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# Self-Reported Night Activity Score and its Association with Daytime Orthostatic Pulse Rate, Anthropometrical Indices, Hemoglobin Genotypes and Blood Groups in Apparently Healthy Young Individuals

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**ABSTRACT**
Studies have enumerated the heath adversities associated with night work. The study investigated whether self-reported night activity score was associated with daytime orthostatic pulse rate, anthropometric indices and inherent biological indices such as hemoglobin genotype and blood group in apparently healthy young individuals. 100 participants comprising of 48 males and 52 females and averaging 19.7± 0.22 12 years who satisfied the inclusion criteria were selected for the research. A well-structured questionnaire was designed to determine extent at which the participants engaged in night activity. Pulse rate and other parameters were determined using standard procedures. Although daytime orthostasis caused a significant increase in pulse rate when compared with baseline, it has no significant relationship with self-reported night score. Self-reported night score showed no relationship with body weight (r=0.003), body height (r=-0.026), body mass index (r=-0.012), age (r=-0.052), gender ($x^2$=2.199) and hemoglobin genotype ($x^2$=2.883). However, there was a significant association ($x^2$=20.630, P<0.05) between self-reported night activity score and the blood groups. The findings of the study suggest a relationship between self-reported night activity score and blood groups.

**Keywords:**
Self-reported night Activity score,
Orthostatic pulse rate,
Anthropometrical Indices,
Hemoglobin Genotypes,
Blood groups

## INTRODUCTION

Unlike the Stone Age, the presence, utilization and popularization of artificial light at night in the modern society contribute significantly to the feasibility of night works (Adeniyi *et al*., 2021; Adeniyi *et al*., 2021). The literature is engorged with the health outcomes of night works. A study by Wang *et al*., (2023) in 1499 oil field workers showed that night work caused an high prevalent rate of type II diabetes and retinol binding protein-4 without any significant difference in family history of hypertension and diabetes mellitus. A study involving 10038 nulliparous pregnant women which was conducted by Wallace *et al*., (2023), pregnant evening shift workers were shown to demonstrate 75% increased likelihood of developing gestational diabetes mellitus as well as 45 minutes higher variability in sleep timing compared to daytime workers. In 4155 participants, Sweeney *et al*., (2020) reported that night work was associated with increased risk of obesity, diabetes mellitus and cardiovascular diseases despite the lower sedentary tendency and higher physical activity.

Besides circadian disruption in physical activity, night work induced obesity is related with changes in lipid metabolisms. For instance, Dutheil *et al*., (2020) noted that being on permanent night work raised the odds of developing elevated blood levels of cholesterol and triglyceride as well as reduced blood levels of high density lipoprotein cholesterol levels without any significant change in the low density lipoprotein. A similar study by Joo *et al*., (2019) investigated whether there was any association between nighttime work and dyslipidemia 5813 participants. It was reported that among men whose sleeping duration was less than 7 hours, nigh workers showed higher likelihood of developing dyslipidemia when compared to daytime workers. White collar women who engage in night work exhibited higher dyslipidemia tendency than those who are doing daytime jobs.

In a cohort study that recruited 822 regular and 1348 night workers, a greater likelihood of dyslipidemia was found in night worker than those who are on permanent day work. Besides,



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hair cortisol concentration was also reported to be elevated in night worker when compared to workers on permanent daytime work (Zhu *et al.*, 2022). Although recent night works had no impacts on C-reactive protein, Nurses who engaged in one to four recent night works showed lower high density lipoprotein cholesterol than those without any recent night works (Johnson *et al*., 2020). A prospective cohort study involving 74,862 participants, Gu *et al.*, (2015) reported that women who had more than five years rotatory night works exhibited high all-cause cardiovascular mortality when compared to those who had no night work experience. With the exception of lung cancer, the authors also noted that there was no relationship between rotatory night works and all cancer mortality. The aim of the study was to examine whether self-reported night activity score was related with orthostatic pulse rate, anthropometric indices and inherent biological indices such as hemoglobin genotype and blood group in apparently healthy young individuals.

## MATERIALS AND METHODS

### Site of the study

The work was executed in Federal University of Health Science Otukpo, Otukpo Local Government Area, in Benue State. **It lies** around latitude 7°08'N to 7°15'N and longitude 8°05'E to 8°15'E. The area was chosen based on the fact that no similar study has been done.

### Sample Size

Sample size was determined from the population using Yamane's formula (Yamane, 1967) (n =$\frac{N}{1+N\,[e.e]}$)

Where N = Population of study (150),

n = Sample size, e = Level of significance at 5% (0.05), 1 = Constant

100 participants comprising of 48 males and 52 females were selected through respondent driven sampling for the research through respondent driven sampling.

### Inclusion Criteria and Exclusion Criteria

Adult students both males and females averaging 19.7± 0.2212 years were accommodated into the study. Written consent was gotten from each participant.

Considerations were given only to subjects between ages 18 years and 21 years irrespective of their ABO & Rhesus blood groups. Other considerations include, systolic blood pressure (90mmHg-120mmHg), diastolic blood pressure (60mmHg-80mmHg), pulse rate (60BPM-100BPM) and respiratory rate (12cycles/min-20 cycles/min).

Subjects with medical history of respiratory diseases, cardiovascular, kidney, hepatic and metabolic diseases and anatomical deformities were ruled out. Participants with hemoglobinopathy as well as those with history of smoking, alcoholism and caffeine or on any form of medication were excluded.

### Self-reported night activity score

A well-structured questionnaire was designed to determine the extent at which the participants engaged in night activity. The instrument centered on nighttime reading frequency, night eating frequency, nighttime engagement frequency in audiovisuals and nighttime urine frequency. The introductory part of the questionnaire contained information about the age, sex, blood group and hemoglobin genotype.

### Evaluation of baseline pulse rate and anthropometric indices

Pulse rate were measured in sitting posture after five minutes of rest using the palpatory method as previously measured (Adeniyi and Idaguko, 2024; Adeniyi and Idaguko, 2024; Adeniyi and Idaguko, 2024;Adeniyi *et al*., 2024).

With the aid of weighing scale (Hanson China) and meter rule, body weight and height were determined respectively.

Body mass index was calculated using (Weight (Kg)/Height$^2$ (m$^2$) as previously conducted (Oni and Adeniyi, 2017; Adeniyi *et al*., 2020).

### Evaluation of daytime orthostatic pulse rate

The participants were requested to stand from sitting position for 5 minutes without swaying. At the end of the 5$^{th}$ minute, pulse rate was measured in standing position.

### Statistical analysis

All quantitative data were expressed as mean ± standard error of the mean (SEM) using SPSS 21. Categorical data were expressed in percentage. Statistically significant differences were accepted at $p<0.05$. Pairwise comparison was done using paired T test. Relationships between variables were determined using Pearson Correlation (continuous data) and chi square (categorical data).

## RESULTS AND DISCUSSION

Table 1 showed the socio-demographic characteristics of the participants. The average age was 19.7± 0.2212. 48% (48 participants) were male while 52% (52 participants) were females. Majority (70.7%) (71 participants) possessed hemoglobin genotype 'AA' while those with 'AS' were 29.3% (29 participants). The most prominent blood group (60%) (60 participants) was '$O^+$'. This was followed by $A^+$ (24%) (24 participants), '$B^+$' (9.33%) (9 participants), $O^-$ (5.33%) (5 participants) and '$AB^+$' (1.33%) (1 participant).

**Table 1: Socio-demographic Characteristics of Participants**

| Age (years) | Gender (%) | | Hemoglobin genotype (%) | | | Blood groups (%) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Males | Females | AA | AS | Others | $O^+$ | $A^+$ | $B^+$ | $AB^+$ | $O^-$ | Others |
| 19.7± 0.2212 | 48.0 | 52.0 | 70.7 | 29.3 | 0.0 | 60.0 | 24.0 | 9.3 | 1.3 | 5.3 | 0.0 |

The socio-demographic characteristics of participants: 52% of were males. 60% were blood group O positive.

**Effect of 5-min daytime orthostasis on pulse rate**

Figure 1 showed the effect of 5-min orthostasis on the pulse rate. There was a significant difference at $P<0.05$ from baseline pulse rate.

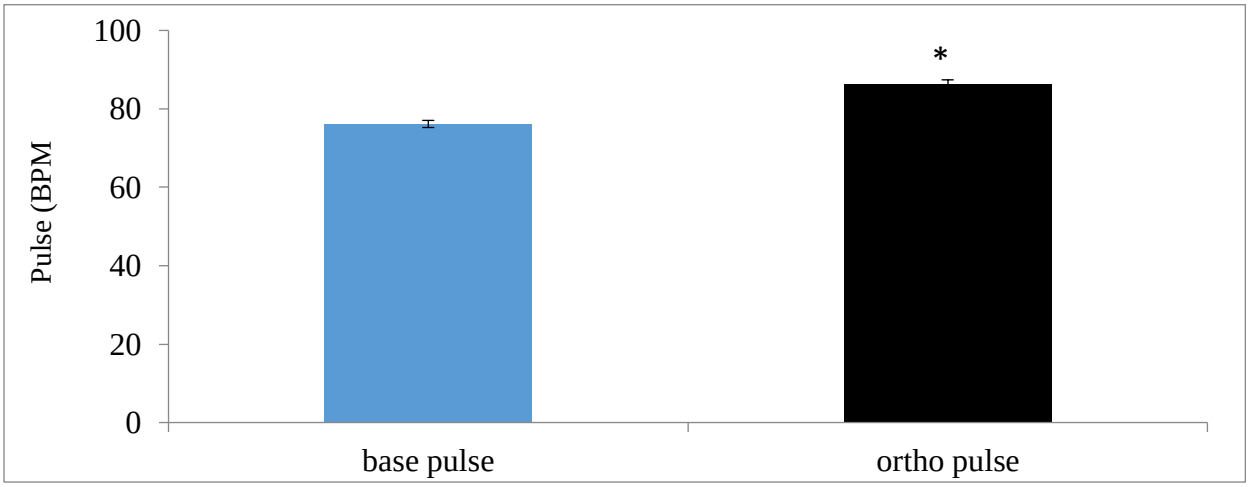


Figure 1: Effect of 5-min daytime orthostasis on pulse rate; '*'represents significant difference (at $P<0.05$) from base pulse rate. 'Ortho' stands for orthostasis, 'base' stands for baseline

**Relationship between self-reported night activity score and daytime orthostatic pulse rate**

Table 2 showed that there was no significant relationship between self-reported night activity score and daytime orthostatic pulse rate

Table 2: Relationship between self-reported night activity score and daytime orthostatic pulse rate

| Pearson correlation (r) | Daytime orthostatic pulse rate (P-value) |
|---|---|
| Self-reported night activity | -0.07 (0.745) |

**Relationship of self-reported night activity score with anthropometrical indices and age**

Table 3 showed that self-reported night activity had no relationship with body weight, body height, body mass index and age

Table 3: Relationship of self-reported night activity score with anthropometrical indices and age

| Pearson correlation (r) | body height (P-value) | body weight (P-value) | body mass index (P- value) | Age (P- value) |
|---|---|---|---|---|
| Self-reported night activity | 0.003 (P= 0.978) | -0.026 (P= 0.824) | -0.012 (P= 0.917) | -0.052 (P= 0.66) |

**Relationship between self-reported night activity score and gender**

Table 4 showed that there was no significant association between self-reported night activity and gender

Table 4: Relationship between self-reported night activity score and gender

| Chi square | Gender (P-value) |
|---|---|
| Self-reported night activity | 2.199 (P=0.333) |

**Relationship of self-reported night activity with hemoglobin genotype and blood group**

Table 5A showed that there was no association between self-reported night activity and hemoglobin genotype. However, there was a significant association between self-reported night activity and blood group. Participants with blood group O positive reported higher night activity.

Table 5A: Relationship of self-reported night activity with hemoglobin genotype and blood group

| Chi square | Hemoglobin genotype (P-value) | Blood group (P-value) |
|---|---|---|
| Self-reported night activity | 2.883 (P=0.237) | 20.630 (P=0.008)* |

* Significant difference (P<0.05)

Table 3.5B Association between self-reported night activity and blood group

| Self-reported night activity | BLOOD GROUPS | | | | |
|---|---|---|---|---|---|
| COUNT | AB POS | A POS | B POS | O NEG | O POS |
| LOW | 0 | 11 | 3 | 2 | 17 |

| | | | | | |
|---|---|---|---|---|---|
| MEDIUM | 0 | 7 | 4 | 1 | 25 |
| HIGH | 1 | 0 | 0 | 1 | 3 |

**Relationship of daytime orthostatic pulse rate with hemoglobin genotype and blood group**

Table 3.6 showed that orthostatic pulse rate had no association with hemoglobin genotype and blood group.

Table 3.6: Relationship of orthostatic pulse rate with hemoglobin genotype and blood group

| Chi square | Hemoglobin genotype | Blood group |
|---|---|---|
| Orthostatic pulse rate | 3.721 (P= 0.156) | 4.616 (P= 0.798) |

Night work poses significant dangers to human health and wellbeing. It causes cognitive impairment and sleep disturbance and high risks of diabetes mellitus, obesity, hypertension and cancers. The aim of the study was to investigate whether self-reported night activity score has relationship with orthostatic pulse rate, anthropometric indices, age, and inherent biological indices such as hemoglobin genotype and blood group in apparently healthy young individuals. The average age of the participants was 19.7± 0.2212. This was similar to previous studies (18, 19). However, 48% of the participants were male while 52% were females. Majority (70.7%) possessed hemoglobin genotype 'AA' while those with 'AS' were 29.3%. This concurs with the literature (Barrett *et al*., 2010). As expected, the most prominent blood group (60%) was '$O^+$'. This was followed by $A^+$ (24%), '$B^+$' (9.33%), $O^-$ (5.33%) and '$AB^+$' (1.33%).

Orthostasis or standing is a physical stressor (Adeniyi, 2022, Awosika and Adeniyi, 2023; Adeniyi *et al*., 2024; Adeniyi and Awosika, 2023). Like other studies, 5 minutes daytime orthostasis was found to lead to an increase in pulse rate. The increase in pulse rate is a cardiovascular response to orthostasis induced diversion of blood to the lower extremities and reduction in blood volume. It is widely documented that inactivation of baroreceptors is a rapid response to reduction in blood volume (Adeniyi and Awosika, 2023; Awosika *et al*., 2023; Adeniyi *et al*., 2025; Adeniyi *et al*., 2022). Deactivation of baroreceptors reduced excitatory discharge from solitary tract nucleus to the dorsal motor nucleus and nucleus ambiguus leading to reduction in vagal dominance and increase in heart rate. Inactivation of baroreceptors also caused tonic excitatory discharge from rostral ventrolateral medulla to the sympathetic chain which culminates into increased heart rate. Other compensatory mechanisms to orthostasis induced reduction in blood volume include incretion secretion of cortisol and activation of renin angiotensin aldosterone system.

Orthostatic pulse rate showed no significant relationship with body weight, body height, age, gender, hemoglobin genotype and blood group. Previous works have similarly reported no relationship between orthostatic heart rate and blood group. The present study also indicated that there was no significant correlation between self-reported night activity score and daytime orthostatic pulse rate. Since orthostasis was done for 5 minutes, further studies involving different orthostatic durations are required to clarify the nature of nexus between self-reported night activity and daytime orthostatic pulse rate.

Furthermore, self-reported night score showed no relationship with the body weight, body height, body mass index, age, and gender and hemoglobin genotype. The major finding of the study was the significant association between self-reported night activity score and the blood groups using chi square. Beyond compatibility and paternity tests, blood groups have other clinical

significances. For instance, people with blood group O are known to exhibit the highest inflammatory responses than non-O blood groups (Aikout *et al*., 2000; Adeniyi *et al*., 2021; Adeniyi and Awosika, 2025). In the present study, participants with blood group O positive reported higher night activity score.

## CONCLUSION

Although, self-reported night activity score was not significantly related with orthostatic pulse rate, body height, body weight, body mass index, age and gender, it has relationship with blood groups. Further studies involving professionals and older populations who are occupationally exposed to night work schedules will be required.

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