



Original Research Article

## Recovery Period Of Skin Temperature Following An Exercise Bout Among Obese Normal And Lean Women

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Received: 01/05/2015

Revised: 19/05/2015

Accepted: 20/05/2015

### ABSTRACT

Humans regulate heat generation and preservation to maintain internal core body temperature. The human body regulates temperature by keeping a tight balance between heat gain and heat loss. During all types of exercise heat is produced as a bi-product of increased metabolism. The purposes of the study were to find out the maximum changes in skin temperature following an exercise bout and to study the recovery period of skin temperature after completing an exercise bout in three categories of women obese, normal and lean. A total of 13 young adult female within the age of 21-30 years were volunteered as subject for this study. Skin temperature was considered as criterion of the present study. Skin temperature was measured by Non-Contact Digital Thermometer. Standard stop watch was used for time specification. Step up and Down for five minutes was used as exercise protocol. All data for the present study was collected at average 25.21<sup>0</sup>C temperature and 63.33% humidity. Multiple group design with three independent mean were considered for the present study. All calculations were done by the standard statistical procedure. Findings have revealed that resting skin temperature of all groups of subjects fall immediately after exercise. The fall of skin temperature immediate after exercise was found highest for G1 group and lowest for G3 group. The recovery period was found longest for G1 group (30 min) and shortest for G3 group (15min). Result clearly indicated that skin temperature fall immediately after exercise in all categories of women and recovery period of skin temperature was also different for women having different body fat amount in the specified environmental temperature and humidity.

**Key words:** Skin temperature, Recovery period, Exercise bout, Obese, Normal and Lean

### INTRODUCTION

The human body regulates temperature by keeping a tight balance between heat gain and heat loss. Core temperature is regulated by the hypothalamus (in the brain), which is often called the body's thermostat. The hypothalamus responds to various temperature receptors located throughout the body and makes physiological adjustments

to maintain a constant core temperature. [1]  
Normal core temperature at rest varies between 36.5 and 37.5 ° Celsius, which is 97.7 to 99.5 ° Fahrenheit. Nevertheless, commonly mentioned typical values are: Oral: 36.8° ± 0.4 °C (98.2° ± 0.7 °F) and Internal: 37.0 °C (98.6 °F). [2]

During all types of exercise the body's ability to thermo regulate is challenged. Heat is produced as a bi-product of

metabolism during exercise. During exercise, heat is produced mainly from working muscle contractions and core temperature can go above 40 °C (104 °F).<sup>[3]</sup> The body temperature increase with exercise depends upon the nature of exercise performed. For short duration high intensity exercise 'producing heat' is actually quite short for which the body temperature may increase slightly and the body's temperature typically returns to normal within 20 minutes after the exercise has been completed.<sup>[4]</sup>

Body fat has vital physiological importance in human body. Body fat includes essential body fat and storage body fat. Essential body fat is necessary to maintain life and reproductive functions. The percentage of essential body fat for women is greater than that for men. The percentage of essential fat is 3–5% in men, and 8–12% in women.<sup>[5]</sup> Storage body fat consists of fat accumulation in adipose tissue, part of which protects internal organs in the chest and abdomen. The minimum amount of total body fat percentage exceeds the essential fat percentage value reported above. On the basis of storage fat women can be categorized as obese, normal and lean. One of the most important functions of body fat is that it protects body heat and helps to maintain constant core body temperature. Fat layer present in subcutaneous level under skin plays vital role to preserve heat in the body. More thick the layer of fat in subcutaneous level, less the heat is radiated to the environment by means of radiation. Fat layer works as an insulator in this case. This is why the obese person, who has higher amount of body fat, feels more comfort in cold winter but feels warmer in hot summer season. The opposite feeling has been experienced by the ectomorphic person who is lean and has lower body fat level.<sup>[6]</sup> Present study was conducted to find out the maximum skin

temperature changes following an exercise bout and to find out the length of recovery period after completing an exercise bout in obese, normal and lean women.

## **MATERIALS AND METHODS**

### **Subject:**

A total of 13 young adult female within the age of 21-30 years were volunteered as subject for this study. They were classified under three groups namely Overweight or obese group (G1), Normal group (G2) and Lean or underweight group (G3). There were 3 subjects in G1 group and 6 subjects in G2 group. G3 group was consisted of 4 subjects. These groups were formed on the basis of body composition of the subjects. The G1 group had more than 32% body fat, G2 had in between 21-32% body fat and G3 group had less than 21% body fat.

### **Criterion Measure:**

The present study considered the (i) Resting Skin temperature (ii) skin temperature immediate after exercise and (iii) Recovery period were measure as criterion in this study.

### **Instruments and Tools Used:**

Body fat was assessed by standard anthropometric equation.<sup>[7]</sup> For this purpose skin folds were measured by Harpendine Holton skin fold caliper.

Skin temperature was measured by Non-Contact Digital Thermometer.

Standard stop watch was used for time specification.

### **Controlling Factors:**

Present study was conducted after controlling two variables: (i) Exercise and (ii) Humidity & temperature of Environment. Step up and down for five minutes on 16 inch high bench was used as exercise protocol in this study. All data for the present study was collected at average 25.21<sup>0</sup>C temperature and 63.33% humidity.

**Design of the study and statistical procedure:**

Multiple group design with three independent mean were used for the present study. Each subject's body fat were measured and were classified under three groups namely overweight or obese group (G1), Normal group (G2) and Lean or underweight group (G3). Mean value and standard deviation for resting and immediate after exercise skin temperature and for recovery period were measured for G1, G2 and G3 group separately and inter group difference was analyzed by using ANOVA. Only 0.05 level of significance was used in this study. All statistical analysis was done by standard statistical software.

**RESULTS AND FINDINGS**

The mean value and standard deviation of skin temperature at Rest, Immediate after exercise and the Recovery period for G-1, G-2 and G-3 have presented

in Table-1. Table-1 indicated that mean skin temperature at rest and immediate after exercise were different. The mean recovery period of skin temperature after exercise for G-1, G-2 and G-3 were also different. In order to find out the significance of inter group difference ANOVA was computed and result presented in Table-3. Table-3 indicated that F-value (F=1.59) for resting skin temperature and the f-value (F=1.33) for recovery period were not significant statistically ( $p < 0.05$ ) but the f-value (F=4.195) for the skin temperature of immediate after exercise was found significant statistically. The inter group difference was measured by t-test for this variables and results have presented in Table-4. Table-4 indicated that t value for G1 – G2 and G2 – G3 were ( $t=0.50$  and  $t=2.00$  respectively) not statistically significant ( $p < 0.05$ ) but t value for G1 – G3 ( $t=2.86$ ) was found significant statistically ( $p > 0.05$ ).

**Table-1: Skin temperature at Rest & Immediate after exercise and during Recovery period for different Group**

Subject Groups	Rest		Immediate after Exercise		Recovery period	
	Mean	SD	Mean	SD	Mean	SD
Gr-1	98.13°F	0.25	96.93°F	0.23	28.67 min	2.31
Gr-2	98.22°F	0.21	97.05°F	0.18	21.33 min	2.42
Gr-3	97.95°F	0.19	97.53°F	0.45	12.16 min	1.63

**Table-2: Result of ANOVA for Skin temperature at Rest, Immediate after exercise and Recovery period among different Groups**

ANOVA for	Sources of Variance	df	Sums of Squares	Mean Variance Square	F
Skin temperature at Rest	Among the means of Groups	2	0.145	0.0725	1.59
	Within the Groups	10	0.455	0.0455	
Skin temperature Immediate after exercise	Among the means of Groups	2	0.73	0.365	4.195*
	Within the Groups	10	0.87	0.087	
Recovery Period	Among the means of Groups	2	16.9	8.45	1.33
	Within the Groups	10	634.33	6.34	

\*Significant at 0.05 level (To be significant 0.05 level the F-value should be 4.10).

**Table-3: Results of t-test for skin temperature at Immediate after Exercise condition for different groups**

Groups Considered	Mean Difference	t
Gr-1 and Gr-2	0.12	0.50
Gr-2 and Gr-3	0.48	2.00
Gr-3 and Gr-1	0.6	2.86*

\*Significant at 0.05 level (To be significant the t-value should be 2.23)

**DISCUSSION ON RESULT**

A comparison of skin temperature at Rest and Immediate after exercise for each three group have presented graphically in Figure-1. It has shown that G2 had highest skin temperature at Rest followed by G1 and lowest skin temperature was found for G3.

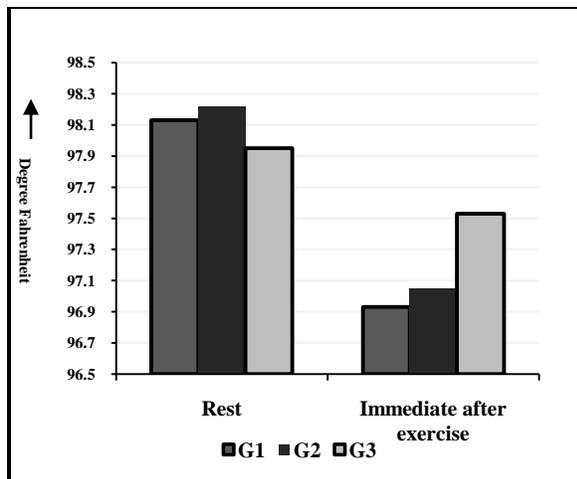


Figure-1: Comparison of skin temperature of different group of subjects at Rest, and Immediate after exercise.

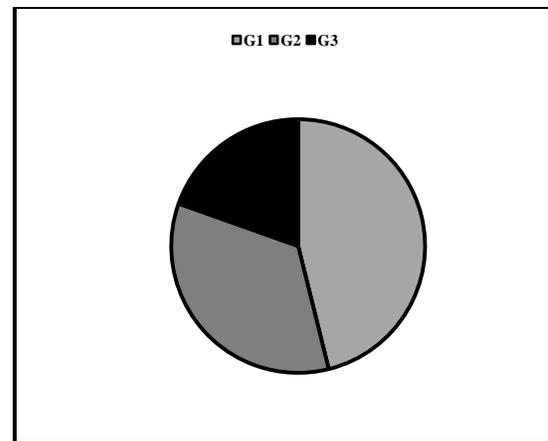


Figure-2: Comparison of Recovery Time (min) of skin temperature for different group after exercise.

Highest fall of skin temperature immediate after exercise was found for G1 and G2 and fall of skin temperature immediate after exercise was lowest for G3. The recovery period taken to return in normal state after exercise for each three group has presented graphically in Figure-2. It has shown that G1 had taken highest recovery time for skin temperature than other two groups. The G2 had taken less than G1 but their recovery time was more than G3. The lowest recovery time was found for G3 in the present study.

Finding of present study was same and supported by the several other studies. Nakayama reported that during light work using the arm in a warm environment, skin temperatures of the arms and chest fell and remained at lower levels during work. [8] Torii, Yamasaki, Sasaki and Nakayama found that the skin temperature began to decline immediately at the onset of the exercise and it reduced more if the work intensities increased. [9] Ohnuki and Nakayama reported that raised work intensities increase the surface area affected by lowered skin temperature. [10]

Research studies revealed that the body temperature raised due to active participation in exercise and physical fitness programme. [11] Exercise increase metabolic rate which helps to increase core body temperature. But present study found that immediate after exercise the skin temperature decreased. The physiology of this finding was due to the segmental vasoconstriction probably caused as a reflex in the spinal cord by non-thermal afferents from exercising muscles or moving tissues. The effect of thermoregulatory vasodilatation was reduced by the reflex vasoconstriction caused by non-thermal factors. [8] The rise in core temperature during and after exercise results from the decreased dry heat loss due to a fall in skin temperature. [8] The amount of sweat on subjects face immediate after exercise suggested that fall in skin temperature during and just after initial exercise was also due to increased of evaporative cooling. [9]

The recovery period of skin temperature after exercise was longer for G1 than G2 and G3. The G3 subject who were lean and had lower percentage of body fat had taken lowest time period to become normal state. It might be due to the fact that obese person had much more fat in sub-contentious level which in other way was

protecting body heat to radiate and transmit outside the environment. Sub-contentious fat layer act as good insulator in that case. As the lean group G3 had lower fat layer under skin their core heat was radiate and transmit faster and took less time to return normal condition.

## CONCLUSION

Within the limitation of the present study the following conclusions were drawn: The skin temperature reduced immediately after exercise in all obese, normal and lean groups of women. Fall in skin temperature immediate after exercise was highest for obese (G1) women and this fall was comparatively lower in lean group.

The recovery period of skin temperature after exercise was longer for G1 than G2 and G3. The obese group had taken longer recovery period than others. The subject who were lean and have lower percentage of body fat had lower recovery period of skin temperature.

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How to cite this article: Sil P. Recovery period of skin temperature following an exercise bout among obese normal and lean women. *Int J Res Rev.* 2015; 2(5):269-273.

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