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## A Study on Relationship Between Job Stress and Lymphocyte Transformation Test in Nurses

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**Abstract:** The present research is a descriptive-analytical study which aims to examine the relationships between the occupational stress levels with the Lymphocyte Transformation Test (LTT) level in nurses in a hospital in Tehran. The sample included all nurses (N = 105) who worked as full-time with at least one year background. In order to determine the level of the LTT the stimulation factor phytohemagglutinin A was carried out. In addition, the Osipow inventory was used to determine the occupational stress scores. Findings showed that all participants had the occupational stress scores at a normal range. That is, the majority of them (84%) had normal stress level and the rest of the subjects (15.2%) showed below the normal range. Furthermore, all subjects indicated the normal range of the LTT. However, there were significant relationships between demographic characteristics with occupational stress scores and LTT.

**Key words:** Lymphocyte transformation test, occupational stress, nurses, Tehran

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### INTRODUCTION

It is a clear fact that healthy and positive work atmosphere have a strong effect on work achievement. Majority of the problems and dilemma in life span are the different forms of stress. The concept of healthy refers to the promotion of both psychological and physical aspects at work. The poverty of milieu and social inconvenience including the bad conditions at work (noises, cold and hot temperature, light, bad hygiene and so on) are the other forms of stress. Because of this fact that human spends most of his own time at work, it is clear that bad work conditions are the most important stressors for the individuals' lives which provide negative consequences on their activities (Sun *et al.*, 2003; Turner *et al.*, 2002; Cole, 1991). The light system and hormones have been changed due to stress, which this directly influenced, on the immune system of the body. In most cases, the immunological changes can be assumed as acceptable criteria to assess the level of individual's tolerance of the stress. In addition, these criteria can predict the physical and mental status of the person. It is reported that many individuals with weak immunological body status are more predisposed to some diseases. Scientific evidences supported this fact that some diseases such as asthma and allergy are more intense in stressful conditions. It

seems that chronic stress was associated with weak immunological body status (Miller and Chen, 2006; Merlot *et al.*, 2004; Norballa, 1997). Different trials also revealed the negative effects of stressful conditions on immune system. For example, the IFN- $\gamma$  (Gamma-interferon) is produced by T-cells can be prevented by stressors. IFN- $\gamma$  is supposed to be a strong activator for macrophage cells, which through different mechanisms carry out an important role against pathogens. However, the decrease of macrophage cells directly weaken the body resistance in exposures of diseases factors which easily enter into blood cycle and finally results into disordered (Galinowski, 1997). Wright *et al.* (2005) concluded that psychological stress might disrupt biological systems and influence on the development and expression of atopy. In a study by Miller *et al.* (2005) and Morikawa *et al.* (2005) showed that stress might cause delay in immune responses through the reduction of T-cells in lymphatic ganglions. This study was designed on an animal model and revealed that stress reduces the Gamma-interferon secretion from lymphocytes and these results into reduced MHC molecules. In fact, this process produces low antigen for T-cells. This is because T-cells can recognize antigen only in adjacent with MHC molecules. Therefore, the animals' responses to vaccination reduced (Miller *et al.*, 2005; Shimamiya *et al.*,

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2004). Nakata's (2002, 2000) studies showed that the number of CD4+CD45RA+T lymphocytes in the higher job strain group was significantly smaller than in the lower job strain group. In addition, they found that the number of CD8+T lymphocytes was positively correlated with the social support at work. In essence, this study revealed that higher job strain decreases the number of T lymphocytes in male Japanese workers. In a similar study by Kawakami *et al.* (1997), it is found that job control significantly and positively was associated with number and percentage of helper-inducer (CD+CD29+) T cells, while the job strain (the ratio of job demands to job control) showed negative association. They concluded that higher job strain or lower job control is associated with a decrease in helper-inducer (CD4+CD29) T cells. Many studies supported that high stress and multi-stress situations may provide a scenario and therefore even a tiny routine stress enable to put an individual at high risk of vulnerability (Miller *et al.*, 2005; Shimamiya *et al.*, 2004; Nakano *et al.*, 1998). Research showed that 50 to 80% of diseases might be caused by stress (Cohen and Williamson, 1996). Similarly, Nowack (1991) and Jupp and Shaul (1991) showed that perceived stress, level of physical exercise and an avoidance coping style had significantly more psychological-physical distress and illness.

Job characteristics are main keys to assess the job strain and work stress. Identity, autonomy, responsibility, job satisfaction and knowledge and skills are some of these characteristics that may result in perceived meaning fullness of work (Morikawa *et al.*, 2005; Turner *et al.*, 2002). Many studies confirmed the mutual interrelated of job satisfaction and good performance (Hochwarter *et al.*, 1999). It is obvious that occupation and work are considered as a main part of the human life, which contain of a wide range of stress. So, it is important to verify the effects of occupation changes on immune system of the body. Nursing because of its special nature and tasks which comprises care of patient, high overload, observing and experience of high socks such as death of patient, emotional relationships with people and seeks to satisfy them is susceptible to be overload by stress. Cole (1992) and Erera (1991) in separate studies focused on nurses' problem and revealed that the majority of nurses were influenced by work stress. They suggested that the changing degree in immune system could be determined by ascertain the immune system status and work stress level. However, if the change degree were above the normal range, in order to reduce the stressful workload and to support the nurses' healthy, it is necessary to promote the work situations. The main aim of the present study is to find the relationships between the immune

system with job strain in the nurses through lymphocyte transformation test.

## **MATERIALS AND METHODS**

In order to verify the relationships between job stress and LTT, all nurses (N = 105) who worked in two hospitals in Tehran (in year, 2000) were requested to participate in the study. The included criteria contains of having a B.Sc. nurse certificate, working as a full time nurse in the hospital and with at least one year experience in the hospital. In order to determine the LTT level of samples, 5cc-heparin blood sample from each subject was taken. The LTT level was determined by using stimulate factor of fitohemoglutenine A. Therefore, the divided level of environmental blood T-cells has been evaluated by stimulated Ph.A factor. The Stimulated Index (SI) was computed by divided the level of stimulated cells into non-stimulated cells and then, the proportion of Stimulated Index (SI) to Criterion Index (CI) demonstrated the level of Lymphocyte Transformation Test (LTT). The level of LTT is concerned as the immune system criterion of the body for the individual. In addition, to have the level of nurses' job stress levels, the OSIPOW questionnaire (Osipow and Spokane, 1983) was conducted. This scale comprises six dimensions including Role Overload (RO), Role Insufficiency (RIS), Role Ambiguity (RA), Role Boundary (RB), Responsibility (R) and Physical Environment (RE) with 10 questions for each dimension. The total scores of the six stress dimensions show the Overall Tension (OT) score. The scores of the OSIPOW subscales as well as the total score of the test were divided into three levels comprising without tension, normal tension and severe tension. This scale has widely used by the researchers and has the valid statistical characteristics. Furthermore, in order to collect the data of individuals' background regarding the stressful events and job responsibility during their previous year, a teacher-made questionnaire has been developed. Data was analyzed by statistical methods such as t-test, Chi-square, correlation and ANOVA.

The sample contains 46 female (44%) and 59 male (56%). The mean age of the sample were 34.34 (SD = 4.87) and 66.7% of the subjects having an age range between 30 to 39. In addition, 84.8% (n = 89) of the subjects were married and had 1 to 3 children. The majority of them (N = 82, 78%) had the B.Sc. nurse certificate with from 1 to 20 years work experiences. All subjects had mortgage with a wide range of less than 1000000 up to 150 million Rials (mean = 23854260, SD = 26173540) which should pay monthly from less than 500000 up to 3600000 Rials (mean = 1025610, SD = 715330), which is nearly

amortized half of their salary. Some of the subjects (N = 59, 56.2%) had stress experiences during the previous year.

**RESULTS**

In order to test the relationships between the subscale of job stress questionnaire (OSIPOW) with the demographic variables, correlation analyses were conducted and the results showed that there were significant relationships between some of them. The significant associations were found between the following items; 1) There were fairly significant and positive associations between RA Osipow subscale with the individuals' debt ( $r = 0.17, p < 0.079$ ). 2) There were significant and positive associations for between age ( $r = 34, p < 0.006$ ) and work background ( $r = 0.30, p < 0.004$ ) with the mortgage. 3) There were significant and negative associations between level of education and number of subjects' children ( $r = -0.22, p < 0.001$ ), while there were

significant and positive association between mortgage ( $r = 0.31, p < 0.001$ ) and work background ( $r = 0.53, p < 0.001$ ) with the number of children. 4) Furthermore, analyses by t-test revealed that there were fairly significant differences between female and male on the LTT level. That is, male nurses (N = 59, M = 4.65, SD = 3.42) had lower LTT level than female nurses (N = 46, M = 6.40, SD = 6.68) ( $p = 0.84$ ). In addition, there were found significant differences between the work shift and the LTT level. In other words, those who were attended at morning work shift (N = 40, m = 71.05, SD = 31.49) had got lower LTT level than those who attended at either morning and afternoon or night and morning work shifts (N = 45, M = 78.8, SD = 25.21) ( $p < 0.51$ ).

In order to find the relationships between work stress and stress experiences during the previous year, analyses by t-test showed that nurses who had stress experiences got less mean scores (N = 12, M = 24, SD = 5.27) than those without experiences (N = 76, M = 28, SD = 6.40) on responsibility subscale ( $p < 0.043$ ).

Table 1: Number and percentage of level of stress on Osipow

| Tension stress level | RO  |       | RI  |       | RA  |       | RB  |       | PE  |       | R   |       | Total tension |       |
|----------------------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|-------|---------------|-------|
|                      | No. | (%)   | No. | (%)   | No. | (%)   | No. | (%)   | No. | (%)   | No. | (%)   | No.           | (%)   |
| No tension           | 19  | 18.1  | 2   | 1.9   | 9   | 8.6   | 3   | 2.9   | 70  | 66.7  | 9   | 8.6   | 16            | 15.2  |
| Normal               | 68  | 64.8  | 56  | 53.5  | 69  | 65.7  | 60  | 57.1  | 25  | 23.8  | 35  | 33.3  | 89            | 84.8  |
| Moderate             | 16  | 15.2  | 35  | 33.3  | 17  | 16.2  | 32  | 30.5  | 7   | 6.7   | 55  | 52.4  | 0             | 0.0   |
| Severe               | 2   | 1.9   | 12  | 11.5  | 10  | 9.5   | 10  | 9.5   | 3   | 2.9   | 6   | 5.7   | 0             | 0.0   |
| Total                | 105 | 100.0 | 105 | 100.0 | 105 | 100.0 | 105 | 100.0 | 105 | 100.0 | 105 | 100.0 | 105           | 100.0 |

RO = Role Overload, RI = Role Insufficiency, RA = Role Ambiguity, RB = Role Boundary, PE = Physical Environment, R = Responsibility,

\*\*\*: Highly significant

Table 2: Number, mean and SD of LTT scores

| LTT level | No. | Mean | SD   |
|-----------|-----|------|------|
| LTT ratio | 105 | 74.8 | 29.4 |
| LTT SI    | 105 | 5.4  | 5.2  |

Table 3: Number and percentage of LTT scores with the cut off 30

| LTT level    | No. | (%)   |
|--------------|-----|-------|
| Less than 30 | 14  | 13.3  |
| 30 and more  | 91  | 86.7  |
| Total        | 105 | 100.0 |

Table 4: Correlation analyses between Osipow and LTT scores

| Tension       | RO                  | RI                     | RA                    | RB                   | PE                  | R                     | Total tension        |
|---------------|---------------------|------------------------|-----------------------|----------------------|---------------------|-----------------------|----------------------|
| RI            | 0.26<br>$r = 0.007$ | ***                    |                       |                      |                     |                       |                      |
| RA            | 0.20<br>$r = 0.037$ | 0.55<br>$r < .001$     | ***                   |                      |                     |                       |                      |
| RB            | 0.26<br>$r = 0.008$ | 0.66<br>$r < .001$     | 0.65<br>$r < .001$    | ***                  |                     |                       |                      |
| PE            | 0.33<br>$r < .001$  | 0.23<br>$r = 0.020$    | 0.16<br>$r = 0.115$   | 0.23<br>$r = 0.018$  | ***                 |                       |                      |
| R             | 0.38<br>$r < .001$  | -0.012<br>$r = 0.91$   | -0.042<br>$r = 0.671$ | 0.12<br>$r = 0.207$  | 0.35<br>$r < .001$  | ***                   |                      |
| Total tension | 0.65<br>$r < .001$  | 0.72<br>$r < .001$     | 0.65<br>$p < .001$    | 0.77<br>$r < .001$   | 0.57<br>$r < .001$  | 0.46<br>$r < .001$    | ***                  |
| LTT           | 0.11<br>$r = 0.26$  | -0.0043<br>$r = 0.965$ | -0.106<br>$r = 0.281$ | 0.023<br>$r = 0.781$ | 0.37<br>$r = 0.707$ | -0.047<br>$r = 0.632$ | 0.005<br>$r = 0.962$ |

RO = Role Overload, RI = Role Insufficiency, RA = Role Ambiguity, RB = Role Boundary, PE = Physical Environment, R = Responsibility

Table 1 shows the number and percentage of the Osipow subscales' mean scores of subjects respecting the level of their tension (i.e., without tension, normal tension, moderate and severe tension). According to this Table 1, the majority of subjects had tension in a normal range. That is, 64.8% on Role Overload, 53.3% on Role Insufficiency, 65.7% on Role Ambiguity and 57.1% on Role Boundary showed normal tension. However, 66.7% of subjects were without tension on Physical Environment. Moreover, 52.4% of subjects showed moderate tension on Responsibility. With regard to the total tension scores, 84.8% of subjects had normal tension and only 15.2% of them were without tension. As the table shows, none of the subjects demonstrated tension on moderate or severe tension levels.

Table 2 shows the mean and SD of LTT scores of the subjects. The level of LTT was calculated on two different ways containing LTT Ratio and LTT SI. Based on both methods, it was found that most of the subjects have got LTT scores on a normal range. Moreover, the cut off of 30 was regarded as a criterion to identify the persons who have LTT level in an immune level. That is, the score of 30 or more of LTT shows the immune level of the individual. According to this, most of the nurses (86.7%) had the normal LTT level (Table 3).

Finally, the association between the subscales of Osipow and LTT scores were computed and the results revealed that there were significant differences between total tension scores and the subscales of the Osipow ( $p < 0.001$ ). Within the subscales of the Osipow, significant associations were found except between Physical Environment and Role Ambiguity ( $p = 0.115$ ) and between Responsibility with Role Insufficiency ( $p = 0.91$ ), Role Ambiguity ( $p = 0.671$ ) and Role Boundary ( $p = 0.207$ ). However, the results failed to show significant association between LTT scores and either total tension scores or Osipow subscales (Table 4).

## DISCUSSION

The present research has greatly looked for finding the scientific links between psychological phenomena with the immune system of the body. A wide range of research has supported this idea that psychological issues, emotional status and personality traits have affected the immune system's performance. In addition, it was found that the immunological changes may be regarded as a valid criterion of stress tolerance in individual as well as the prediction of both physical and mental status (Miller *et al.*, 2006; Wright *et al.*, 2005; Erera, 1991; Cole, 1992; Hochwarter *et al.*, 1999).

The present study demonstrated that female nurses significantly had a better immune system than male nurses did. The results supported the biological findings of the previous research (Miller *et al.*, 2005; Morikawa *et al.*, 2005; Sun *et al.*, 2003; Kawakami *et al.*, 1997; Nokano *et al.*, 1998). However, the present research did not indicate the significant association between job stress and LTT, which is contrary to the previous studies (e.g., Miller *et al.*, 2006; Merlot *et al.*, 2004). When the stress has continued in one of life dimensions such as job stress, it is more possible the body has returned to the immune level, as it initially existed. In other words, it can be said that the body has become adjusted to the stressful situation, at least for a determined period. In a similar vein, Dhabharm and McEwen (1996) showed that the level of immune system of the rats which were under stress situation, has increased and returned to the normal level. In addition, regarding the normal level of total tension in the subjects, it is more likely that the marked changes have not occurred for the immune system (i.e., the LTT level). Present results supported the results of Abdi's (1994) study. In particular, both studies showed that the total tension scores were in a normal range.

Present findings concerning Osipow scale showed that the majority of nurses had either moderate or normal tension in all subscales, except in physical environment subscale. That may be true that despite the high stressful job for nurses, they are prone to adjust themselves to the situation for several reasons including the comparing themselves with the other populations in the society, low expectations, good internal control and positive relations with their colleagues. These variables may influence on the immune system and the results failed to show a significant association between LTT with tension levels, which needs further investigation. However, with respect to the stress dimension, Abdi (1994) indicated that moderate tension was found for the Role Boundary while, in our findings, this was found for the responsibility subscale. It is interesting to note that the present study revealed both male and single nurses significantly showed more stress levels than female and married ones, respectively. In addition, those with B.Sc. nurse certificate had also higher stress level than those with lower education level. In sum, these results demonstrated that nurses with more responsibility in their lives have more stress level. In particular, it is more likely that those with more experiences or responsibility may have more expectancies of their environment. Therefore, these persons may more suffer from their job characteristics. In return, it is also possible that in the community level such as family, society and job status there are high

expectancies of them. Similarity, results revealed that those with stress event experiences during the past year had significantly less tension on both role boundary or responsibility subscales. One way for interpretation these results may be that stress event experiences may increase the stress tolerance in individuals and they were more capable to adjust them with the daily stress, while in contrast, those without these experiences were more anxious in handling the daily stress.

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