

Short Report

## Assessment of Psychological Stress Levels of Students Using a Stress Meter and its Correlation with Mental Health Levels Measured by General Health Questionnaire 28

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(Accepted Oct. 29, 2007)

Key words: stress levels, stress meter, GHQ28, mental health level, social activity disorder

### Abstract

The relationship between psychological stress and mental health levels of university students was studied using a Stressometer (stress meter) and the Japanese version of General Health Questionnaire (GHQ) 28. A GHQ28 survey was performed on 22 students with high stress levels of 70 or higher TNR (TNR: units measured by a stress meter) and 19 students with normal stress levels 36 or lower TNR. In students with high stress levels, the average overall GHQ28 score was 9.0. In students with normal stress levels, the average mental health score of 5.3 was significantly lower ( $p < 0.02$ ). In students with high stress levels, a particularly notable feature was the social activity disorders in the GHQ factor scales. This study suggests that measurement of stress levels using a stress meter may be useful for assessing mental health levels.

### Introduction

Many attempts have been made to assess levels of psychological stress that find expression through different and complex mechanisms [1]. The methods involved range from the analysis of genetic manifestation profiles [2] or a functional magnetic resonance imaging (fMRI) [3,4] to the filling out of mental health survey forms [5]. However, it is not an easy matter to find a method that makes it possible to quantify concisely the levels of varied stress reactions in individuals [6,7]. In this study, a stress meter recently developed by Comby et al [8] was used to measure quantitatively the level of psychological stress. Using this device, authors previously reported a significant correlation between stress levels and breath concentrations of carbon monoxide, which is produced in the cells by oxidative stress-induced heme oxygenase-1 [9]. It is well known that psychological stress induces the production of reactive oxygen species, which can result in oxidative stress and inflammatory reaction [10,11].

In this study, by the medical checkups carried out on students at a medical welfare university provided an ideal opportunity to assess the state of psychological stress among university students employing a stress meter and the Japanese version of General Health Questionnaire (GHQ) 28. This could be the first study

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to report on the correlation between stress levels measured by a stress meter and mental health states evaluated by GHQ28, and further comprehensive studies with a larger number of subjects are needed to properly interpret the data that was obtained.

## Materials and Methods

### *Study protocol*

Stress levels were measured using a stress meter in 151 students selected randomly at the time of the annual medical checkup at Kawasaki University of Medical Welfare. Nineteen students (6 males, 13 females) with normal stress levels showing 36 or lower TNR (tremor of the nervous system at rest units) measured by a stress meter and 22 students (10 males, 12 females) with high stress levels of 70 or higher TNR were selected and asked to fill out a GHQ28 form prepared by Nippon Bunka Kagakusha Co., Ltd., concerning the state of their mental health. The other 110 students not selected for GHQ28 either did not agree to participate in the study or showed intermediate stress level scores between 37 and 69 TNR. This research was approved by the Ethics Committee of the university.

### *Measurement of stress levels*

Stress levels were measured using a stress meter manufactured by TNR Inc. in France [6]. The measurement of stress (minute tremor in the hand) levels using this device and its significance was previously reported in detail [9]. The average value of stress levels measured in 151 students was 49.5. A previous study [9] showed 13.0% of students with high stress levels of 70 or higher TNR among 445 students measured.

### *Assessment of mental health levels using GHQ28*

Developed by Goldberg and Blackwell [12], GHQ28 is a mental health survey form that is in accord with WHO standards. Its appropriateness and reliability have been thoroughly studied, and it is used widely today throughout the world for evaluating psychological stress levels, for example, in people suffering from a great disaster [13–15]. In terms of content, the factor scale is divided into four categories: somatic symptoms (A: Felt not in good health, Felt in need of tonic, Felt run down, etc.), anxiety and insomnia (B: Felt under stress, Edgy and bad-tempered, Scared or panicky, etc.), social activity disorder (C: Not doing things well, Not satisfied with task, Could not made decision, etc.), and severe depression (D: Felt worthless, Felt life hopeless, Felt life not worth living, etc.). There are seven questions in each category (total of 28 questions). The higher the GHQ score, the poorer the state of the subject's mental health. Taking account of sensitivity and specificity, the demarcation point (critical point) is considered to be 5 or 6. Around 90% of patients suffering from neuroses have a score of 6 points or more, while 86% of healthy adult subjects have a score of 5 points or less [16]. Using the extensive results of previous research [17–19], a GHQ score of 5 points or less was selected as indicating student with a good mental health and a score of 6 points or above as indicating a student with a problem of some kind, i.e. in poor mental health. For the four different factor scales, it was assumed that a problem was evident with score of 4 or more points out of a full score of 7 points with A and B and a score of 3 or more points out of a full score of 7 points with C and D [13].

### *Statistical analysis*

The results obtained were expressed as an average value  $\pm$  standard deviation. Significant difference was verified using the Student *t* test, chi-square test and Fisher's exact probability test, and significant

difference was considered to be  $p < 0.05$ .

## Results

A comparison of the total GHQ28 scores (total of 28 points) between students with normal stress levels of 36 or lower TNR and those with high stress levels of 70 or higher TNR showed that the total scores of the normal group ( $5.3 \pm 4.1$ ) were significantly lower than total scores of the high stress group ( $9.0 \pm 5.0$ ,  $p < 0.02$ , Fig. 1). The proportion of students with GHQ scores of 6 points or more (i.e. poor mental health) was significantly lower in the low TNR group (47.4% vs 73.7%,  $p < 0.03$ ). Also, the average stress level (TNR) of students with total GHQ scores of 5 and below ( $44.8 \pm 33.2$ ) was lower than that of students with scores of 6 and above ( $75.9 \pm 45.4$ ,  $p < 0.02$ , Fig. 2). The percentage of students with high stress levels of 70 or higher TNR was significantly higher in those with total GHQ scores of 6 points and above (68.0%, 31.3% in the 5 and below group,  $p < 0.03$ ).

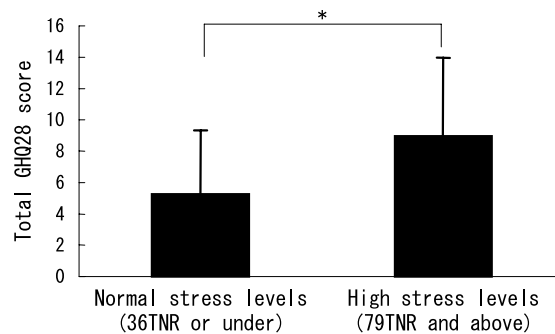


Fig. 1 Total GHQ28 scores (max. 28 points) for students with normal stress levels (36 TNR and under) and with high stress levels (70 TNR and above).  $5.3 \pm 4.1$  for students with normal stress levels ( $n=19$ ) and  $9.0 \pm 5.0$  for those with high stress levels ( $n=22$ ). \* $p < 0.02$ .

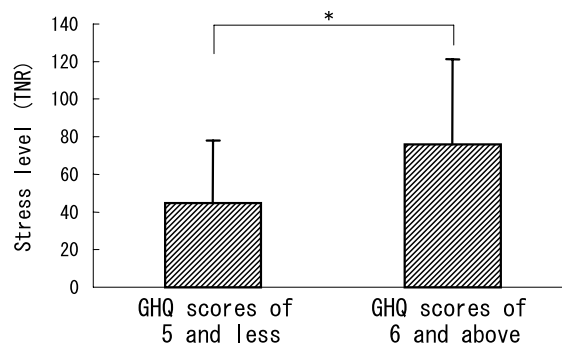


Fig. 2 Stress levels for students with total GHQ28 scores of 5 or less and 6 or more.  $44.8 \pm 33.2$  for total GHQ28 scores of 5 or less ( $n=16$ ) and  $75.9 \pm 45.4$  for those 6 or more ( $n=25$ ). \* $p < 0.02$ .

Mental health levels were then investigated individually for each of the categories A, B, C and D in the GHQ 28 factor scales. In category C, social activity disorders, of the scores for students with normal stress levels and those with high stress levels were  $0.8 \pm 1.3$  and  $2.0 \pm 1.6$ , respectively. This difference was significant ( $p < 0.02$ , Fig. 3). The proportion of students with social activity problems was high tendency in students with high levels of stress (31.8% vs 10.5%,  $p=0.100$ ). In category A, somatic symptoms, the scores for normal and high stress level students were  $1.7 \pm 1.8$  and  $2.9 \pm 2.1$ , respectively ( $p=0.054$ ).

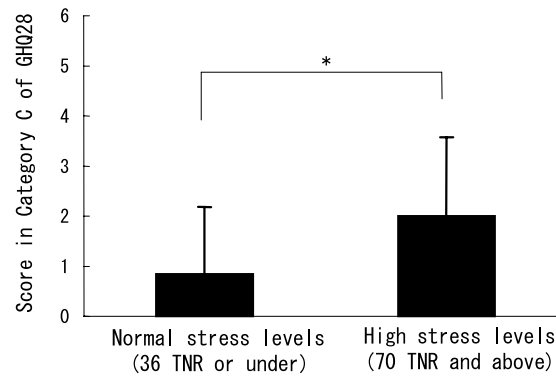


Fig. 3 Stress level scores (max. 7 points) for factor scale category C (social activity disorders) of GHQ28 in students with normal stress levels (36 TNR and under) and high stress levels (70 TNR and above).  $0.8 \pm 1.3$  for normal stress levels ( $n=19$ ) and  $2.0 \pm 1.6$  for high stress levels ( $n=22$ ). \* $p < 0.02$ .

## Discussion

The present study is of interest because it demonstrated that stress levels measured using a stress meter are related to levels of mental health assessed of GHQ28. Of particular interest were the correlations observed for students with social activity disorders (Category C) and physical symptoms (Category A) but not for Category B and D of GHQ28. High frequency of high stress levels among students with extensive physical symptoms is understandable, but further study is needed to clarify why high stress levels were found in students complaining of social activity disorders.

This was a preliminary study in which the extremes of stress level were selected. The students with TNR scores between 36 and 70 were excluded in this pilot study. Therefore, the correlation between TNR and GHQ28 for evaluating the state of personal stress should be examined with a larger number of students that includes those in the whole range of TNR.

Tremor is often evident among highly-nervous individuals, especially at times such as mental tension, fatigue and excitement, and during cold spells. A number of reports [20,21] have been published on how mental stress has the effect of increasing the amplitude of hand tremor. The author in a previous study [9] also discussed in detail the neurological mechanism of minute tremors [22] and its correlation to the assessment of psychological stress levels using the stress meter.

However, we need to be aware that there are normal individual stress levels (basic values) and daily variations, and it would be preferable to be able to assess increases in stress levels (TNR) that are the result of applied psychological stress. High stress levels as measured by a stress meter and poor mental health detected by GHQ28 could be ameliorated by several stress-relaxation methods such as biofeedback and self-regulation, autogenic training and progressive relaxation of muscles. Pulse rate as a marker of autonomic manifestation of stress expression could be correlated with TNR values before and after stress overload. Further studies with a larger number of subjects will have to be carried out to clarify these matters.

## Conclusion

In summary, this study suggested that measurement of stress levels using a stress meter could be useful for assessing mental health levels.

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