	80	21	14	14	17	19	20	16.8
109	123	73	17	10	11	13	12	12	11.6
104	105	90	15	14	14	18	20	20	17.2
99	106	90	17	17	20	18	24	20	19.8
112	130	85	16	11	11	12	15	16	13
96	123	96	20	12	8	14	9	10	10.6
110	114	69	25	21	18	25	29	30	24.6
102	136	96	27	14	12	13	24	24	17.4
97	105	67	18	17	15	14	20	22	17.6
89	145	90	20	14	15	13	19	18	15.8
83	103	57	22	13	14	15	30	32	20.8
111	115	70	20	33	29	30	35	38	33

10 min later		
Physiological factors		
heart rate		B.P.(mmH
	sys	dia
82	127	89
86	117	78
86	108	66
78	125	87
82	129	78
83	115	77
85	126	90
88	118	83
88	110	84
86	126	87
75	100	69
86	105	86
72	106	69
85	120	96
85	125	96
70	105	70
78	111	86
69	100	81

Immediate After Walking (500m)									
Physiological heart rate	factors B.P.(mmHg)		calories	Green	Cognitive Red	test time Brown	(seconds Purple	Blue	Avg. cognitive response time
	sys	dia							
87	101	69	35	17	19	19	23	23	20.2
95	134	81	26	22	23	19	23	21	21.6
94	35	81	35	11	14	15	12	14	13.2
88	147	98	35	13	16	17	16	25	17.4
104	133	82	37	12	18	13	14	15	14.4
81	125	67	30	11	12	17	13	13	13.2
88	127	80	37	25	25	30	40	42	32.4
100	103	65	35	13	14	14	17	18	15.2
104	115	83	34	14	10	13	14	14	13
104	147	98	37	12	14	16	18	19	15.8
83	115	74	45	15	16	18	19	20	17.6
103	154	90	40	10	11	11	15	14	12.2
79	111	80	30	8	10	12	15	18	12.6
96	113	87	37	17	19	18	28	25	21.4
112	117	96	24	12	14	16	15	20	15.4
110	114	79	30	16	12	18	19	20	17
89	130	90	34	15	12	19	20	25	18.2
70	115	83	26	12	17	15	30	28	20.4
113	123	79	20	33	30	32	35	40	34

10 min later		
Physiological factors		
heart rate		B.P.(mmHg
	sys	dia
80	110	110
82	115	72
92	114	92
86	125	92
91	111	71
85	136	97
99	127	86
83	103	65
88	117	86
91	100	60
79	100	69
88	114	92
75	110	70
88	110	88
88	125	98
75	110	89
78	110	86
70	117	86
99	105	86
80	98	70

Figure 2. Sample Data-2.

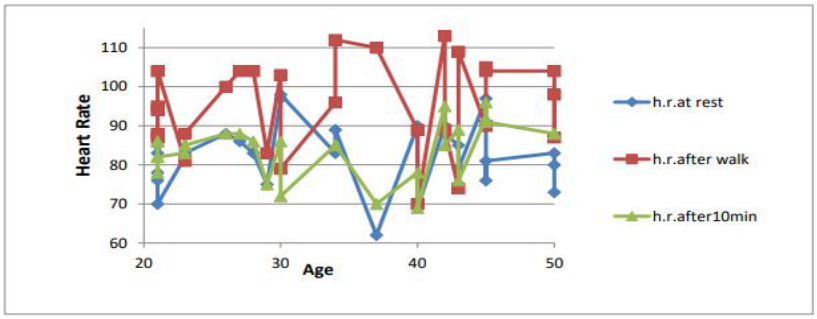

Figure 3. Effect of walking on heart rate with age.

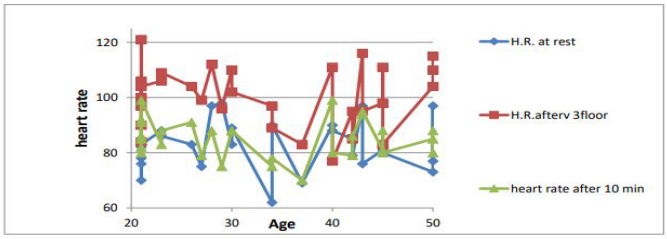

Figure 4. Effect of climbing on heart rate

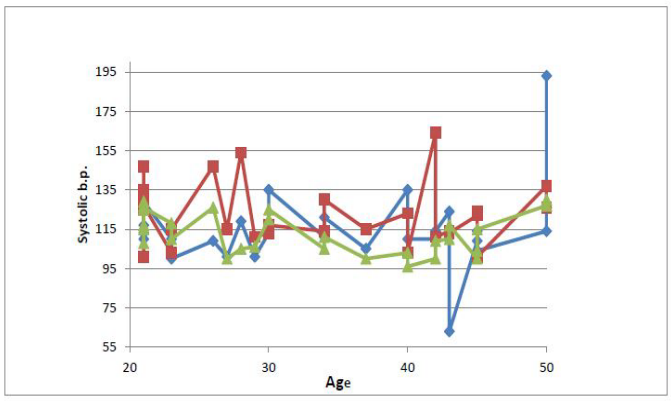

Figure 5. Effect of walking on systolic B.P.

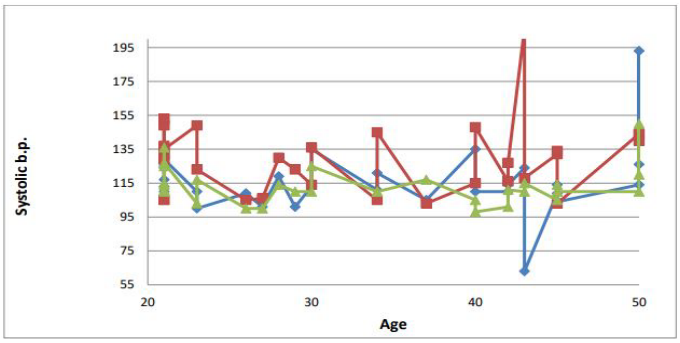

Figure 6. Effect of climbing on systolic blood Pressure.

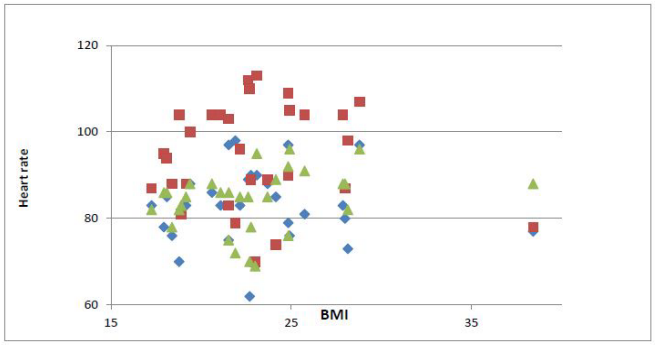

Figure 7. Effect of Walking on heart rate.

- Effect of climbing on systolic blood Pressure. **(Figure 6).**
- **Case 3**: Variation in Heart rate with increase in BMI.
- Effect of Walking on heart rate. **(Figure 7).**
- Effect of climbing on heart rate. **(Figure 8).**

Case 4: Variation in blood pressure with increase in BMI.

- Effect of Walking on systolic B.P **(Figure 9).**
- Effect of climbing on systolic B.P **(Figure 10).**

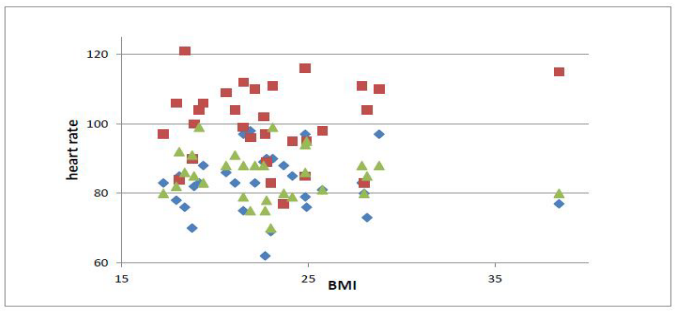

Figure 8. Effect of climbing on heart rate.

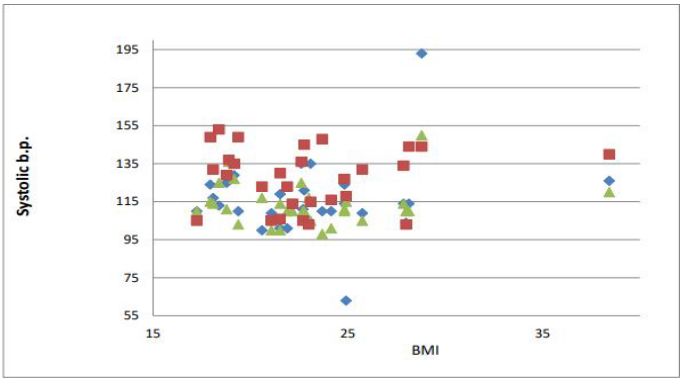

Figure 9. Effect of Walking on systolic B.P.

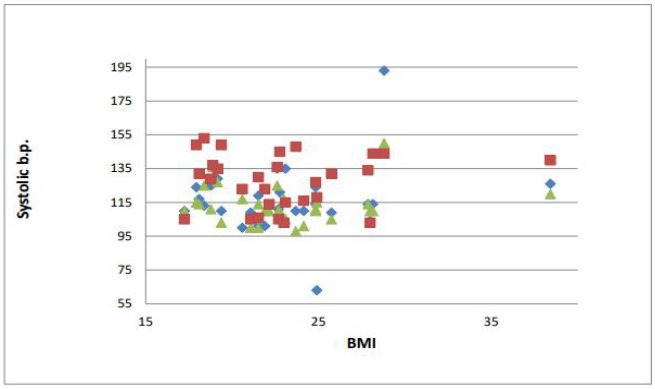

Figure 10. Effect of climbing on systolic B.P.

Results

From all the above variation graphs, it has been clearly seen that it takes 10 or more minute for an individual to get back to their normal rate. Also, for light as well as slightly heavy activity like stairs climbing, heart rate and systolic blood pressure does not go beyond the normal range of 80bpm- 120bpm and 120mm/Hg-160mm/Hg.

Conclusion

From the data analyzed it is seen that within 10mins of recovery time, heart rate becomes almost normal whereas the blood pressure after walking comes almost to normal, however 10mins after staircase climbing systolic B.P. still remains at higher value. The faster the heart rate and blood pressure comes back to normal, the fitter the person is. The cognitive performance of the subjects were found to be increased i.e. less time was needed post activity i.e. more blood flows to the brain and it performs well. We hence conclude that at any workplace to ensure proper work allocation to the worker, their physiological factors must be taken into consideration. The data we collected helps in finding the fitness level of an individual, which helps allocating

appropriate job to the individual. This type of test are mostly carried in for females as their muscle strength is lesser than that of men , so they must be allocated with jobs according to their fitness

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