

Cardio-Vascular Response of Isometric Handgrip Exercise in Normal Healthy Adults as a Familiar Stressor

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Abstract: This study was designed to examine the effect of the heart rate response and blood pressure response to a stressor like IHG exercise over a short term period like five days in young healthy subjects. Ten healthy subjects were recruited for the isometric handgrip exercise. Same task was repeated by the same individuals for 5 successive days. There is a significant decline in DP increments to sustained isometric handgrip from day 1 through day 5 ($P = 0.002$) with a linear trend ($P < 0.0001$). In contrast, HR response to isometric handgrip exhibited a nonlinear trend ($P < 0.04$). It shows that the individuals become more and more familiar with a particular task if it is carried out repeatedly. Therefore it can be concluded that when a person gets expose to a similar type of work repeatedly, the magnitude of the cardioacceleratory response would wane without a rise in heart rate.

Keywords: Short term effect of HR and BP, Familiar stressors, autonomic reflex test, isometric handgrip exercise.

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I. Introduction

Blood pressure response to sustained isometric handgrip (IHG) has long been used to evaluate sympathetic control of blood vessels (1). Guyton and Hall described blood pressure as a force exerted by the column of blood against any unit area of blood vessels. In contemporary physiology, stress is defined as any stimulus that is associated with an increase in plasma levels of adrenocorticotrophic hormone (Ganong 25th edition). Hans Selye's defined stress as the nonspecific response to the body to any demand (2). However an increase in blood pressure and/or heart rate is used as an index of sympatho-adrenomedullary axis activation (Ganong 25th edition). It is inferred that IHG exercise can be a simple, cost effective way of measuring the blood pressure effect on healthy individual over ten weeks time (3)

This study was designed to examine the effect of the heart rate response and blood pressure response to a stressor like IHG exercise over a short term period like five days in young healthy subjects. The broader purpose of this study is implications for the usage of this parameter for monitoring autonomic reactivity. **MATERIAL AND METHOD:** 10 motivated healthy adult male and female subjects, aged 25 ± 3.2 years (mean \pm SD) were recruited for this study. They were all made to sit comfortably on a chair with their back supported for more than 5 minutes before taking basal BP, HR and performing the task. The test was carried out in department of physiology between 8 a.m. and 12:30 p.m, after 1-2 hrs of light breakfast.

Sustained isometric handgrip at 1/3 maximal voluntary contraction for 1 minute: the maximal voluntary contraction of the subject was measured at baseline. The subject was then asked to maintain 1/3 MVC for at least one full minute and BP and HR at the end of a minute of sustained handgrip were measured.

Statistical analysis: Since repeated measurements were made on the same subjects, a repeated measures one-way analysis of variance (ANOVA) was used to determine if there was a significant difference among column means; i.e. whether time per se had any effect on the BP and HR responses to the IHG exercise. In each case, the P value was insignificant which meant that time had no significant effect on the mean values of the parameters measured. The five values obtained from the same subject on 5 consecutive days are more likely to be similar to each other than the ten values obtained on one particular day. This assumption was tested by using the repeated measures ANOVA. The matching was effective in most cases. This only means that the repeated measure ANOVA was the appropriate test for the data in question. Further, since the five values obtained from one individual over a 5 day period are more likely to be similar to each other than data from 10 individuals on any one day, this data is an example of clustered data. In other words, all data obtained from one individual constitute a cluster. The amount of clustering was measured by using intraclass correlation coefficient (ICC). Statistical analysis was performed using a demo version of GraphPad InStat [GraphPad Software Inc, San Diego, CA, USA].

Result of isometric handgrip exercise: There is a significant decline in DP increments to sustained isometric handgrip from day 1 through day 5 ($P = 0.002$) with a linear trend ($P < 0.0001$). In contrast, HR response to isometric handgrip exhibited a nonlinear trend ($P < 0.04$).

Table 4: Response of subjects' (n= 10) systolic pressure (SP), diastolic pressure (DP) and HR response to isometric handgrip.

Parameter	Day	Column mean \pm SD	Intraclass correlation coefficient
SP response	1	19 \pm 8	0.92
	2	22 \pm 12	
	3	21 \pm 11	
	4	16 \pm 8	
	5	15 \pm 10	
DP response	1	20 \pm 11	0.83
	2	20 \pm 11	
	3	18 \pm 9	
	4	11 \pm 7	
	5	11 \pm 8	
HR response	1	9 \pm 8	0.95
	2	9 \pm 10	
	3	12 \pm 10	
	4	5 \pm 9	
	5	11 \pm 12	

SP: systolic pressure; DP: diastolic pressure; HR: heart rate

II. Discussion

we have started the work to find out if a subject is exposed to a familiar stressor that is IHG examination, for a five successive days what is the difference in measurements between the different days in the same subject due to? The effect can be due to repeated exposure over five days to same stressor on blood pressure and heart rate responses.

It is seen that there is a significant decline in diastolic pressure to IHG examination from day one through day five. Therefore it can be concluded that when a person gets exposed to a similar type of work repeatedly, the magnitude of the cardioacceleratory response would wane without a rise in heart rate. On the other hand isometric hand grip exercise can be used in heart patient safely because after sometime diastolic blood pressure decreases.

Limitation- the limitation of the study is that the difficulty of the exercise could not be standardized across days within subjects, although it was stressful.

References

- [1]. **Sneddon J.** Cardiovascular autonomic function testing. In measurement in cardiology, Sutton P (Ed). The Parthenon publishing group, Lancashire, 1999: 101-112.
- [2]. **Selye's H. A.** syndrome produced by diverse noxious agents. Nature 138: 32, 1936.
- [3]. **Rinku Garg, Varun Malhotra, Avnish Kumar et al.** Effect of isometric handgrip exercise training on resting blood pressure in normal healthy adults. Journal of Clinical and Diagnosis Research. September 2014. 8(9), BC08-BC10.
- [4]. **Guyton AC and Hall JE.** Textbook of Medical Physiology. Philadelphia, PA: Saunders, 2016.
- [5]. **Ganong WF.** Review of Medical Physiology. International edition, Mc Graw Hill Co, 25TH edition.
- [6]. **Bannister and Mathias (Eds).** A textbook of disorders of the autonomic nervous system. Oxford University Press, London 1992.
- [7]. **Kelley, George A, Kristi S. Kelley.** Isometric handgrip exercise and resting blood pressure: a meta-analysis of randomized controlled trials. Journal of Hypertension.2010;28(3):411-18.
- [8]. **Mortimeter J, Mckune AJ.** Effect of short-term isometric handgrip training on blood pressure in middle-aged females. Cardiovasc J Afr. 2010;21:1-4.

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