

**Synopsis of the thesis**

**A STUDY ON SOME PHYSIOLOGICAL PARAMETERS  
DURING DIFFERENT PHASES OF SYNODIC PERIOD OF  
MOON IN MALE HUMAN SUBJECTS**

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## **SYNOPSIS**

The gravitational pull of the moon on the earth varies in different phases of the lunar month, i.e. new moon (NM), first quarter (FQ), full moon (FM) and third quarter (TQ). As evidence of this variation of lunar gravitational pull the amplitude of ocean tides changes according to the relative position of the moon in its orbit. The influence of this gravitational pull on some marine invertebrates and vertebrates has been reported. Though the influence of lunar cycle on human body in pathological condition has been indicated in several studies, the physiological changes induced by lunar cycle remained unknown. The present investigation has been made to know the changes of various physiological parameters (cardiovascular, haematological, anthropometric and body composition, and autonomic) in different phases of synodic periods of moon in young and old male human subjects.

The cardiovascular activity was assessed by measuring resting heart rate (HR) and resting blood pressure (BP), peak HR and peak BP, recovery HR and BP after Harvard step test by the Student Lab PRO version of BIOPAC MP35 acquisition unit in different phases of synodic period of moon. The physical fitness index (PFI) was determined by Harvard step test. The hematological status of the subjects was assessed by measuring the TC of WBC, TC of RBC, concentration of hemoglobin (Hb), pack cell volume (PCV), DC of WBC and Arneht count of neutrophils by the standard procedure in resting condition in different phases of synodic period of moon. From those hematological parameters the mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated. The standing height, body weight and skin folds (chest, abdomen and thigh) were measured for the assessment of total body water, body mass index (BMI), body density, total body fat, % of body fat and fat-free mass in different lunar phases. The autonomic neural activities were assessed by measuring

30<sup>th</sup>:15<sup>th</sup> ratio from orthostatic test, E: I ratio and difference of inspiratory heart rate (IHR) and expiratory heart rate (EHR) from deep breathing test, galvanic skin response (GSR) in resting and reflex condition (postural change, during deep breathing and mental task), Valsalva ratio (VR), tachycardia ratio (TR) and bradycardia ratio (BR) from Valsalva maneuver, blood pressure in cold cold pressor test in different phases of synodic period of moon. All the parameters of those experiments were measured by BIOPAC MP35 polygraph system following the BIOPAC Student Lab PRO Manual, 2005.

The PFI of university students was higher in NM and FM compared to FQ and TQ. It was also found that the resting HR did not change significantly in different phases of synodic periods of moon. But the resting BP in NM and FM was lower than that of the other phases of lunar month. The HR immediately after cessation of exercise i.e. the peak HR in NM and FM was lower than that of FQ and TQ. Similarly the BP immediately after cessation of exercise i.e. the peak BP in NM and FM was lower than that of FQ and TQ. From the recovery HR during the first ten minutes duration after exercise in the different phases of lunar month it was found that recovery was quicker in NM and FM than that of FQ and TQ. Therefore, the cardiovascular dynamics was influenced by the lunar cycle, and the exercise-induced cardiovascular changes were more prominent than in the resting condition. Moreover, the physical efficiency of humans was increased in NM and FM might be due to the alteration of hemoconcentration and/or autonomic neural activity.

It was found from the hematological study that the TC of WBC, TC of RBC, Hb concentration and PCV were higher in NM and FM compared to both FQ and TQ. The MCH and MCV were lower in NM and FM than that of the other phases of lunar month. The MCHC did not show any significant difference in different phases of lunar month. Therefore, the higher PFI in NM and FM might be due to this higher hemoconcentration in these phases. The hemoconcentration was

increased in NM and FM might be due to the alteration of hydration status of the body and/or autonomic neural activity.

It was found from the results that the total water content of the body (hydration status of the body) was not changed significantly in different phases of synodic period of moon. The other body composition and anthropometric parameters were not changed significantly in different phases of synodic period of moon, except thigh skin fold, which was significantly higher in NM and FM in comparison to FQ and TQ. Therefore, the alteration of hemoconcentration in different phases of lunar cycle was not due to the alteration of hydration status of the body.

The 30<sup>th</sup>:15<sup>th</sup> ratio was higher in NM and FM than that of FQ and TQ. Therefore, the autonomic tone (sympathetic and parasympathetic) was increased in NM and FM compared to FQ and TQ. The E: I ratio was higher in NM and FM than that of FQ and TQ. The difference between IHR and EHR was more in NM and FM compared to FQ and TQ. Therefore, the parasympathetic neural activity was increased in NM and FM compared to FQ and TQ. The basal value of GSR in different posture was lower in NM and FM compared to FQ and TQ. The peak value, difference between peak and minimum value, and integral value of GSR during deep breathing were significantly increased in NM and FM compared to FQ and TQ. In experimental condition with mental task, the difference of maximum and minimum GSR value (fluctuation of GSR), mean values, peak values, minimum values and integral values were higher in NM and FM than other phases. Therefore, the reflex sympathetic neural activity was higher in NM and FM may be due to the higher activity of sweat glands and lower skin resistance compared to FQ and TQ. In the cold pressure test, the SBP was lower in NM and FM compared to FQ and TQ. The DBP was increased more than SBP during cold pressor test. The SBP almost comeback to the normal level (pre immersion of hand in cold water) after 1min removal of hand from water, but DBP remains 3 to 4 mmHg above the pre exposure level. Therefore, the autonomic

neural activity was efficiently adjusted in NM and FM. It was found from the Valsalva maneuver experiment that the Valsalva ratio (VR) was more in NM and FM in comparison to FQ and TQ. Though the tachycardia ratio (TR) did not show any significant difference, the bradycardia ratio (BR) was less in NM and FM in comparison to FQ and TQ. Therefore, there was a favorable reflex autonomic neural activity in NM and FM in comparison to FQ and TQ. The hemoconcentration was increased in NM and FM might be due to splenic contraction by this higher autonomic neural activity. The PFI was increased in NM and FM might be due to the higher autonomic neural activity and higher hemoconcentration in NM and FM.

In old subjects PFI was higher in NM and FM compared to FQ and TQ. The HR immediately after cessation of exercise i.e. the peak HR in NM and FM was lower than that of FQ and TQ. The HR recovery towards resting level (near about the resting HR) after the exercise was quicker in NM and FM compared to FQ and TQ. It was found from the hematological study in old subjects that the TC of WBC, TC of RBC and PCV were higher in NM and FM compared to both FQ and TQ. The MCV was lower in NM and FM than that of FQ and TQ. The MCH was lower in NM and FM compared to FQ and TQ. The Hb concentration did not show any significant change in different phases of lunar month. In spite of increment of TC of RBC, the Hb concentration did not increase in NM and FM probably due to the lower MCH in NM and FM. The body composition and anthropometric data did not show any significant difference in different phases of synodic period of moon. The GSR of old subjects in supine, sitting and standing posture was lower in NM and FM than that of FQ and TQ. The difference between supine GSR and standing GSR, sitting GSR and standing GSR were significantly lower in NM and FM than that of FQ and TQ. The peak value, difference between peak and minimum value of GSR during deep breathing were significantly increased in NM and FM compared to FQ and TQ. During the mental task of old subjects, the peak value of GSR, difference between peak and minimum value, mean value and the area covered by the GSR graph were

significantly higher in NM and FM compared to FQ and TQ. The 30<sup>th</sup>:15<sup>th</sup> ratio in old subjects was significantly higher in NM and FM compared to FQ and TQ. The E: I ratio, and the difference between IHR and EHR in old subjects were significantly higher in NM and FM compared to FQ and TQ. The VR was higher in NM and FM, and TR and BR were lower in NM and FM compared to FQ and TQ. Therefore, the cardiovascular, autonomic and hematological parameters in old age were changed similarly as young age in different phases of synodic period of moon. However, reflex autonomic neural activities were less efficient in old subjects compare to young subjects.

From the present study it can be concluded that the autonomic neural activity is higher in new moon and full moon in comparison to first quarter and third quarter. The cardiovascular system is influenced differently in the four phases of lunar month. Physical efficiency is higher in new moon and full moon compare to first quarter and third quarter, is probably due to greater venous return by higher hemoglobin concentration in blood and efficient regulation of heart and blood vessels, and splenic contraction by the autonomic nervous system. The cardiovascular, autonomic and hematological parameters in old age changed similar as young age. However, reflex autonomic activities are less efficient in old subjects compare to young subjects.