

# Effect of Modified Valsalva Maneuver on Heart Rate and ECG among Young Non –Athletes and Athletes

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## Abstract

**Introduction:** Valsalva maneuver (VM) is an indicator of cardiac Autonomic function as well as it is used clinically for testing patency of Eustachian tube in Ear examination. According to one Cochrane systematic review, the modified maneuver may be effective in 19-54% of cases and there is insufficient evidence to either recommend it or advise against it in supra-ventricular tachycardia.

**Material and Method:** The present cross sectional study was conducted in research lab, Department of Physiology, Late Shree Barat Ratana Atal Bihari Vajpeyi Memorial Medical college, Rajnandgaon (C.G) India, during study period April to October 2016. There are two study groups – young athletes engaged in endurance sports and non athletes, first year students of medical college. All the subjects had been demonstrated and practiced modified Valsalva Maneuver and after that subjects were selected for the study (30 in each group comprising of males and females). During modified Valsalva Maneuver continuous recording of Heart Rate and ECG is done. Data obtained so will be recorded and analyzed.

**Observations-**Heart rate was significantly higher after Modified Valsalva Maneuver in athlete, while it was significantly lower in non athlete after Modified Valsalva Maneuver. No significant difference in heart rate between athlete & non athlete group before Modified Valsalva Maneuver. But there was significant difference heart rate between both groups after Modified Valsalva Maneuver. Significantly higher no. of Athletes showed increase t wave duration & prolonged TP Segment as compared to non athletes.

**Conclusion:** Modified Valsalva Maneuver is good index of cardiovascular system.

**Keywords-** Modified Valsalva Maneuver, Athletes, Non athletes, Supraventricular tachycardia.

## Introduction

Valsalva maneuver (VM) is an indicator of cardiac Autonomic function as well as it is used clinically for testing patency of Eustachian tube in Ear examination. <sup>(1)</sup> The Valsalva Manoeuvre is a tactic that demonstrates a basic cardiovascular physiologic feedback loop. The purpose of it is to induce vagal firing from the

cardiovascular control centre in the medulla, in order to slow the heart rate, and interrupt the rapid ventricular rate in a supraventricular tachycardia.

The Valsalva maneuver or Valsalva manoeuvre is performed by moderately forceful attempted exhalation against a closed airway, usually done by closing one's mouth, pinching one's nose shut while pressing out as if blowing up a balloon. Variations of the maneuver can be used either in medical examination as a test of cardiac function and autonomic nervous control of the heart, or to "clear" the ears and sinuses (that is, to equalize pressure between them) when ambient pressure changes, as in diving, hyperbaric oxygen therapy, or air travel. <sup>(2)</sup>

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The technique is named after Antonio Maria Valsalva, a 17th-century physician and anatomist from Bologna whose principal scientific interest was the human ear. <sup>(3)</sup> He described the Eustachian tube and the maneuver to test its patency (openness). He also described the use of this maneuver to expel pus from the middle ear.

A modified version is done by expiring against a closed glottis and maintaining pressure of a mercury column at 40mm Hg by lying down face up and raising legs with the help of an assistant. <sup>(4)</sup> This will elicit the cardiovascular responses described below but will not force air into the Eustachian tubes.

Modified Valsalva maneuver is used to terminate an attack of abnormal heart rhythm (arrhythmia)

According to one Cochrane systematic review, the modified maneuver may be effective in 19-54% of cases and there is insufficient evidence to either recommend it or advise against it in SVT. <sup>(5)</sup>

Modified version of Valsalva maneuver has therapeutic role in terminating Supraventricular Tachycardia (SVT). The hemodynamic Effect of Valsalva maneuver is well known- it affects Cardiac output, Blood Pressure, Stroke volume and Heart rate. Few studies had done in this context but data regarding the effect of VM among athletes and non athletes is lacking. <sup>(6, 7, 8)</sup> Hence we tried to explore Modified Valsalva maneuver as a test for cardiac function with respect to its effect on Heart Rate and ECG.

In the Present study we tried to evaluate modified Valsalva maneuver and its effect on two hemodynamic parameters first Heart rate and secondly on ECG (wave morphology and durations) among young athletes and non athletes.

#### **Aims and objectives:**

To evaluate effect of modified Valsalva Maneuver on hemodynamic parameters Heart rate and ECG (wave morphology and durations) among young athletes and non athletes.

### **Material and Method**

The present cross sectional study was conducted in research lab department of physiology. There are two

study groups – young athletes engaged in endurance sports and non athletes, first year students of medical college. Consent from IEC had been taken before the study.

All the subjects had been demonstrated and practiced modified Valsalva Maneuver and after that subjects was selected for the study (30 in each group comprising of males and females). Informed consent from the subjects was taken. Basic anthropometric parameters like Age, Height, Weight, BMI was recorded in both the groups.

Heart rate was recorded by using pulse oximeter and ECG is recorded by ECG machine (Philips ECG) in supine and resting condition. After that the subject is encouraged to perform modified Valsalva Maneuver of 25 to 30 seconds by exerting maximum effort and keeping the mercury column in the sphygmomanometer to value of 40 mm of Hg and lying down face up and raising legs with the help of an assistant.

#### **Inclusion criteria:**

We included 60 subjects out of which 30 subjects are athlete and practising daily exercise.

#### **Exclusion criteria**

Pt. With P/H/O high Blood pressure, Coronary Artery Disease, Flutter & Fibrillation.

Also we took 30 non athlete student who are not practising any kind of exercise. We excluded subjects who is suffering from hypertension as well as hypotension, who is having Diabetes or having any kind of respiratory diseases. Along with that we also excluded smokers and alcoholic.

During modified V Maneuver continuous recording of Heart Rate and ECG is done. Data obtained so will be recorded and analyzed. Statistical analysis was done by using descriptive and inferential statistics using students paired and unpaired t test and chisquare test and software used in the analysis were SPSS17.0 version and GraphPad Prism 6.0 version and  $p < 0.05$  is considered as level of significance ( $p < 0.05$ ).

**Observations****Table-1: Comparison of heart rate in athletes and non athletes before and after Valsalva Maneuver (VM)**

		Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value	p-value
Athletes	Before VM	76.00	30	5.63	1.02	6.63±4.49	7.26	0.0001,S
	After VM	69.36	30	6.86	1.25			
Non Athletes	Before VM	76.56	30	5.03	0.91	8.53±9.22	5.06	0.0001,S
	After VM	85.10	30	10.23	1.86			

**Table 2: Comparison of heart rate in athletes and non athletes before and after VM**

		No.	Mean	Std. Deviation	Std. Error Mean	Mean Difference	t-value	p-value
Before VM	Athletes	30	76.00	5.63	1.02	0.56±1.37	0.41	0.68, Non Significant
	Non Athletes	30	76.56	5.03	0.91			
After VM	Athletes	30	69.36	6.86	1.25	15.73±2.24	6.99	0.0001 Significant
	Non Athletes	30	85.10	10.23	1.86			

Heart rate was significantly higher after Modified Valsalva Maneuver in athlete, while it was significantly lower in non athlete after Modified Valsalva Maneuver. No significant difference in heart rate between athlete & non athlete group before Modified Valsalva Maneuver. But there was significant difference heart rate between both groups after Modified Valsalva Maneuver. [Table-1, 2]

**Table 3: Comparison of T Wave duration (ECG) findings in two groups**

ECG Finding	Athletes	Non Athletes	Chi square value, d. f. , p value
Normal	11 (%)	14(%)	27.745, 2, <0.0001 Highly Significant
Increase T Wave duration	18 (%)	0	
Short T Wave duration	1 (%)	16 (%)	
Total	30 (100%)	30 (100%)	

Significantly higher no. of Athletes showed increase t wave duration as compared to non athletes. [Table-3]

**Table 4: Comparison of other ECG findings (TP Segment & QRS complex) in athletes group**

ECG Finding	Athletes	Non Athletes	Chi square value, d. f. , p value
Prolonged TP Segment	15 (%)	0	28.125, 3, <0.00001 Highly Significant
Reduce TP Segment	0	17 (%)	
Short QRS complex	1 (%)	0	
Normal ECG	14 (%)	13 (%)	
Total	30 (100%)	30 (100%)	

Significantly higher no. of Athletes showed prolonged TP Segment as compared to non athletes. [Table-4]

## Discussion

Valsalva manoeuvre is defined as the effort to breathe out forcibly while the mouth and nose are firmly closed or the vocal cords pressed together. The Valsalva manoeuvre is employed while straining at stool and in other circumstances. It causes a rise in blood pressure followed by a sharp drop and then a second sharp rise in blood pressure. This may be dangerous in people with heart disease and should be avoided.

A modified Valsalva manoeuvre is done by expiring against a closed glottis and maintaining pressure of a mercury column at 40mm Hg by lying down face up and raising legs with the help of an assistant. This will elicit the cardiovascular responses described below but will not force air into the Eustachian tubes. Modified Valsalva maneuver is used to terminate an attack of abnormal heart rhythm (arrhythmia).<sup>(9)</sup>

Seyed Mehran Hosseini et.al in 2015 did study on Valsalva Maneuver and Strain-Related ECG Changes and saw that Following the Valsalva Maneuver, the RR and PR intervals, corrected QT interval (QTc), P wave duration and amplitude, T wave amplitude, and the ratio of T/R amplitudes showed significant changes. The QRS duration and R wave amplitude did not show significant changes. The Valsalva Maneuver caused time and voltage changes in some ECG waves during the strain phase.<sup>(8)</sup>

Alterations in heart or lung volume, electrode-related alterations, and autonomic tone may cause these changes. In the current study found that, after practising the modified Valsalva maneuver in athletes we observe that there occur increase in T wave duration and also they had prolonged TP segment. While, in non-athletes

subject we saw that there occur decrease in T wave duration and with reduced TP segment.

Looga in 2005 did study on The Valsalva manoeuvre-cardiovascular effects and performance technique and found that the changes in heart rate and blood pressure during an expiratory Valsalva Maneuver are greater than the responses observed during completion of an inspiratory Valsalva Maneuver.<sup>(9)</sup> In the present study we found that in athlete initially heart rate is more (but within physiological limit) and after practicing Modified Valsalva Maneuver the heart rate reduces significantly in them. We, also concluded in this study that in non- athlete initially heart rate is more (but within physiological limit) but after practicing Modified Valsalva Maneuver the heart rate increases significantly in non- athlete subject even it crosses physiological limit in some subjects .

De jong et.al in 1997 studied The Valsalva manoeuvre as a cardiovascular reflex test in healthy children and teenagers and observe that the Valsalva manoeuvre seems applicable as a cardiovascular reflex test to assess neurocardiovascular control in children and teenagers.<sup>(10)</sup> We also concluded that after regular exercising the modified Valsalva manoeuvre there occur significant reduction in the heart rate with more ventricular filling during ventricular repolarization by increasing the T wave duration.

A.E. Navarro et.al in 1996 assess Heart rate changes during the Valsalva maneuver in patients with isolated aortic insufficiency and found that When compared to the normal sedentary controls the Valsalva ratio was slightly lower in the asymptomatic patients with aortic insufficiency.<sup>(11)</sup> Our study also prove that with regular practicing Modified Valsalva Maneuver the cardiac

output increases with increase in duration of ventricular filling time period which ultimately reduces the chances of aortic insufficiency.

### Conclusion

Modified Valsalva Maneuver is good index of cardiovascular system. By regular practicing Modified Valsalva Maneuver subject can enhance the autonomic response. Modified Valsalva Maneuver indirectly help in increasing the the cardiac output by increase in duration of ventricular filling time period.

Modified Valsalva Maneuver also decreases the heart rate with prolonged T wave duration meaning it provide a good time period for ventricular filling. Therefore, our study stress to practise the Modified Valsalva Maneuver by healthy individual so get a better cardiovascular response for betterment of life.

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**Conflict of Interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee.

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