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The Effect of Hard Work and Environment of Work Place on Blood Pressure and Heart Rate

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Abstract

Background and objective: Hypertension is a well known disease in a recent time and the only way for detecting it is by measurement of the blood pressure. Alot of factors may affect such measurement and in our study we evaluate the effect of hard work and stress on blood pressure measurement. Hard work has been associated with an increased risk for heart and cardiovascular disease.

Methods: In this study we took (100) participants male with no any disease, age ranging from (20 until 50) year and put them under observation and checking their blood pressure and heart rate and heart rate variability two days a week after doing hard work and one non work day every week for four weeks. Chronic hard work stress was defined on the base of synergist model, as: (1) high imbalance, a combination of high effort and low reward at work, or (2) high over commitment, an exhaustive work –related coping style indexing the inability to unwind.

Results: Hard work as it exert its effect on heart rate and blood pressure it means that indirectly work on more of one risk factors of heart diseases, and this hard work will make plaques inside the blood vessels more vulnerable for rupture and that person who do hard work more prone to develop heart disease.

Conclusion: All the participants in this study show more elevation in blood pressure and as a consequence increased prevalence of heart and cardiovascular disease. The results from this study suggests that the detrimental effects of hard work are partly mediated by increased heart rate reactivity to a stressful work day, an increase in systolic blood pressure level.

Keywords: Heart rate, Blood pressure, Stress, Hard work.

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Introduction

Blood pressure and heart rate as two important vital signs that reflect the health condition of a person will be affected by various factors including endogenous and exogenous factors. Some of these factors that affect blood pressure and heart rate has some time a beneficious affect and may promote health and build immunity and improving health condition, even some time all health authority ask population to do that for being in good health condition and used as a preventive strategy.[3]

Blood pressure is the pressure exerted by blood on the wall of blood vessels and it varies with each heartbeat. When the heart contracts, blood flow in the blood vessels increases. The maximum force thus acting on the vessel walls is known as "systolic blood pressure". When the heart relaxes, blood flow in the blood vessels decreases and the pressure also reduces. The pressure recorded during relaxation of the heart is called "diastolic blood pressure".[4]

Blood pressure as reflect the pressure that will be exerted by blood on blood vessels and its vital signs together with heart rate, respiratory rate, oxygen saturation, and body temperature. Blood pressure is influenced by cardiac output, total peripheral resistance and arterial stiffness and varies depending on situation, emotional state, activity and relative health /disease states.[5]

Heart rate also is a vital sign, and its defined as the speed of the heart beat measured by the number of contractions (beats) of the heart per minute. The heart rate can vary according to the bodies physical needs, including the need to absorb oxygen and excrete carbon dioxide. Activities that can provoke change include physical exercise, sleep, anxiety, stress, illness and ingestion of drugs.[6]

Hence as seems that both blood pressure and heart rate will be variously affected by hard work and this effect is variable but if sustained it may be harmful! especially if it prolonged. Whenever one person tried to do a hard work this will affect directly on blood pressure and heart rate and physically all the physiological changes will take place inside the body and whenever you check the vital signs of such person it will be clear that this person is under hard work and stress.[7]

Not at the office that much? You're still not out of the woods—working 41-48 hours per week was linked to a 54% higher chance of having masked hypertension and 42% greater chance of having sustained hypertension. We should be sure to account for other factors like job strain—basically, having a job with high work demands and little authority to make decisions—age, sex, occupation, smoking status, body mass index, and more.

Work Stress and Heart Rate Variability(HRV).

HRV is simply a measure of the variation in time between each heartbeat. This variation is controlled by a primitive part of the nervous system called the autonomic nervous system (ANS). It works regardless of

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our desire and regulates, among other things, our heart rate, blood pressure, breathing, and digestion.[2]

The ANS is subdivided into two large components, the sympathetic and the parasympathetic nervous system, also known as the fight-or-flight mechanism and the relaxation response.[15]

The brain is constantly processing information in a region called the hypothalamus. The hypothalamus, through the ANS, sends signals to the rest of the body either to stimulate or to relax different functions.[1] Heart rate variability (HRV) is the temporal variation between sequences of consecutive heart beats. On a standard electrocardiogram (ECG), Physical inactivity greatly increases your risk of developing heart disease. As work stress will affect heart rate, it will also affect the heart rate variability.[12]

Hard work and blood pressure: In fact, new research finds that office employees who work long hours are more likely to have high blood pressure, hypertension—including a type that your doc may miss during checkups. And high blood pressure is a contributing cause of death for more than 410,000 Americans, according to the Centers for Disease Control and Prevention (CDC).[16] Hard work and work stress effect all persons normal and diseased ones, Blood pressure elevation was much pronounced at the end of day and after heavy work, so, when you check the blood pressure the reading is elevated and also if someone have high blood pressure as a respond to heavy work it may be a clue that he will develop hypertension in the future.[12]

it was clear in our study, hard work and work in long duration will effect on blood pressure and pulse rate and hence as a consequence of long effect it will make the person more prone to heart and cardiovascular disease in the future.

Methods

Material of Study:

The study population involved white-collar workers aged (20 to 50) years old employed by private sector in Erbil and working near "***MALA FANDI***" primary health center. Their jobs encompassed the full range of different occupations, including workers, senior management (10.4%), professional (35.5%), technical (20.8%), and office (30.6%) workers. Education levels ranged from an illiterate to non high-school diploma to university degree. The study design and population and they were under observation for one month, participated in a prospective study intended to evaluate the effects of job strain on blood pressure and cardiovascular disease. All the 100 participant come regularly to primary health center PHC ? but in last 10 days (2.3%) has been lost for follow up.

The wider model of job intensity is Johannes Siegrist's “effort-reward” scheme. The model describes dangerous job conditions as a “mismatch between high workload (high

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demand) and low control over long-term rewards".[22]Siegrist stresses personal influence over long-term compensation since, for adolescents, "distressing interactions frequently arise from basic challenges to the stability of a vital social role," often the work role. That is obviously the case, "of loss of jobs or career uncertainty. However, similar conditions of low compensation and low security, such as forced change in work, downward mobility, lack of advancement opportunities, workers of unclear educational history (status inconsistency) can also be described.[23]Workload elements of Siegrist's studies include piecework, work transitions, noise, task strain, and workload changes.

Data Collection and Variables:

At baseline and follow-up, workers completed a self-administered questionnaire focusing on demographic characteristics, risk factors for hypertension and cardiovascular disease (smoking, low level of physical activity, high cholesterol, diabetes), family history of cardiovascular disease or hypertension, and characteristics of work and social life.[8] At the worksite (with the exception of those not working at follow-up who were seen at a research clinic), trained nurses measured blood pressure, weight, height, and waist circumference using validated protocols

In accordance with the American Heart Association protocol, workers' blood pressure was measured at rest after they had been sitting for 5 minutes.[9] The averages of 2 blood pressure measurements taken at baseline and 3 taken at follow-up, 1 to 2 minutes apart, were used as baseline and follow-up blood pressure levels. Table 1 Two outcome variables were created separately for systolic and diastolic blood pressure**.**

Table 1: Relation of BP and age period in rest and exercise

Age period (year)	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
20 – 30	**Rest: 10.0 – 7.0** **Exe: 12.0 – 14.0**	**6.0-7.0** **7.0-8.0**
30 – 40	**Rest: 11.0-12.0** **Exe: 13.0 – 14.0**	**7.0-8.0** **8.5 – 9.5**
40 – 50	**Rest: 13.0 – 14.0** **Exe: 15.0 – 16.0**	**8.5 – 9.5** **9.0-10.0**

The first was mean follow-up blood pressure. Workers treated for hypertension at follow-up were excluded from these analyses because their blood pressure level value had been lowered via medication. The second was a dichotomous variable identifying workers with mean blood pressure increases in the highest quintile of the sample. This variable allowed inclusion of workers treated for hypertension, who were assigned to the highest quintile group.

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Results and Discussion

Relation between Heart Rate, Hypertension and Stress:

All the persons selected in this study were in the age group of 20-50 years of range: Table 2 showed the effect of stress , age and interaction of them on heart rate in males.

Stress effective group showed significant tachycardia when compared with normal condition. For normal condition at age 50 years old showed lower heart rate $(80.60\pm1.63)^{ab}$ when compare with other groups $(98.20\pm1.69)^{c}$, (90.80 ± 1.69)b $(88.90\pm1.69)^{ab}$ $(82.20\pm1.69)^{ab}$ respectively. And groups of (normal condition + 20 years old) $(98.20\pm1.69)^{c}$ was higher heart rate than other group. The results of interaction between different ages groups, stress and normal condition groups recorded that (stress + 28 years old) $(105.20\pm3.96)^{e}$ group hear rate higher than other groups. In our study, its clear that high blood pressure, heart rate is associated with high work stress as shown in (figure1). Heart rate variability and high blood pressure is due to this low vagal tone, its seems to be unsatisfactory but high work stress and chronic stress directly lower this vagal tone through unknown neurophysiological mechanism.[13]

That's why in advancing through this mechanism they have somewhat high blood pressure and hypertension. Perhaps chronic stress speeds up this normal autonomic nervous system aging process of vagal tone. And it should be mentioned some point about psychological condition of the person who do hard work and face work stress and studying further about mood of the person who participated whether he was in good mood or he complaining of (e.g anxiety, depression…). As all of them will be reflected on the patient condition and on the effect of work stress and hard work on the physiological state and psychology of the worker and work outcome.

Table 2: Effect of stress, age and interaction of them on heart rate in males

Years		Heart rate (beat/min.)
20 years	Normal	98.20 ± 1.69^{c}
28 years	Normal	90.80 ± 1.69^{b}
35 years	Normal	88.90 ± 1.69^{ab}
42 years	Normal	82.20 ± 1.69^{ab}
50 years	Normal	80.60 ± 1.63^{ab}
20 years	Stress	100.20 ± 1.85^{cd}
28 years	Stress	105.20 ± 3.96^{e}
35 years	Stress	90.60 ± 1.60^{cd}
42 years	Stress	93.60 ± 1.88^{d}
50 years	Stress	87.40 ± 1.50^{bcd}

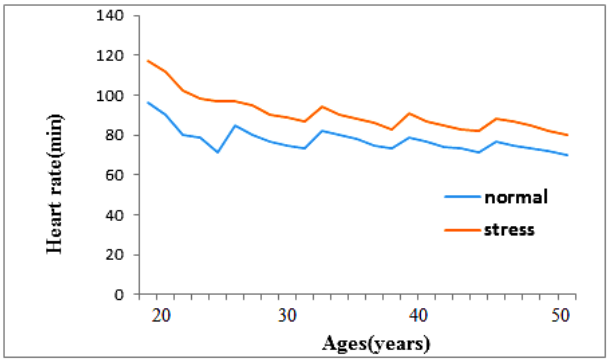

Figure 1: Relationship between age, heart rate and stress.

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Heart Rate and Blood Pressure Respond to Hard Work:

Table 3 shows the statistical evolution of the effect of hypertension, ages, and interaction of them on heart rate in males according to analytical Duncan test, the group of normal blood pressure showed significantly higher heart rates when compared with hypertension groups. Age 35 years $(105.20\pm3.96)^{c}$ beat /minute old showed significant higher heart rate in compared with 40,45,50 years old $(94.20\pm4.60)^{b}$ beat /minute $(82.90\pm2.11)^{a}$ beat /minute and $(91.60\pm1.88)^{d}$ beat /minute

The results of interaction between different ages hypertensive and normal blood pressure groups recorded that (hypertensive +45 year old) groups were higher heart rates $(84.80\pm2.62)^{a}$, and hypertensive groups+45 years old were lower heart rate in hypertension group.

Table 3: Effect of blood pressure (hypertension), age and interaction of them on heart rate in male

Years		Heart-rate beat/minute)
35	Normal	105.20±3.96c
40	Normal	94.20±4.60b
45	Normal	82.90±2.11a
50	Normal	91.60±1.88d
35	Hypertension	83.4±39bc
40	Hypertension	84.80±2.62a
45	Hypertension	78.00±2.09ab
50	Hypertension	80.2±2.06a

Heart rate and blood pressure do not necessarily increase at the same rate of hard work. A rising heart rate does not cause your blood pressure to increase at the same rate. Even though your heart is beating more times a minute, healthy blood vessels dilate (get larger) to allow more blood to flow through more easily.[14] When you exercise, your heart speeds up so more blood can reach your muscles. It may be possible for your heart rate to double safely, while your blood pressure may respond by only increasing a modest amount.[10]

High blood pressure means that the heart works so hard to strain the muscles and destroy the blood vessels. When your blood vessels can't easily carry the blood through your body, your heart and other essential organs like your lungs, brain, and kidneys cannot get the oxygen and nutrients they need. High blood pressure increases the cholesterol, heart attack, cardiac failure, stroke, and kidney disease risk. Low blood pressure, means beating the heart slowly than normal. It's not necessarily a concern- often athletes have low blood pressure. Hypotension can also cause symptoms such as nausea, dizziness, exhaustion, and blurred vision.[17]

In the other side, a high heart rate or pulse may signify pain, overweight, use of drugs, low health level or location of the body. Your heart rate is the amount of times that your heart beats every minute, which may slowly increase as you age. The difference between blood pressure and pulse is both in what they measure and what they affect. This is interesting to remember that the pulse rate and blood pressure do not necessarily rise and fall in unison. And if they all rise, that

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does not mean that they both rise at the same pace.[18]

The heart rate will increase while exercise, but the blood pressure can remain the same or rise to a lesser degree (figure 2). That's because the size of the blood vessels increases to allow quicker and easier flow. The blood supply does not have the same effect on measuring the blood pressure as the heart rhythm does. It's normal for the individual blood pressure levels to have some variation. If a reading is elevated at borderline, the doctor may make you repeat it every day or check it the next time you go to the doctor's office. Depending on your exertion and stress level, your heart beat will also adjust.[19]

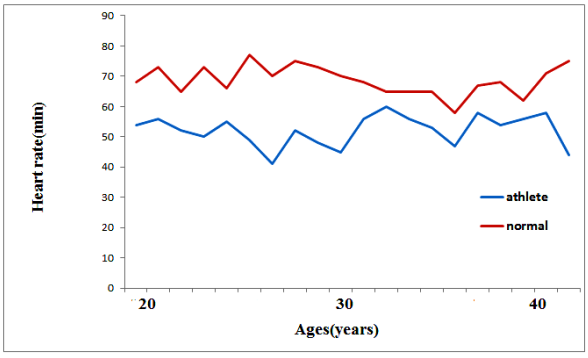

Figure 2: Heart rate of normal male and athlete.

In evaluating effects of hard work on blood pressure some point will be taken on consideration, such as:

A. Cold work environment: Working in a cold environment may induce constriction of blood vessels causing the blood pressure to rise.

B. Work stress: It can result in tension causing a rise in the blood pressure. Through exercise, it is common for the systolic blood pressure to rise to between (160 and 220) mmHg. Stop exercise if the systolic blood pressure reaches 200 mmHg if you have not checked it with the doctor. Your chance for a heart attack rises above 220 mmHg.

How the cardiovascular system reacts to exercise may be affected by different influences. Many of these considerations cover diet, safety conditions and pharmaceutical goods.[20]

Exercising hypertension, for example, is a condition that causes an extreme spike in blood pressure during physical activity. During exercise people with exercise hypertension can experience spikes in systolic blood pressure up to 250 mmHg.

Your blood pressure will usually return to normal within few hours after a workout. And though, you can find that your blood pressure doesn't immediately return to what it was before exercise. That's because blood pressure is common to drop marginally within a few hours of exercise.[21]

C. Physical demand: Metabolism will rise when work load is heavy and work is physically demanding, leading to a rise in blood pressure.

D. Hot and humid work environment: Manual works may result in excessive sweating and dilation of blood vessels that may cause postural hypotension also working in hot environment causing the heart rate increase lead to increases the pees of blood in the vessel as show in (figure 3).

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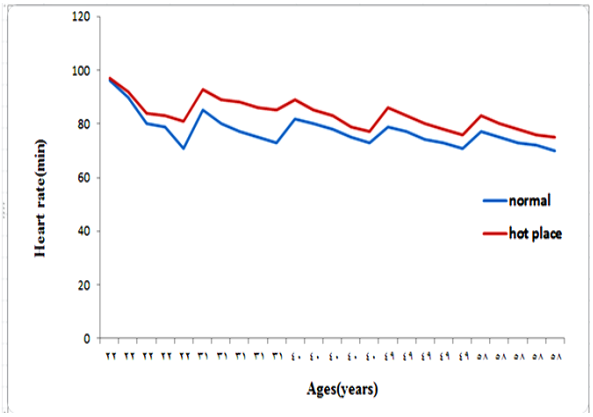

Figure 3: Effect of hot place on heart rate

Also when you evaluate effect of hard work on blood pressure and heart rate should take into consideration that the person under evaluation is free of disease or have a disease, as the effect of work on this two vital sign will change according this two principles.

Effect of gender on the heart rate at different ages

From the (figure 4) below, showed there was no big difference in hearts rate in both males and females for different ages (20,25,30,35,40,45,50 years). Although heart rate in females showed slightly higher than males.

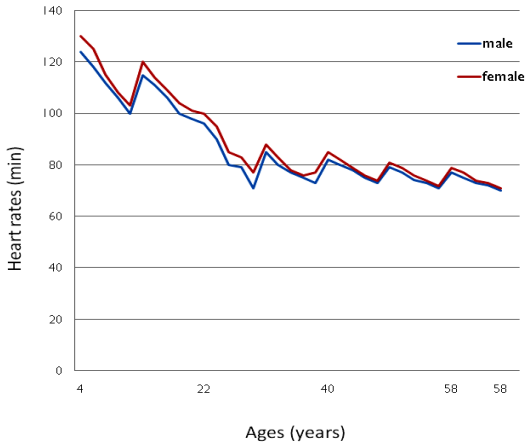

Figure 4: Relation between age and heart rate for male and females

Conclusion

Heart disease occurs when the arteries that supply blood to the heart muscle become hardened and narrowed, due to a buildup of plaque on the arteries' inner walls. Plaque is the accumulation of fat, cholesterol, and other substances. As plaque continues to build up in the arteries, blood flow to the heart is reduced.

Risk factors are conditions or habits that make a person more likely to develop a disease. They can also increase the chances that an existing disease will get worse. Other major risk factors for heart disease that you can change are smoking, high blood pressure, high blood cholesterol, overweight, and diabetes.

Hard work and work stress, defined as effort –reard imbalance, has repeatedly shown to predict heart disease. The results from this study suggest that the detrimental effect of hard work are partly mediated through:

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(1). Increased heart rate activity to a hard work day,

(2). An increase in systolic blood pressure,

(3). Lower 24 hour vagal tone,

These three characteristic of high work stress are all associated with increased cardiac disease risk.

In our study there is deficiency regarding whether if the participants put under observation for more time and even we will be more sure about the consequences, and work stress and even study of the personality and mood condition of the participants will effect the work performances and effect of work stress on the blood pressure and heart rate and then effect of work stress on heart and cardiovascular disease.

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