Effect of stress on serum cholesterol levels in nurses and housewives of Hyderabad-Pakistan

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Abstract: A cohort type study was designed to evaluate environmental, psychological and physiological stresses in nurses and housewives and to correlate with their serum total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride levels. Total 160 females from middle socioeconomic groups (nurses, $n=80$ and housewives, $n=80$) aged between 25-45 years participated in this study and subjects were selected from Hyderabad and its adjoining areas. Environmental, psychological and physiological stress levels were measured with likert scale. Total cholesterol, LDL cholesterol and HDL cholesterol were measured by CHOD-PAP method and triglyceride levels were measured by GPO method. Housewives were found to have high levels of total cholesterol, LDL cholesterol and triglycerides. The HDL cholesterol were lower. Environmental, psychological and physiological stresses were significantly higher in housewives as compared to the nurses. Highest level of environmental stress was observed in nonworking group i.e. housewives. A significant relation between serum cholesterol levels and three types of stresses was observed.

INTRODUCTION

Stress is the sum of the biological reactions to any adverse stimulus, physical, mental, or emotional, internal or external, that tends to disturb the homeostasis of an organism[1]. Mental health has a great impact on physical health. Environment is an important contributor to life style. Environmental stresses from noise, heat, air pollution and crowding cause physical dysfunction in people[2].

Psychological stress is a result of many factors and can be defined as a set of interactions between the person and the environment that result in an unpleasant emotional state, such as anxiety, tension, guilt, or shame[3,11].

Few studies have examined the relationship of cholesterol and serum lipids to psychiatric disorders[6]. Chronic emotional stress is also a risk factor and acute emotional or physical stress may participate in heart attack[10].

Depression is also associated with higher cholesterol levels[7]. Excess cholesterol increases the risk of heart disease, which in turn leads to untold fear, anxiety, disability, and grief.

The elevated levels of cholesterol in the blood increases opportunity for cholesterol and other substances to soak into the lining of the blood vessels in the body, forming blockages called "plaque".

These blockages may interfere with the flow of blood through the artery, depriving cells of receiving oxygen[8]. The present study documents the impact of three different types of stress on blood lipid concentrations.

MATERIALS AND METHODS

It was a cohort study. The study was performed at Institute of Biochemistry, University of Sindh, Jamshoro, during the years 2005 to 2006. The Ethical Committee (EC) of Sindh University approved the study and informed consent was taken from all the participants included in this study. One sixty females, 80 nurses and 80 housewives were participated in this study. Age group of both the classes ranged between 25 to 45 years and both the classes were belonged to middle socioeconomic status and were resident in the same area of Hyderabad and its adjoining colonies.

The informed consent was obtained from each subject, after approval of the experimental protocol by a local human ethics committee. For the calculation and variations of different stresses a questionnaire comprising of questions/ statements that measured the environmental, psychological and physiological aspects of stress was used.[12,13] The method of scoring was based on eight-point likert scale.

In order to see the effect of different nutrients on stress, a separate questionnaire[14] was used. This questionnaire was filled in for each individual in both the groups, in which age, height, weight, marital status, socioeconomic status and diet patterns were recorded.

Anthropometric measurements were conducted using the standard methods[13]. Weight with minimum clothing was recorded to the nearest 0.1 kg, using a portable digital scale (Tanita model 1597; Tanita, Tokyo, Japan). For height, the subject stood straight for measurement to the nearest 1mm. The body mass

index (BMI) was calculated as weight divided by the square of height (kg/m^2).[15]

Blood samples were collected in the morning by disposable syringes and a maximum of 5 ml blood was taken. Serum samples were transported to diagnostic laboratory, Institute of Biochemistry, University of Sindh, Jamshoro, for the analysis of total cholesterol, HDL-cholesterol, LDL-cholesterol and triglyceride. All blood samples were analyzed using 'Merck – Micro lab 200' instrument, Germany, by using the prescribed standard methods given in the instrument operational manual of the company.

Total cholesterol levels were measured by CHOD-PAP method[16], HDL-cholesterol levels were measured by CHOD-PAP method[17], LDL-cholesterol levels were measured by CHOD-PAP method[18] and triglyceride levels were measured by GPO method, [19,20]. Data were expressed as mean ± standard deviation (SD). Means of two groups were compared by using student's *t–test* or analysis of *variance*. The results were considered statistically significant and the *p–value* was less than 0.001. Data in this study was analyzed by the Statistical Package for Social Sciences version 12.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

Demographic and professional characteristics of responding nurses and housewives are given in Table 1. Thirty three percent of nurses were < 30 years of age, 55.5 % in between 30-40 years, and 11.5 % were of 40 years. 10 % of housewives are < 30 years, 76.9 % are 30-40 years and 13.1 % females of this group were above 40 years of age. The mean body mass index (BMI) in kg / m^2 of nurses is 25 ± 3.9, while the mean BMI of housewives is 24.2±2.0. There was no female with BMI greater than 30.0.

Table 1: Demographic and professional characteristics of responding nurses and Housewives.

Variables		Nurses	Housewives
Number		*n* = 80	*n* = 80
Socioeconomic Condition (SEC)		Middle socioeconomic	
Age (years)	≤ 30	33 %	10%
	30 – 40	55.5 %	76.9%
	≥ 45	11.5 %	13.1%
Weight (kg)		51.7 ± 4.9	53.8 ± 4.9
Height (cm)		145.4 ± 8.1	149 ± 2.9
BMI (kg/m^2)		25 ± 3.9	24.2 ± 2.0
BMI > 25 (kg/m^2)		32.5%	37.4%
BMI < 25 (kg/m^2)		67.5%	62.5%

Data was shown as mean±SD, Percentage of subjects with BMI > 25 (kg/m^2) and BMI < 25 (kg/m^2) respectively.

Comparison of different categories of stresses *i.e.* environmental, psychological and physiological,

in nurses and housewives is presented in Table 2. Statistical difference has been calculated by using *t*-test, Housewives are under more stress as compared to nurses because housework is considered to be of low status and isolating. The mental health of nurses also appears sounder.

Table 2: Statistical comparison of stress in nurses and Housewives.

Stress	Nurses *n* = 80	Housewives *n* = 80	*t*-test	Probability
Environmental	23.8 ± 3.9	28.8 ± 4.8	7.2	0.001
Psychological	21.6 ± 2.9	26.7 ± 4.5	8.5	0.001
Physiological	19 ± 3.7	24.8 ± 3.5	4.5	0.001

Values are Mean±SD

There was a significant difference between the two groups as it is evident from *t*=test. The elevated level might be due to their physical inactivity and type of stress they are facing in the house. The slight decrease in HDL cholesterol in housewives than in nurses is may be due to low mobility of housewives. There is no significant difference for HDL cholesterol levels in both the groups.

Table 3: Serum lipid concentrations of nurses and housewives.

Variables	Statistical Results	Nurses (*n*=80)	Housewives (*n*=80)	*t*-test	Probability
TC (mg/dl)	Mean ±SD	151.3 ±16.2	157.3 ±18.3	2.1	0.001
	Range	128-191	128-199		
HDL (mg/dl)	Mean ±SD	43.3 ± 6.0	39.6 ±5.6	0.2	0.8
	Range	32-54	32-50		
LDL (mg/dl)	Mean ±SD	117.2 ±16.9	126 ± 10.7	3.8	0.001
	Range	81-135	90-137		
TG (mg/dl)	Mean ±SD	127 ±23.4	133 ±18.2	1.7	0.001
	Range	63-170	94-170		
TC/HDL ratio	Mean ±SD	3.4 ± 0.3	3.9 ±0.4	---	---
TC > 220 mg/dl	---	0%	0%	---	---
TC < 140 mg/dl	---	23.75%	13.75%	---	---

TC=Total Cholesterol, HDL=High Density Lipoprotein Cholesterol, LDL=Low Density Lipoprotein Cholesterol, TG=Triglyceride. Data was shown as mean±SD, Range, Percentage of subjects with total cholesterol > 220 mg/dl and < 140 mg/dl respectively.

The elevated level of bad cholesterol in housewives is 126-±10.7 mg/dl and quite significance difference exists in both the groups. The possibility is that lipoprotein lipase activity is reduced during psychological stress[21].

The increased levels of triglycerides in housewives are 133±18.2 mg/dl than nurses *i.e.* 127± 23.4 mg/dl and a significant difference is also found in both the groups.

DISCUSSION

Social anxiety and distress, as well as fear of negative evaluation, adversely influences the mental health of women in general, but economic autonomy as well as temporary absence of the family factors may help the working women[22,23]. The equally qualified women who are staying at home, or have been made to stay at home may have a feeling of under utility of their talent and hence derive frustration out of it. Also, a feeling that their complete involvement at the domestic front goes unacknowledged may intensify the problem[24]. Full time housewives tend to be less happy with their lives and in turn are more depressed than working women[25, 26].

Catecholamines stimulate lipolysis in adipose tissue, through activation of hormone-sensitive lipase, leading to the breakdown of triacylglycerols into fatty acids and glycerol[27]. Cortisol, which is a key stress hormone, sensitizes this effect[28,29]. Increased levels of fatty acids and cortisol, lead to insulin insensitivity in tissues and promote increased triacylglycerol synthesis and apolipoprotein B secretion by the liver[30].

These combined effects result in increased hepatic production and secretion of very low-density lipoprotein and are ultimately converted to LDL, which is the principal carrier of cholesterol in the blood. LDL is normally cleared from the blood through binding to hepatic LDL receptor. LDL receptor expression is stimulated by insulin and inhibited by cortisol[31].

Short periods of psychological stress can cause the body to take longer to remove heart-damaging fats from the bloodstream. Stress causes triglycerides to stay in the bloodstream longer. If a person has a high-fat snack or meal during a time of stress, that fat is going to be circulating in the blood for a longer period of time it may be more likely to be deposited in the arteries where it can contribute to heart disease[32,33].

CONCLUSION

The result showed that housewives are found to be under more stress as compared to nurses. The main contributory factor is their confinement within the four walls of the house. In case of serum lipid concentrations, housewives have high level of total cholesterol, LDL-cholesterol and triglyceride than nurses but reverse is found to have low levels of HDL-cholesterol in housewives than in nurses.

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