Individual Differences in Physiological Responses and Type A Behavior Pattern

Kazuo Oishi\textsuperscript{1)}, Mami Kamimura\textsuperscript{2)}, Takashi Nigorikawa\textsuperscript{3)}, Toshiyuki Nakamiya\textsuperscript{4)}, Richard E. Williams\textsuperscript{5)} and Steven M. Horvath\textsuperscript{5)}

\textsuperscript{1)} Health and Sports Sciences Institute, Senshu University
\textsuperscript{2)} Department of Health and Sports Sciences, Nippon Engineering College of Hachioji
\textsuperscript{3)} College of Community and Human Services, Rikkyo University
\textsuperscript{4)} School of Human Sciences, Waseda University, Japan (present adress: Osaka University of Health and Sport Sciences)
\textsuperscript{5)} Sansum Medical Research Institute, USA

Abstract. The relationships between individual differences in psychophysiological responses and tendency of Type A behavior pattern (TABP) were investigated during mental arithmetic (MA) at a steady rhythm, challenging calculation (Uchida-Kraepelin serial addition test: UK test), music listening, and exposure to an 80 dB SPL of white noise. Each mental task was sustained for 5 minutes. Sixteen healthy Japanese adults, (10 males and 6 females) with an age from 18 to 36 years old volunteered for this study. The KG’s Daily Life Questionnaire (KG Questionnaire) was used to investigate the tendency toward TABP, which included three sub-factors: aggression-hostility, hard-driving and time urgency, and speed-power items. Recorded physiological variables were respiratory rate (RR), skin resistance response (SRR), eyeblinks, and heart rate (HR) calculated using frequency analysis to render high frequency power (HF) and the ratio of low/high frequencies (L/H ratio). During the MA and UK tests, significant increases in HR, L/H ratio, RR occurred, while significant decreases in HF were observed. Eyeblinks significantly increased during the MA test and significantly decreased during the UK test. During music and white noise, no significant changes occurred except for SRR, which decreased significantly. The coefficient of variances in each response was over 20% for almost all variables, indicating that individual differences in the magnitude of each response were large, even if the direction (increase or decrease) of the change was the same in almost all subjects. The highest correlation coefficients (r) between the mean values of relative magnitude for each variable and TABP scores during the MA and UK tests were obtained for the L/H ratio (MA: r=0.591, UK test: r=0.577) and the RR (MA: r= - 0.576, UK test: r= - 0.511). These values were statistically significant (p<0.05). Similar results were obtained for TABP sub-factors. Though other investigations have reported relationships between HF and TABP, we found no significant relationship. It was suggested that sympathetic nerve activity became greater for TABP individuals than for Type B individuals under stress conditions. (Appl Human Sci, 18 (3): 101-108, 1999)

Keywords: Type A behavior pattern, KG's Daily Life Questionnaire, autonomic responses, eyeblinks, stress conditions

Introduction

Mental activity is accompanied by many psychophysiological changes. Typical cardiovascular responses are elevation of heart rate, blood pressure, and respiration rate. Mental stress also induces several autonomic responses (Callister et al., 1992), and modify immune and endocrine functions. It is well known that there are individual differences in magnitude and/or direction of stress responses. Recently the personality and/or behavior pattern of each person has been considered to be a large factor accounting for these individual differences, since these responses reflect cognitive processes (Deschaumes-Molinaro et al., 1991; Lacy and Lacy, 1970; Wallin and Fagius, 1996).

Type A behavior pattern (TABP) is a concept developed from Friedman and Rosenman’s observation (Friedman and Rosenman, 1974) that certain behavioral attributes are associated with coronary heart disease (CHD). TABP is a major independent risk factor for CHD and the risk is of similar magnitude as that for traditional factors such as high blood pressure, advancing age, elevated serum cholesterol and cigarette smoking (A review panel). TABP is defined as a combination of
physiological and behavioral characteristics including enhanced aggressiveness, hard driving competitiveness, and a chronic sense of time urgency (Friedman and Rosenman, 1959). The typical TABP individual is highly competitive, achievement-oriented, impatient, reacts to frustration with hostility, feels pressured for time, is often involved in work and other activities subject to deadlines, and tends to be fast-moving and emphatic in speech (Hayano et al., 1991). The constituents of TABP has been reported as: 1) aggression-hostility, 2) hard-driving and time-urgency, and 3) speed-power (Yamasaki et al., 1992). Conversely, Type B behavior pattern (Type B) is defined as a relative absence of these characteristics.

The difference in psychophysiological responses between TABP and Type B individuals has been described utilizing changes in physiological variables from baseline in response to cognitive challenges. For example, blood pressure (Dembroski et al., 1982; Lacy and Lacy, 1970) and the concentration of plasma epinephrine (William et al., 1982) in TABP individuals were found to be greater than that of Type B during stress conditions. It has been generally accepted that greater stress responses, particularly in the sympathetic nervous system, are observed in TABP individuals than in Type B individuals (Dembroski et al., 1978; Glass et al., 1980).

Most of the physiological variables employed to study psychophysiological responses of TABP individuals during stressful conditions have been limited to those associated with CHD. Few reports utilize multiple variables, and fewer still include autonomic responses recorded simultaneously. Many studies measure psychophysiological responses in TABP individuals to only stressful tasks such as mental arithmetic and failure to include mental or emotional loads such as noise or music. Additionally, most of the former reports in this area have used the method in which the two extremes of behavior pattern, i.e. TABP and Type B groups, were compared excluding the middle class individuals. In the present study, the relationships between individual differences in psychophysiological responses to several kinds of mental stress loads including music and the tendency toward TABP were investigated in normal subject group.

Methods

Subjects

Sixteen healthy Japanese adults (10 males and 6 females) 18 to 36 years old volunteered in this study. Mean and SD ages were 23.5 ± 3.5 years for the males and 20.5 ± 6.2 years for the females. After a thorough explanation of the purpose and procedures of the study and informed consent obtained, experiments were initiated. Since it is known that age and/or food may effect HR variability (Hayano et al., 1990b; Lipsitz et al., 1990), younger subjects were selected and experiments were conducted at least 3 hours after their last meal. The illumination of the experimental room was an average of 1100 lux approximately on the table height level.

Protocol

After preparations for the electrical recordings were completed, a 5-minute rest period was provided to establish a baseline. This was followed by a 5-minute control period in which all physiological variables were recorded. Subjects were instructed to remain relaxed for this period. Following the rest measurement, recording continued as subjects performed one of the 5-minute mathematical tests, or listened to one of the audio tests for 5 minutes.

Recording and analysis of physiological variables

Electrocardiogram

An electrocardiogram was recorded by bipolar surface electrodes attached to the chest of subjects. The electrocardiogram signal (time constant 0.03 sec) was A/D converted at a sampling rate of 1 KHz to obtain RR interval data, and stored on a computer. These data were analyzed by frequency-domain analysis (MEM method by MemCalc 200/1000 system, Suwa Trust Ltd.). Power spectral analysis assesses sympathetic and parasympathetic activities (Akselrod et al., 1981). Higher frequencies of HR variability (HF power, set at 0.16–0.46 Hz) tend to reflect parasympathetic nervous system activity (Berger et al., 1989; Hayano et al., 1991). While lower frequencies (LF power, set at 0.04–0.14 Hz) reflect both parasympathetic and sympathetic nervous system activities (Akselrod et al., 1981; Pagani et al., 1986; Pomeranz et al., 1985), the ratio of low/high frequencies (L/H ratio) represents the activity of the sympathetic nervous system.

Respiratory, electrodermal activity, and eye blinks

Electrodermal activity was recorded as a skin resistance response (SRR). Two detecting Ag-AgCl electrodes were set on fore and middle fingers. The SRR signals were digitized at a 10 Hz sampling frequency by a computerized SRR analyzing system (NEC Medical System Inc.). Respiratory rate (RR) was determined by a thermistor, which was located at the nostril. Changes between inhaled and exhaled air indicated breath rate. The RR signals (time constant 0.03 sec) were analyzed by a computer analysis system (NEC Medical System Inc.). Complete procedures have been previously described (Oishi et al., 1994). Eyeblinks were recorded by means of an electro-oculograph (EOG). Potential change was recorded by bipolar Ag-AgCl surface electrodes attached on the lower forehead and upper cheek. The amplified signal (NEC Medical System Inc., time constant 3 sec) of EOG was sent to pen oscillograph. The blink rate was manually counted by examiner from the oscillogram (Yamada et al., 1979). The above variables were recorded...
simultaneously on a magnetic tape recorder (TEAC, MR-10) and analyzed separately.

Evaluation of TABP tendency

Jenkins Activity Survey (JAS) (Jenkins et al., 1971) is one of the most common questionnaires in the United States. However, there has been criticism for using this questionnaire with Japanese subjects since there are many life-style and cultural differences. Several questionnaires have been developed specifically for the Japanese (Sato, 1992; Yamasaki et al., 1992; Yamasaki, 1992). In this study the KG’s Daily Life Questionnaire (KG Questionnaire) (Yamasaki et al., 1992) was selected, since the three elements of TABP structure (aggression-hostility, hard-driving and time-urgency, and speed-power) can be scored in addition to the TABP score. The KG Questionnaire consists of 55 items (44 TABP and 11 irrelevant or “dummy”). Subjects were instructed to choose one of the three answers (Yes, ?, or No) for each question. This method has been applied to many Japanese, and the validity and reliability of this questionnaire are considered to be excellent (Tanaka et al., 1992; Yamasaki et al., 1992; Yamasaki, 1992).

It has been suggested that the results of this questionnaire are different between male and female groups (Yamasaki et al., 1992). However, Ueda et al. reported that there were no obvious differences in TABP scores between males and females by using the same questionnaire (Ueda et al., 1998). In this study, TABP scores including the three sub-factors were compared between males and females. An unpaired student’s t test failed to reveal significant differences in these groups, except for the hostility element (Table 1). Consequently, the data obtained were analyzed together for the two groups in all cases.

Mental loads

Four randomly ordered 5-minute mental tasks were given to each subject. The rest periods between tasks were at least five minutes. During this rest period, subjects received information regarding the next task. Subjects sat in a comfortable chair and were instructed to maintain a steady position during each task. Any movement of the hand on which the electrodes for SRR detection were attached was carefully noted and the SRR data for the corresponding time disregarded.

Mental arithmetic (MA)

Mental arithmetic was conducted using a cassette tape on which voice-directed single digit additions (e.g. 7 + 6, 8 + 9, 6 + 9, etc.) were prerecorded. A total of 60 additions was presented to the subjects in five minutes at a steady rhythm (1 task/5 sec). These calculations were presented through a cassette tape player set 1m from the subjects with an average sound of 50 dB SPL. Subjects were instructed to write down each answer using a felt pen on a plastic board (10 cm · 10 cm) set on a desk at elbow height.

Uchida-Kraepelin serial addition test (UK test)

The Uchida-Kraepelin serial addition test (UK test) required subjects to perform calculations as fast and as accurately as possible within five minutes. This was done using pre-printed paper containing 5 lines of random, single-digit, horizontally aligned numbers. For each minute of the test, subjects were instructed to begin a new line regardless of their position on the current line. Each line contained an excess of calculations such that the subjects were not able to finish any line for a particular minute before being prompted to move on for the start of the next minute by the examiner’s prompting.

Music and white noise

Music listening was conducted to induce relaxation in the subjects. The music used was the Nocturne (Op. 37-1) by F. Chopin, and played from the cassette tape player set 1 m from the subjects. The sound of music was set at the same volume level for all the subjects, which was from 25 to 60 dB SPL approximately.

White noise was administered at 80 dB SPL for 5 minutes as a control for the music test since both utilized the sense of hearing. The noise was produced from a speaker set 1 m from the subjects.

Data analysis

The Student’s t test was used to detect the difference between the means of all tests.

Results

Changes of physiological variables and individual difference

The mean values of differences for all subjects of physiological variables between mental tasks and control baselines are shown in Figure 1. During the MA and UK tests, increases in HR (MA: 5.5 – 15.2 beat/min, df=15, t=4.61, p<0.001, UK test: 9.0 – 16.7 beats/min, t=5.83, p<0.001), L/H ratio (MA: 0.479 – 10.541, df=15, t=2.31,
Physiological Responses and Type A

Fig. 1 Differences of mean values of all subjects for physiological variables between mental tasks and control levels. a: heart rate (HR), b: high frequency components of heart rate variability (HF), c: ratio of low/high frequency component (L/H ratio), d: respiratory rate (RR), e: eyeblink rate, f: skin resistance response (SRR).

MA: mental arithmetic, UK: Uchida-Kraepelin series addition test, Music: Nocturne-F. Chopin (Op.37 No.1 G moll), W-noise: 80 dB SPL (sound pressure level) of white noise. NS: not statistically significant. ***: p<0.001, **: p<0.01, *: p<0.05.

p<0.05 UK test: 0.533 – 10.645, t=2.21, p<0.05, and RR (MA: 4.71 – 13.14 cycle/min, df=15, t=7.13, p<0.001, UK test: 4.76 – 13.91 cycle/min, t=5.70, p<0.001) were observed. Additionally, significant decreases in HF (MA: -335.3 – 1380.3 msec/Hz, df=15, t=3.76, p<0.05, UK test: -374.7 – 1509.9 msec/Hz, t=3.20, p<0.05) and SRR (MA: -316.1 – 1444.5, df=15, t=2.55, p<0.05, UK test: -313.9 – 1414.0 kΩ, t=2.69, p<0.05) were observed. The directional change of these variables was similar during the MA and UK tests. However, eyeblink rates increased
remarkably (17.9 – 114.3 blinks/min, df=15, t=4.65, p<0.001) during MA, but decreased remarkably (- 9.9 – 111.1 blinks/min, t=4.49, p<0.001) during the UK test.

During music and white noise, absolute changes of the means of all subjects’ physiological variables showed no significant changes from control, except SRR which was significantly decreased (music: -238.2 ± 1332.3 kW, df=15, t=2.40, p<0.05, UK test: -218.8 ± 1301.5 kW, t=2.36, p<0.05). Individual differences in the magnitude and the direction of each response are shown, although these changes were not statistically significant.

Table 2 denotes the relative values of all responses as a percent of each control value (100%). The direction of each variable response was generally similar in all subjects. However, the coefficient of variance (CV) of each response indicated large values over 20% except for HR.

**Table 2** Physiological responses of all subjects during four mental loads

<table>
<thead>
<tr>
<th></th>
<th>MA</th>
<th>UK test</th>
<th>Music</th>
<th>W-noise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>HR (%)</td>
<td>109.6</td>
<td>6.41</td>
<td>115.4</td>
<td>8.36</td>
</tr>
<tr>
<td>HF (%)</td>
<td>60.1</td>
<td>18.64</td>
<td>46.8</td>
<td>19.34</td>
</tr>
<tr>
<td>L/H ratio (%)</td>
<td>141.8</td>
<td>38.24</td>
<td>143.9</td>
<td>31.92</td>
</tr>
<tr>
<td>RR (%)</td>
<td>133.2</td>
<td>25.58</td>
<td>136.2</td>
<td>30.81</td>
</tr>
<tr>
<td>Blink rate (%)</td>
<td>253.1</td>
<td>166.6</td>
<td>52.4</td>
<td>41.4</td>
</tr>
<tr>
<td>SRR (%)</td>
<td>50.1</td>
<td>24.80</td>
<td>46.8</td>
<td>23.92</td>
</tr>
</tbody>
</table>

Relationships between changes in physiological variables and TABP tendency

The correlation coefficients (r) between relative mean values (%) for each variable and TABP score are shown in Table 3. The variables in which comparatively higher coefficients (>0.5) with TABP score during MA and UK test were L/H ratio (MA: r=0.591, UK test: r=0.577) and RR (MA: r=-0.576, UK test: r=-0.511). Relationships between the speed-power score and the L/H ratio (MA: r=0.621, UK test: r=0.794), and the hard-driving score and RR (MA: r=-0.624, UK test: r=-0.529) were striking. During music, relationships between HR and the TABP score (r=0.584) or the hard-driving score (r=0.595), the L/H ratio and the hard-driving score (r=0.603) were also impressive. During white noise, the TABP score and RR (r=-0.614), the Hard-driving score and all variables except HF and SR showed relatively high correlation coefficients. From these data, it is clear that the variables with the strongest relation to TABP score were the L/H ratio and RR. In contrast, no significant relationships were obtained for HF or eyeblinks.

**Table 3** Correlation coefficients between each physiological response during four mental tasks and TABP or three sub-factors scores obtained by using KG questionnaire

<table>
<thead>
<tr>
<th></th>
<th>TABP</th>
<th>Speed</th>
<th>Hostility</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. HR</td>
<td>0.319</td>
<td>0.380</td>
<td>0.442</td>
<td>0.211</td>
</tr>
<tr>
<td>UK test</td>
<td>0.216</td>
<td>0.339</td>
<td>0.057</td>
<td>0.026</td>
</tr>
<tr>
<td>Music</td>
<td>0.584*</td>
<td>0.440</td>
<td>0.029</td>
<td>0.595**</td>
</tr>
<tr>
<td>W-noise</td>
<td>0.233</td>
<td>0.021</td>
<td>0.303</td>
<td>0.558*</td>
</tr>
<tr>
<td>b. HF</td>
<td>0.035</td>
<td>0.180</td>
<td>0.323</td>
<td>0.314</td>
</tr>
<tr>
<td>UK test</td>
<td>0.205</td>
<td>0.086</td>
<td>0.003</td>
<td>0.299</td>
</tr>
<tr>
<td>Music</td>
<td>-0.164</td>
<td>-0.151</td>
<td>0.128</td>
<td>-0.187</td>
</tr>
<tr>
<td>W-noise</td>
<td>0.129</td>
<td>0.150</td>
<td>0.222</td>
<td>0.006</td>
</tr>
<tr>
<td>c. L/H ratio</td>
<td>0.591**</td>
<td>0.621**</td>
<td>0.370</td>
<td>0.308</td>
</tr>
<tr>
<td>UK test</td>
<td>0.577*</td>
<td>0.794**</td>
<td>0.221</td>
<td>0.262</td>
</tr>
<tr>
<td>Music</td>
<td>0.378</td>
<td>0.075</td>
<td>0.050</td>
<td>0.603**</td>
</tr>
<tr>
<td>W-noise</td>
<td>0.291</td>
<td>0.067</td>
<td>0.161</td>
<td>0.597**</td>
</tr>
<tr>
<td>d. RR</td>
<td>-0.576*</td>
<td>-0.432</td>
<td>-0.203</td>
<td>-0.624**</td>
</tr>
<tr>
<td>UK test</td>
<td>-0.511*</td>
<td>-0.386</td>
<td>-0.223</td>
<td>-0.529*</td>
</tr>
<tr>
<td>Music</td>
<td>-0.408</td>
<td>-0.377</td>
<td>-0.494*</td>
<td>-0.094</td>
</tr>
<tr>
<td>W-noise</td>
<td>-0.614**</td>
<td>-0.518*</td>
<td>-0.390</td>
<td>-0.526*</td>
</tr>
<tr>
<td>e. Blink rate</td>
<td>-0.096</td>
<td>-0.271</td>
<td>0.019</td>
<td>-0.138</td>
</tr>
<tr>
<td>UK test</td>
<td>0.309</td>
<td>0.277</td>
<td>0.382</td>
<td>0.099</td>
</tr>
<tr>
<td>Music</td>
<td>-0.286</td>
<td>-0.220</td>
<td>-0.525*</td>
<td>0.073</td>
</tr>
<tr>
<td>W-noise</td>
<td>0.168</td>
<td>0.065</td>
<td>-0.109</td>
<td>0.504*</td>
</tr>
<tr>
<td>f. SRR</td>
<td>0.430</td>
<td>0.540*</td>
<td>0.204</td>
<td>0.196</td>
</tr>
<tr>
<td>UK test</td>
<td>0.244</td>
<td>0.446</td>
<td>-0.045</td>
<td>0.166</td>
</tr>
<tr>
<td>Music</td>
<td>0.209</td>
<td>0.386</td>
<td>0.110</td>
<td>0.116</td>
</tr>
<tr>
<td>W-noise</td>
<td>-0.115</td>
<td>-0.299</td>
<td>-0.324</td>
<td>-0.021</td>
</tr>
</tbody>
</table>

**p<0.01, *p<0.05.**

Discussion

Two types of mental arithmetic were used as stress loads in this study. The effects on the psychophysiological responses to each type were different. MA was conducted passively under a consistent speed by means of a tape player, providing 60 calculations in 5 minutes for all subjects. The UK test was a challenging test since the subject’s calculations were forced as fast and as precisely possible within 5 minutes. However, the UK test revealed the subjects’ progress each minute. Ward & Chesny (1986) suggested that TABP individuals are stimulated by more challenging tasks than are type B individuals. In this study,
responses in TABP Individuals were greater during UK test than during MA responses for all variables except eyeblinks, though these differences were not significant.

Changes in eyeblink rate have been suggested to relate to arousal level, attention, or cognitive processes, though the mechanisms of eyeblinks have not been fully revealed (Stern et al., 1984). In this study, large individual differences in the magnitude of changes of eyeblinks were observed during all mental tasks. The direction of this change was generally similar in all subjects. The most remarkable finding was that eyeblinks decreased by about 50% during the UK test in spite of the increase in sympathetic activity and a concomitant decrease in parasympathetic activity. This is inconsistent with the data during MA in which eyeblinks increased by over 150%. These results indicate that eyeblinks may relate more strongly to attention than to arousal level. Additionally, the senses used for attention may be linked more directly to the eyeblink mechanism (e.g. the sense of vision or hearing). Though eyeblinks have been considered to be the significant factor which connected to TABP tendency (Friedman, 1979), significant relations between eyeblinks and TABP tendency or TABP sub-factors were not obtained in this study.

Autonomic activities as seen from changes in HR variability have been observed from a relation to several kinds of diseases. Mayers et al. (1986) reported the relationship between arrhythmia and HR variability, indicating a transient increase in the L/H ratio before a spontaneous incident of atrial fibrillation. Several reports have related HR variability analyses to the study of TABP. Kamata and Monou (1992) recorded power spectra of HR variability during successive calculation tasks for TABP and Type B groups judged by JAS. Though there was no significant difference between the two groups, on average HR, blood pressure, and L/H ratio as the index for the sympathetic activity indicated significant higher values for TABP group than Type B group both during resting and task periods. This study suggests that the sympathetic nervous system is dominant for TABP individuals (Dembroski et al., 1978). Additionally, more recent studies suggest that the reduced function of the parasympathetic nervous system are related to cardiovascular disease (Hayano et al., 1990a; Martin et al., 1987). In the present study, HF as the index for the parasympathetic activity decreased by 40 to 55% and L/H ratio increased by 40 to 55% during the MA and UK tests. Correlation coefficients between the magnitudes of each physiological response during the four mental loads and scores of the TABP and sub-factors were calculated and no significant relation was found between TABP score and HF. Although subjects were not instructed to breathe at a particular rhythm, RR increased significantly in all subjects. There is a possibility that this increase of RR relates to changes in HF (Hayano et al., 1991; Hirsch and Bishop, 1981). It was shown that the physiological variable which has the strongest relationship to TABP and its sub-factors was the L/H ratio (r=0.577 to 0.794). This finding may support the report of Kamata and Monou (1992), suggesting that the sympathetic nerve activity became higher for TABP individuals than for Type B individuals under stress situations.

Music listening was utilized to induce a relaxed state in the subjects. It was expected that the emotional response without stress would be induced during the music. Generally, music listening induces a positive emotional response and thus relaxation. However, some music can cause uneasiness or fear, depending primarily on personal taste (Taguchi et al., 1992). There were no significant differences for each response during music listening, the control resting state, and white noise listening in this study. The values of CV for each response revealed large differences however, indicating a large inter-subject variation of physiological responses to the listening. Additionally, relatively high correlation coefficients were obtained between TABP scores with HR (r=0.584), and hard-driving scores with L/H ratio (r=0.603) for the listening tests. Similar findings were obtained during white noise. These results suggest that TABP individuals have greater difficulty relaxing during music listening, even if individual music taste is a factor since this is not linked to TABP.

Recently, the most attractive sub-factor of TABP in relation to CHD is the aggression-hostility element in the United States (Barefoot et al., 1983; Shekelle et al., 1983). The results in this study showed no significant relationships between any physiological responses and aggression-hostility. Though there is an occurrence of this factor as a modified pattern in Japanese, the level of aggression-hostility element for the Japanese individual is considered to be low in general (Monou, 1992). These results may reflect Japanese character differences with those of the United States.

As mentioned previously, the KG Questionnaire has been applied to a very large number of Japanese, and the validity and reliability of this questionnaire are considered to be excellent (Tanaka et al., 1992; Yamasaki et al., 1992; Yamasaki, 1992). The examiners who established the KG Questionnaire reported that this method was necessary to accumulate the data particularly related to CHD, based on the concept that TABP tendency is associated with CHD. The results in this study showed significant relationships between TABP tendency and the magnitude of the response of sympathetic nervous system. These results are considered to support the validity of the KG Questionnaire from the basis of autonomic functions, in addition to directly supporting the general premise that the risk of CHD disease is higher for TABP individuals than for Type B individuals.
References


Friedman M (1979) The modification of Type A behavior pattern in post-inaction patients. Am Heart J 97: 551-600


Friedman M, Rosenman RH (1974) Type A behavior and your heart. New York, Knopf


Graham FK (1975) The more or less startling effects of weak prestimulation. Psychophysiol 12: 238-248


Review Panel on Coronary-Prone Behavior and Coronary Heart Disease (1981): Coronary-prone behavior and
coronary heart disease: A critical review. Circulation 63: 1199-1215

Received: August 8, 1998
Accepted: March 24, 1999
Correspondence to: Kazuo Oishi, Health and Sports Sciences Institute, Senshu University, 2-1-1, Higashimita, Tama, Kanagawa 214-8580, Japan
e-mail: QWK02752@niftyserve.or.jp