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Short Communication

# A Short Communication Pilot Study on Stress and Its Chronic Consequences of College Students

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## Abstract

Stress can be described as 'any provocation to homeostasis' or the body's internal balance feeling. It can reveal itself either as eustress or as distress. Eustress is interpreted as 'good stress.' It is a simple form of stress that motivates a person to maintain performance, but it influences physical or psychological when being chronic issues. Stresses are issues due to the external environment, psychological or social situations or internal illness, or medical procedures. The purpose of the study

is to investigate the relationship between stress, cortisol level, body mass index, blood pressure, and heartbeat for 44 female university students. Consent was included from all individual associates in the organized and questionnaire practice. There is no particular question of the questionnaire documents illustrates how subjects feel stress, but multiple indicators include sleep indicators, behavioral indicators, emotional indicators, personal habits, blood pressure, pulse rate, and personal medical history. The blood pressure and pulse speed results are range in a clinical lab and parallel with two separate instrumental Citizen and Omron devices. There is a significant positive relationship between stress, blood cortisol level as well as blood pressure and pulse in 44 females university students at $p \leq 0.05$; this may be due to stressful situations increase multiple neurochemical, neurotransmitter, and hormonal fluctuations by permanently stimulating the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis. That will need further study.

## Introduction

Stress is the body's response to any difference that requires an adaptation or response. The body scene these differences with physical, mental, and emotional responses [1,2]. Stress is a regular part of life when the body conclusion risk of stress, whether real or imaginary, the body's resistance power into high effects in a speedy, automatic manner known as the "fight-or-flight" reaction stress response by the neuroendocrine and biological process. Stress can also assist the body to raise the defense to meet the challenge [1-3]. If the body fails to coincide with the balance, stress can lead to chronic disease, including heart, diabetes, joint inflammation, inflammatory bowel, anxiety, poor eating habits, obesity, etc. Stress results when the combination of internal and external loads beats the individual's support to cope with their situations [1,3-5]. For many adolescent adults, college and university is the best time of life. Depression, anxiety, and stress can also threaten these critical university years. Students are likely to feel some or various stressors, which may test their ability to cope and adapting to a new environment [5-8]. The present study hypothesis a positive relationship between chronic stress, cortisol level, blood pressure in University students. Furthermore, if students cannot manage stress, it can upset their academic performance, emotional, social well-being, and induce many inflammatory diseases [8-12]. Thus, this study will perform in college students at Jazan University to provide primary data for a relationship between stress, blood cortisol level, blood pressure, and pulse.

## Subjects and Methods

### Subjects

A total of 44 female students (18-35 years old) were involved in this investigation. The evaluation takes place in the period 2019-2020. The institutional research committees approved ethical consideration of all procedures performed in this study in participating hospitals, universities, and the Helsinki Declaration 2008. Written consent sign by each student after a full description of the method of the investigation. There is no single question of the questionnaire documents on how subjects feel stress. The study records groups of items about physical indicators, sleep indicators, behavioral indicators, emotional indicators, and personal habits. Blood pressure and pulse rate are measurements in a clinical lab compare with two different instrumental Citizen and Omron devices [9-15].

## Methods

### *Anthropometrics*

Weight and Height were recorded with a digital Height Weight measuring instrument, and BMI was calculated from the equation, according to Hamouda 2018 [1]. The equation is BMI = kg/m$^2$, where kg is a student's Weight in kilograms, and m$^2$ is their Height in meters squared. A BMI of 25.0 or higher is overweight, while the healthy scale is 18.5 to 24.9.

### *Laboratory Investigations*

All-blood sample was drawn as fasting blood samples at 8 am. Cortisol level measured using MAGLUMI 600 instrumental in Abu-Arish general hospital Jazan in Saudi Arabia [15-19].

### *Statistical Analysis*

Data entered to the computer data sheet using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). The Kolmogorov- Smirnov, Shapiro, and D'agstino tests use to confirm the normality of distribution of variables, judged between groups for categorical variables analyzed using the Chi-square test (Fisher or Monte Carlo). ANOVA was used to compare between more than two groups for the means of normally distributed quantitative variables and followed by the Post Hoc test (Tukey) for pairwise comparison. Pearson coefficient was used to correlate between quantitative variables. The significance of the obtained results judged at the 5% level.

## Result

Table (1) represented the data and results of the correlation between stress indicators and different parameters. According to Evans (1996) who suggests for the absolute value of r: 0.00-0.19: "very weak", 0.20-0.39: "weak", 0.40-0.59: "moderate", 0.60-0.79: "strong", 0.80-1.0: "very strong". Where there is a strong significant positive correlation between stress indicators(emotional and personal habits) with cortisol blood level in the university students, on the other hand, there is a strong significant positive correlation between stress indicators(emotional and physical) and diastolic blood pressure, and the result is confirmed by two blood pressure measuring instrumental (Citizen and Omron devices). Also, there is a strong significant positive correlation between a stress indicator and heartbeats that are confirmed by measuring by three instrumentals (citizen, Omron, and band devices), statistically significant at $p \leq 0.05$.

***Table 1:*** *Correlation between stress with different studied parameters (n= 44)*

| | | Indicators Point Total | | | | |
|---|---|---|---|---|---|---|
| | | **Physical** | **Sleep** | **Behavior** | **Emotional** | **Personal Habits** |
| **BMI (kg/m$^2$)** | **r** | 0.157 | 0.239 | -0.001 | 0.009 | 0.007 |
| | **p** | 0.309 | 0.119 | 0.996 | 0.956 | 0.966 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Cortisol (nmol/L)** | **r** | -0.250 | 0.108 | 0.382* | -0.338* | -0.138 |
| | **p** | 0.102 | 0.485 | 0.010 | 0.025 | 0.371 |
| **Blood pressure (Citizen devices)** | | | | | | |
| Systolic (Upper mmHg) | **r** | 0.141 | 0.286 | 0.127 | 0.116 | -0.035 |
| | **p** | 0.362 | 0.060 | 0.412 | 0.454 | 0.823 |
| Diastolic (Upper mmHg) | **r** | 0.366* | 0.160 | -0.044 | 0.436* | 0.098 |
| | **p** | 0.015 | 0.300 | 0.776 | 0.003 | 0.529 |
| **Blood pressure (Omron devices)** | | | | | | |
| Systolic (Upper mmHg) | **r** | 0.099 | 0.236 | 0.229 | 0.022 | -0.039 |
| | **p** | 0.522 | 0.122 | 0.135 | 0.889 | 0.802 |
| Diastolic (Upper mmHg) | **r** | 0.374* | 0.196 | -0.053 | 0.374* | 0.130 |
| | **p** | 0.012 | 0.202 | 0.734 | 0.012 | 0.402 |
| **Heart beats (Citizen devices)** | **r** | 0.062 | 0.156 | 0.393* | -0.001 | -0.025 |
| | **p** | 0.692 | 0.313 | 0.008 | 0.994 | 0.872 |
| **Heart beats (Omron Devices)** | **r** | 0.426* | 0.317 | 0.219 | 0.477* | 0.212 |
| | **p** | 0.004 | 0.036 | 0.154 | 0.001 | 0.168 |
| **Heart beats (Band)** | **r** | 0.181 | 0.200 | 0.259 | 0.481* | 0.323* |
| | **p** | 0.239 | 0.192 | 0.089 | 0.001 | 0.033 |

r: Pearson coefficient
*: Statistically significant at $p \leq 0.05$

Table 2 shows the descriptive analysis of the studied cases according to stress, the data represented as Mean ± SD where, Physical stress indicator showed( 46.3±12.1), Sleep stress indicator showed(13.7±3.7), Behavior stress indicator showed(36.4±7.4), Emotional stress indicator showed(55.1±16.1), Personal Habits stress indicator showed(22.9±5.7). Also, it represents the presence of level of standard indicators; for example, the most danger indicator above the acceptable level of stress indicator is an emotional indicator where the mean represented as 55 (17% from 44 students) that represent a high indicator it means 17% of 44 students represent danger indicator. Thus, the arrangement of danger indicators as emotional, physical, sleep, behavior, respectively, compared to the normal range. Table 3 also represents the comparison between different studied parameters with all stress indicators and the data reported as Mean ± SD and compared to the reference range. There are 41 students with the normal level of cortisol but are under abnormal levels of stress indicator, as well; there are three abnormal levels of cortisol under an abnormal level of stress indicator compared to a reference range. There are 22 students with the normal level of Systolic blood pressure but are under abnormal levels of stress indicator, as well; there are 22 abnormal levels of Systolic blood pressure (use citizen) under an abnormal level of stress indicator compared to a reference range. There are 20 students with the normal level of Diastolic blood pressure but are under abnormal levels of stress indicator, as well; there are 24 abnormal levels of Diastolic blood pressure (use citizen) under an abnormal level of stress indicator compared to a reference range. As well all students showed abnormal Systolic blood pressure as compared with normal range (use Omron). There are 15 students with the expected level of Diastolic blood pressure

but is under abnormal levels of stress indicator, as well there are 29 abnormal levels of Diastolic blood pressure (use Omron) under an abnormal level of stress indicator as compared to a reference range statistically significant at $p \leq 0.05$ (table 3).

***Table 2:*** *Descriptive analysis of the studied cases according to stress*

| Indicators point total | Mean ± SD. | Very Low | Medium | High | Very High | Danger |
|---|---|---|---|---|---|---|
| **Physical** | 46.3±12.1 | 1(2.3%) | 9(20.5%) | 19(43.2%) | 5(11.4%) | 10(22.7%) |
| **Sleep** | 13.7±3.7 | 1(2.3%) | 5(11.4%) | 7(15.9%) | 8(18.2%) | 23(52.3%) |
| **Behavior** | 36.4±7.4 | 1(2.3%) | 19(43.2%) | 20(45.5) | 1(2.3%) | 3(6.8%) |
| **Emotional** | 55.1±16.1 | 0(0.0%) | 2(4.5%) | 17(38.6%) | 8(18.2%) | 17(38.6%) |
| **Personal Habits** | 22.9±5.7 | 2(4.5%) | 10(22.7%) | 18(40.9%) | 9(20.5%) | 5(11.4%) |

Data represented as Mean ± SD, is statistically significant at $p \leq 0.05$

***Table 3:*** *Relation between stress and different studied parameters*

| | | No of sub-jects. | Indicators point total | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Physical** | **Sleep** | **Behavior** | **Emotional** | **Personal habits** |
| **Cortisol (nmol/L)** | | | | | | | |
| Normal (185-624) | | **41** | 45.7±11.7 | 14.0±3.7 | 36.2±7.5 | 54.6±15.6 | 22.6±5.5 |
| Abnormal | | **3** | 54.3±16.9 | 9.7±1.2 | 39.3±7.8 | 62.3±25.2 | 27.0±7.5 |
| **p** | | | 0.239 | 0.049* | 0.490 | 0.427 | 0.196 |
| **Blood pressure /mmHg (Citizen devices)** | **Systolic** | | | | | | |
| | Normal (<120) | **22** | 47.3±11.1 | 13.2±3.7 | 36.7±7.1 | 54.9±15.4 | 23.0±4.9 |
| | Abnormal (≥120) | **22** | 45.4±13.2 | 14.2±3.7 | 36.1±7.9 | 55.3±17.1 | 22.7±6.4 |
| | **p** | | 0.606 | 0.356 | 0.796 | 0.934 | 0.855 |
| | **Diastolic** | | | | | | |
| | Normal (<80) | **20** | 43.1±9.2 | 13.4±3.9 | 35.6±6.3 | 48.7±11.9 | 23.3±5.6 |
| | Abnormal (≥80) | **24** | 49.0±13.7 | 14.0±3.6 | 37.1±8.3 | 60.5±17.3 | 22.5±5.8 |
| | **p** | | 0.108 | 0.569 | 0.505 | 0.011* | 0.664 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Blood pressure/mmHg (Omron devices)** | **Systolic** | | | | | | |
| | Normal (<120) | **0** | - | - | - | - | - |
| | Abnormal (≥120) | **44** | 46.3±12.1 | 13.7±3.7 | 36.4±7.4 | 55.1±16.1 | 22.9±5.7 |
| | **p** | | - | - | - | - | - |
| | **Diastolic** | | | | | | |
| | Normal (<80) | **15** | 41.8±9.9 | 12.5±2.6 | 37.3±6.4 | 49.6±13.5 | 21.6±5.4 |
| | Abnormal (≥80) | **29** | 48.7±12.6 | 14.3±4.1 | 36.0±8.0 | 58.0±16.8 | 23.6±5.8 |
| | **p** | | 0.074 | 0.133 | 0.598 | 0.103 | 0.284 |
| **Heart beats (Citizen devices)** | | | | | | | |
| Normal (60-100) | | **24** | 50.0±14.2 | 14.0±4.5 | 33.6±6.1 | 59.3±16.9 | 23.2±5.9 |
| Abnormal | | **20** | 42.0±7.0 | 13.4±2.6 | 39.8±7.6 | 50.1±13.8 | 22.6±5.5 |
| **p** | | | 0.021* | 0.569 | 0.005* | 0.058 | 0.724 |
| **Heart beats (Omron Devices)** | | | | | | | |
| Normal (60-100) | | **35** | 45.5±11.1 | 13.4±3.6 | 35.1±6.2 | 53.3±15.0 | 22.3±5.0 |
| Abnormal | | **9** | 49.4±15.7 | 14.8±4.3 | 41.8±9.6 | 62.3±18.9 | 25.0±7.8 |
| **p** | | | 0.391 | 0.336 | 0.014* | 0.133 | 0.214 |
| **Heart beats (Band)** | | | | | | | |
| Normal (60-100) | | **36** | 44.9±11.8 | 13.2±3.4 | 36.0±7.0 | 52.4±15.1 | 22.3±4.6 |
| Abnormal | | **8** | 52.8±11.8 | 16.1±4.3 | 38.5±9.5 | 67.1±15.9 | 25.5±9.0 |
| **p** | | | 0.097 | 0.040* | 0.391 | 0.018* | 0.358 |

p: p value for Student t-test compare two means between the two groups
*: Statistically significant at $p \leq 0.05$

There are 24 students with the expected level of Heartbeats but are under abnormal levels of stress indicator, as well, there are 20 abnormal levels of Heartbeats (use citizen) under an abnormal level of stress indicator compared to a reference range. There are 35 students with the expected level of Heartbeats but are under abnormal levels of stress indicator, as well there are nine abnormal levels of Heartbeats (use Omron) under an abnormal level of stress indicator compared to a reference range. There are 36 students with the normal level of Heartbeats but are under abnormal levels of stress indicator, as well, there are eight abnormal levels of Heartbeats (use band) under an abnormal level of stress indicator compared to a reference range, statistically significant at $p \leq 0.05$ (table 3). Table 4 shows a descriptive analysis of the studied cases according to different parameters.

***Table 4:*** *Descriptive analysis of the studied cases according to different parameters*

| | **Normal Mean±SD** | **Abnormal Mean±SD** | **Total Mean±SD** |
|---|---|---|---|
| **Cortisol (nmol/L)** | **(n=41)** | **(n=3)** | **(n=44)** |
| | 324.3±261.0 | 425.1±126.0 | 432.5±113.3 |
| **Blood pressure /mmHg (Citizen devices)** | | | |
| Systolic | **(n=22)** | **(n=22)** | **(n=44)** |
| | 106.4±10.6 | 129.5±9.6 | 118.0±15.4 |
| Diastolic | **(n=20)** | **(n=24)** | **(n=44)** |
| | 66.4±8.3 | 92.7±9.8 | 80.8±16.0 |
| **Blood pressure/mmHg (Omron devices)** | | | |
| Systolic | **(n=0)** | **(n=44)** | **(n=44)** |
| | - | 119.7±14.5 | 119.7±14.5 |
| Diastolic | **(n=15)** | **(n=29)** | **(n=44)** |
| | 70.3±5.0 | 91.9±8.6 | 84.5±12.8 |
| **Heart beats (Citizen devices)** | **(n=24)** | **(n=20)** | **(n=44)** |
| | 87.1±11.7 | 101.9±12.6 | 93.8±14.1 |
| **Heart beats (Omron Devices)** | **(n=35)** | **(n=9)** | **(n=44)** |
| | 87.2±8.8 | 105.1±5.0 | 90.8±10.9 |
| **Heart beats (Band)** | **(n=36)** | **(n=8)** | **(n=44)** |
| | 83.6±11.2 | 97.5±27.8 | 86.1±16.0 |

Data represented as Mean ± SD, is statistically significant at $p \leq 0.05$

## Discussion

The present study reported a significant positive correlation between stress indicators' emotional and personal habits with cortisol blood level and blood pressure, and heartbeats compared with reference range. The present results agree with recent work indicating cortisol increases the blood pressure and heartbeat levels [20-23]. These varieties help the body copy short periods of stress. However, constant chronic stress led to chronic issues and inflammatory diseases [23-25]. The symptoms of long-term, slightly high cortisol (chronic subtle hypercortisolism) cover crushed immunity, beginning to more infections, raised blood pressure (hypertension), high blood sugar (hyperglycemia). The chronic stress and chronic cortisol led to insulin resistance and dysphoria, leading to carbohydrate cravings, metabolic complex, obesity, and type 2 diabetes; fat deposits on the face, neck, and belly, reduced libido, and suppressed thyroid hormones [25-28]. Cortisol, a glucocorticoid (a steroid hormone), is manufactured from cholesterol in the two adrenal glands found on each kidney's top. It is discharged in response to events and conditions such as waking up in the morning, training, and acute stress. Cortisol's far-reaching, systemic forces perform many tasks in the body's effort to carry out its methods and control homeostasis [26-29]. Of concern to the dietetic association,

cortisol also plays a vital role in human nutrition. It manages energy by selecting the appropriate type and quantity of substrate (carbohydrate, fat, or protein) the body needs to satisfy the physiological needed fixed on it. When chronically raised, cortisol can severely affect weight, immune function, and chronic disease risk [29-30]. Cortisol (along with epinephrine) is best known for its involvement in the "fight-or-flight" response and transient increase in energy production immediately for survival during stress [30-33].

Understanding the chemistry behind Cortisol, including its behaviors and connections to other biochemical components, the immune system, and health consequences, is essential to the success in treating. Learning about how the body responds and deals with stress is considered a healing power [33-34]. Hamouda 2018 reported that chronic stress was linked with both HPA and SNS axis hyperactivity and hypoactivity, similar to the human body's noise, including blood pressure and heart rate that agrees with the present study. As a result of stressful situations led to multiple neurochemical, neurotransmitter, and hormonal changes by permanently activating the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis [1]. Chronic stress has been linked with hypothalamic–pituitary–adrenal axis (HPA) hyperactivity and HPA axis hypoactivity. The link of stress and HPA axis hypoactivity in fibromyalgia or rheumatoid arthritis has been used to describe the difference in knowledge regarding the nature of the HPA axis in chronic stress states. The strength of the stress response essential governed by glucocorticoids, the primary molecules needed in the stress response. Stress can be temporary and beneficial. Stress can also be long-lasting, chronic, and severe, which stored stress-causing suffocation, depression, and continuous chronic pain as fibromyalgia [1,6,33-35]. Stressful situations induce multiple neurochemical, neurotransmitter, and hormonal changes by activating the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis. SNA and HPA axis are noticed to deliver chemical mediators to defend the body from stress [6,35-37]. SNS influence efferent vagus nerve control of the heart, lungs, and digestive tract. For example, catecholamines raise heart rate and blood pressure, helping the body fight or flight [1,36,37].

Although regular and sustained stress led to heart rhythm conditions, this agrees with the current study, where there is a strong significant positive correlation between a stress indicator and heartbeats. This appropriate body reaction was called "allostasis." This state is beneficial to body survival and restoration, and this considers as evolutionarily adaptive benefits. However, when stress stimuli are prolonged, in other words, chronically increases directly to pathophysiology. In the last two decades, growing evidence reported that severe or prolonged (chronic) stress combined with risk for a physical and psychiatric condition called stress-related disease. Stress is the significant risk factor of 75%-90% of maladies, including the circumstances which create the first morbidity and mortality. A recent review reported that the primary stress-related illness is cardiovascular diseases, hypertension, atherosclerosis, and metabolic diseases such as diabetes. Stress disorder includes hemolytic anemia, fibromyalgia syndrome, psychotic, neurodegenerative disorders such as depression, Alzheimer's disease, and Parkinson's disease, cancer, and others [1,20,37,38].

Moreover, stress causes neurons in the hypothalamus into corticotropin-releasing hormone (CRH) inducer to cortisol modulation development and led to cortisol deregulation consequences alter the balance between anti-inflammatory and proinflammatory cytokines. The outcome is both the imbalance and raised in a release of the proinflammatory cytokines interleukin (IL)-1, IL-6, and tumor necrosis factor (TNF) α influence mainly grew synthesis of the acute-phase protein serum amyloid A protein (SAA) by hepatocytes and c- receive protein and led to an autoimmune disorder and IBD. The immediate explanation is chronic

stress led to FM and autoimmune disease sustained the pain and other early symptoms that patients complain from severe complications and change in a heartbeat and blood pressure [1,20,39,40].

## Conclusion

There is a significant positive relationship between stress indicators (emotional and personal habits) with the university students' cortisol blood level. There is a significant positive correlation between stress indicators (emotional and physical) and diastolic blood pressure. Also, there is a significant positive correlation between a stress indicator and heartbeats. This may be due to stressful situations that influence the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis.

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## Conflict of Interest

The authors declare that they have no conflict of interest.

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