Effects of Shiatsu Stimulation on the Cardiovascular System

Japan Shiatsu College
Students: Sakuo Koyata, Yukio Miyazaki, Yoshimune Kawamata, Shin'ya Takahashi, Hinako Taniguchi, Akemi Saitoh, Terumi Sakurai, Hidetaka Haruna, Akiko Yamamoto
Supervisors: Kazuo Kokubo, Masahiro Fujii, Takashi Namikoshi, Matsuko Namikoshi
Hideo Ohsawa (Tsukuba College of Technology), Hidetoshi Mori (Tsukuba College of Technology)

I. Introduction

Shiatsu, a form of manual therapy, has long been known to stimulate the body's natural healing power for improved health. Shiatsu has shown great promise in alleviating the symptoms of diseases and unidentified illnesses. However, little research has been conducted into the physiological effects of shiatsu, and there is a need to scientifically verify the effectiveness of shiatsu and explain the mechanisms of its therapeutic effectiveness.

It is recognized that somatosensory stimulation of an organism using manual pressure stimulation evokes a reflex response in the various internal organs via the autonomic nervous system[1,2]. This somatovisceral reflex is thought to be responsible for the therapeutic effectiveness of shiatsu.

Here we report on the results of research into the effects of shiatsu on the cardiovascular system through observation of heart rate and fingertip pulse wave, conducted as a first step toward clarifying the physiological effects of shiatsu.

II. Methods

1. Subjects

Research was conducted on 27 healthy adults (12 males, 15 females) aged 18–64 years (mean age: 37.3 ± 13.8 years old).

Test procedures were fully explained to each test subject and their consent obtained. They were also asked to abstain from eating, smoking, ingestion of stimulants, or vigorous exercise for two hours prior to testing.

2. Test period

April 11 to June 5, 1998

3. Test location

Testing was conducted in the shiatsu research lab at the Japan Shiatsu College. Room temperature was 25 ± 1.5°C with subdued lighting and silence maintained.

4. Items measured

A polygraph system (Nihon Kohden Corp. model RM-7000) was used to measure the following items:

(1) Heart rate

A pulse tachometer (Nihon Kohden Corp. model AT-601G) was used to calculate the momentary heart rate (hereafter, 'heart rate') as triggered by the ECG's R wave (the second deflection on the ECG).

(2) Fingertip pulse wave

The fingertip volume pulse wave (hereafter, 'pulse wave') was measured on the second digits of each hand and foot using a reflex pickup (Nihon Kohden Corp. model MPP-3A).

(3) Respiratory curve

The respiratory curve was measured using a thermistor breathing pickup (Nihon Kohden Corp. model TR-712T) inserted into the nasal cavity.

5. Data recording

The items measured in (1) to (3) above were recorded on magnetic tape using a data recorder (Sony model PC208AX), in addition to continuous recording using a polygraph thermal recording device.

6. Data analysis

After completion of testing, data was replayed and transferred to a personal computer (IBM 300GL) via an A/D convertor (BIOPAC Systems, Inc. model MP-100), then analyzed using data analysis software (AcqKnowledge, BIOPAC Systems, Inc.). Analysis was performed on heart rate and pulse wave data from one minute prior to stimulation to one minute after stimulation. However, data due to pronounced body motion, artifact, or swallowing was omitted.

7. Stimulation

Full-body treatment is standard for Namikoshi

shiatsu[3], but because mobility of the test subject was limited due to attachment of the ECG electrodes and other constraints, the areas to which shiatsu was applied were limited to the following (Fig. 1):

(1) Point 1, left lateral crural region: approximately 3 cm disto-lateral to the tibial tuberosity. This is the point where the common peroneal nerve emerges from the popliteal region to the lateral lower leg and divides into the deep and superficial peroneal nerves. Standard pressure was applied using thumb-on-thumb pressure for 5 seconds, repeated 10 times.

(2) Median line of the head: 6 points, located along the median line between the hairline and the crown. Standard pressure was applied using thumb-on-thumb pressure, 3 seconds per point, repeated 3 times, with pressure maintained for 10 seconds on final application to crown of head.

(3) Abdominal region (small intestine region): referred to as the small intestine region in Namikoshi shiatsu, consisting of 8 points located clockwise around the navel, with Point 1 located diagonally to the right (test recipient's right) and inferior to the navel. Standard pressure was applied using two-thumb pressure, 3 seconds per point, repeated 3 times.

(4) Rippling palm pressure to the abdomen: standard pressure is not used here; instead the therapist applies the palms of both hands to the abdominal region, centered on the navel, and draws the descending colon toward him with his fingers, then presses the ascending colon away with the heels of his hands. This back-and-forth suction pressure was repeated 10 times.

(5) Point 1, left anterior cervical region: located on the medial margin of the sternocleidomastoid muscle, near the carotid artery in the carotid triangle. Positioned behind the test recipient's head, the therapist applied standard pressure using one-thumb pressure with the left hand for 3 seconds, repeated 6 times.

All treatment was carried out by the same therapist, applying approximately 5–15 kg pressure, depending on the comfort level of the test recipient. All standard pressure was applied using gradual increase and decrease of pressure.

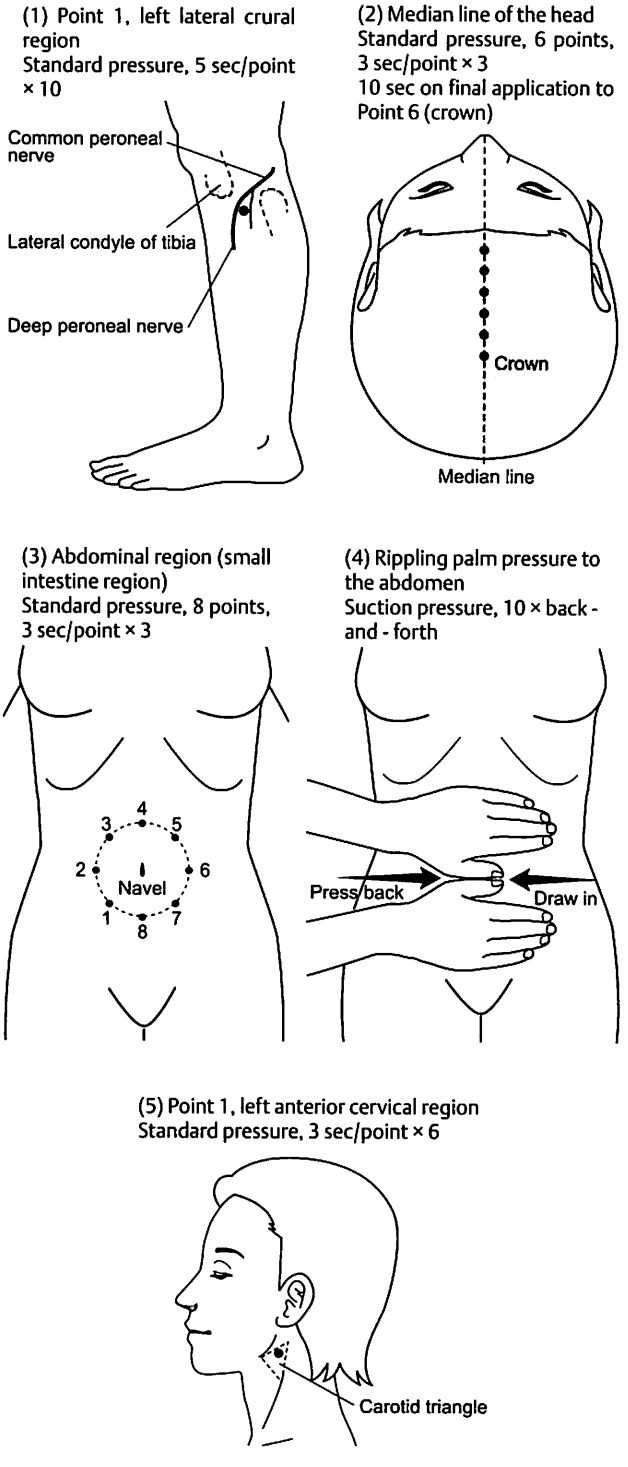

Fig. 1. Areas and methods of shiatsu application (Namikoshi style)
Adapted from *The Complete Book of Shiatsu Therapy* by Toru Namikoshi

8. Test procedure

Testing commenced after the subject had been lying quietly for a minimum of 20 minutes in the supine position.

Stimulation was carried out in the following order: Point 1, left lateral crural region; median line of the head; abdominal region (small intestine region); rippling palm pressure to the abdomen; Point 1, left anterior cervical region. A minimum of 5 minutes was allowed between each shiatsu procedure, and heart rate and pulse wave were allowed to stabilize before the next stimulation was applied.

9. Statistical processing

Data were analyzed at 10 second intervals from 1 minute prior to 1 minute after stimulation. The measurement taken 10 seconds prior to commencement of stimulation was used as the control in order to establish a standard value for evaluating response, shown as 100%. Other measurements were converted to percentage and expressed as mean ± SE.

Statistical verification was carried out using analysis of variance according to Dunnett's multiple comparison test, with <5% considered significant.

III. Results

During testing there were no instances requiring cessation of treatment due to pain or discomfort. Pulse wave results shown are for the left hand, the same side as to which the stimulus was applied, as measurements taken at hands and feet on both sides displayed the same trends.

1. Point 1, left lateral crural region

Figure 2 indicates changes to heart rate and pulse wave due to stimulation of Point 1 of the left lateral crural region. Heart rate showed a significant reduction between 10 sec after commencement of stimulation and 20 sec after completion, with a maximum reduction of 6.6% at 30 sec after commencement of stimulation. Pulse wave showed a significant reduction of 18% at 10 sec after commencement of stimulation, before promptly returning to pre-stimulation levels.

2. Median line of the head

Figure 3 indicates changes to heart rate and pulse wave due to stimulation of the median line of the head. Heart rate showed a significant reduction between 10 sec and 60 sec after commencement of stimulation, with a maximum reduction of 5.4% at 20 sec after commencement of stimulation. Pulse wave showed a significant reduction of 20% at 10 sec after commencement of stimulation, before promptly returning to pre-stimulation levels.

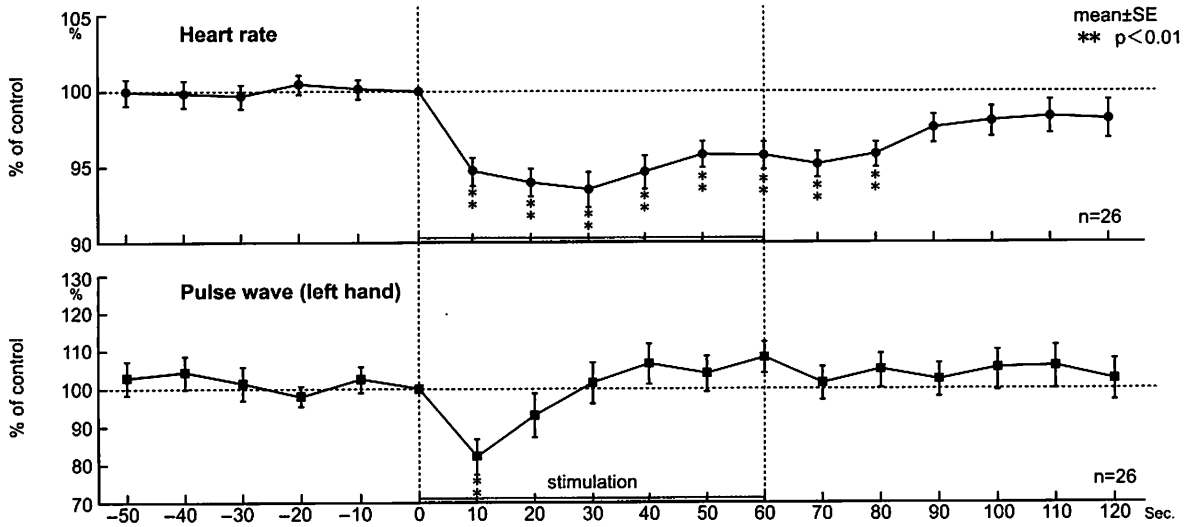

Fig. 2. Changes to heart rate and pulse wave (left hand) due to stimulation of Point 1 of the left lateral crural region

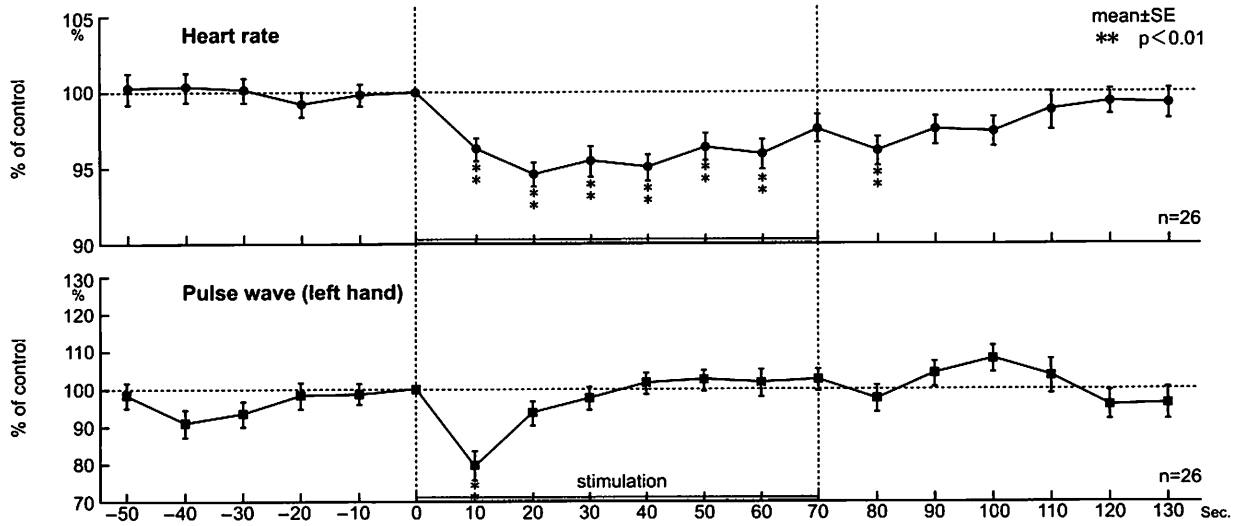

Fig. 3. Changes to heart rate and pulse wave (left hand) due to stimulation of median line of the head

3. Abdominal region (small intestine region)

Figure 4 indicates changes to heart rate and pulse wave due to stimulation of the abdominal region (small intestine region). Heart rate showed a significant reduction between 10 sec after commencement of stimulation and 10 sec after completion, with a maximum reduction of 6.7% at 20 sec after commencement of stimulation. Pulse wave showed a significant reduction of 16% at 10 sec after commencement of stimulation, before promptly returning to pre-stimulation levels.

4. Rippling palm pressure to abdomen

Figure 5 indicates changes to heart rate and pulse wave due to stimulation using rippling palm pressure. No significant change to heart rate due to stimulation was detected. Pulse wave showed a significant reduction of 24% at 10 sec after commencement of stimulation, before promptly returning to pre-stimulation levels.

5. Point 1, left anterior cervical region

Figure 6 indicates changes to heart rate and pulse wave due to stimulation of Point 1 of the left anterior cervical region. Heart rate showed a significant reduction between 10 sec and 30 sec after commencement of stimulation, with a maximum reduction of 6.5% at 20 sec after commencement of stimulation. Pulse wave showed a significant reduction of 24% at 10 sec after commencement of stimulation, before promptly returning to pre-stimulation levels.

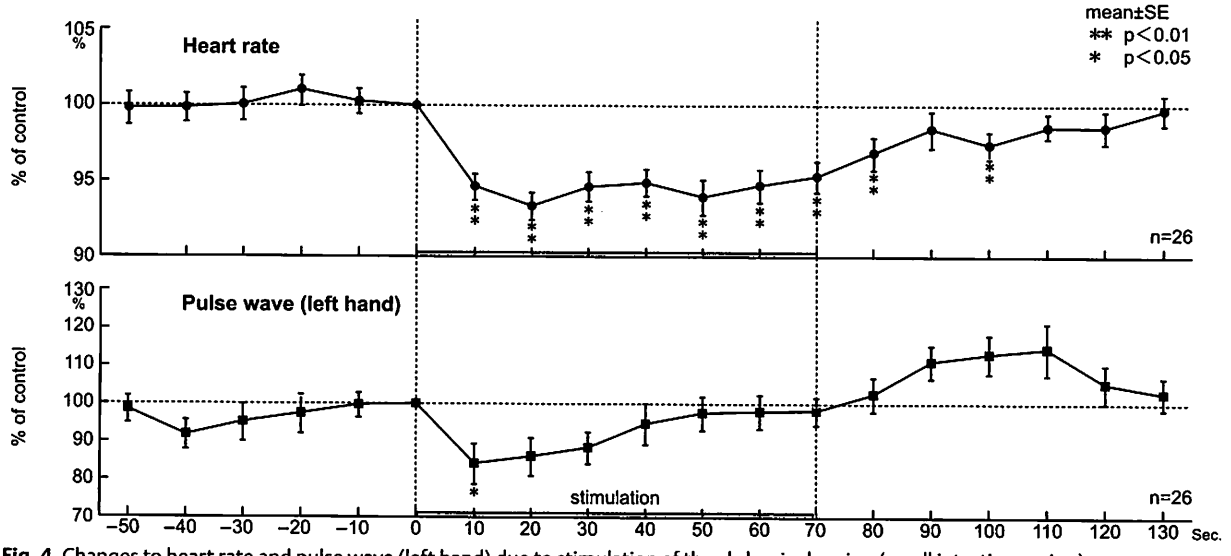

Fig. 4. Changes to heart rate and pulse wave (left hand) due to stimulation of the abdominal region (small intestine region)

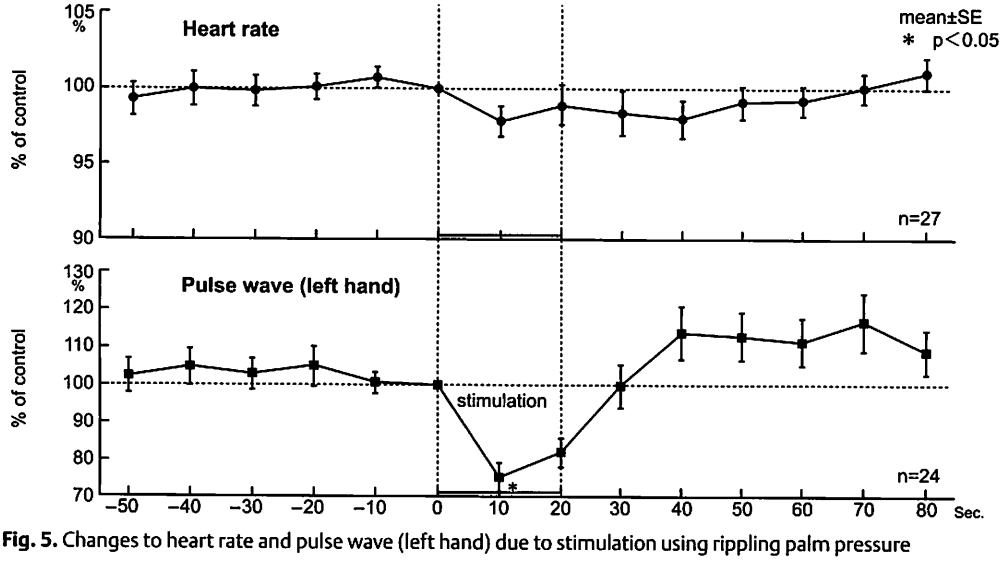

Fig. 5. Changes to heart rate and pulse wave (left hand) due to stimulation using rippling palm pressure

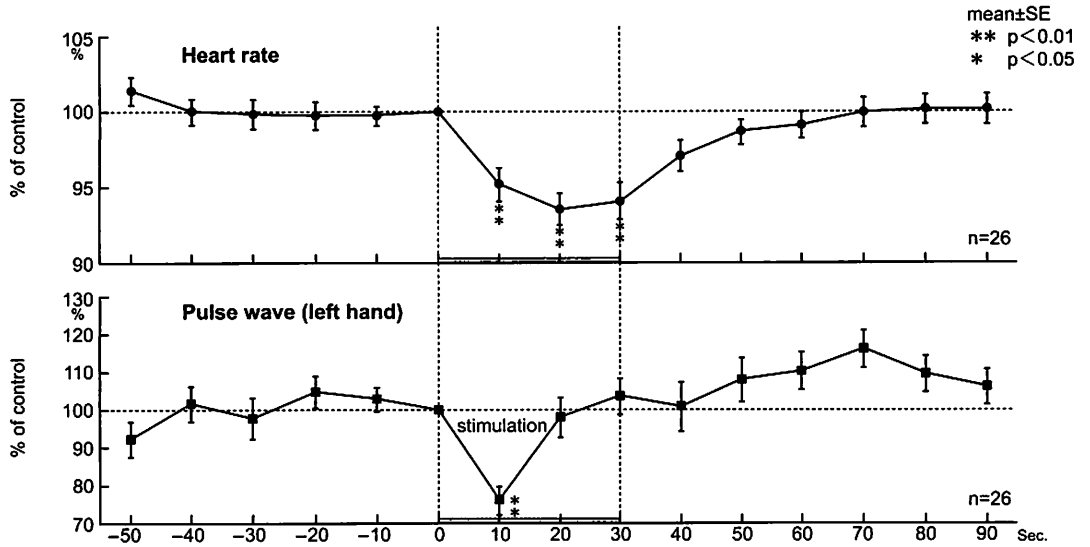

Fig. 6. Changes to heart rate and pulse wave (left hand) due to stimulation of Point 1 of the left anterior cervical region

IV. Discussion

The test results confirm a significant reduction in heart rate due to shiatsu stimulation using standard pressure. Changes to heart rate due to somatosensory stimulation have been reported by many researchers. Sato et al (1976) and Kimura et al (1995) have reported an increase in heart rate in anesthetized rats due to nociceptive mechanical stimulation of the skin[4,5]. Nishijo et al (1979) reported an increase in heart rate in healthy adults when subjected to heat pain stimulation using an algesimeter[6]. The shiatsu stimulation tested here involved standard pressure not accompanied by pain sensations in the test subjects, and showed that the effect of shiatsu stimulation on heart rate is clearly different from that of nociceptive stimulation.

This heart rate reduction response due to shiatsu stimulation using standard pressure was confirmed through stimulation of regions corresponding to a variety of spinal segments, including Point 1 of the lateral crural region, supplied by the L_5 segment; the median line of the head, supplied by the trigeminal nerve; the abdominal region (small intestine region), supplied by the T_{10-12} segments, and Point 1 of the anterior cervical region, supplied by the C_3 segment. Kimura et al (1995) reported that, in rats with the central nervous system intact, nociceptive mechanical stimulation throughout the body produced a universal response of increased heart rate[5]. Although the direction of the heart rate response differs between nociceptive mechanical stimulation and shiatsu stimulation, it is highly probable that the heart rate reduction response due to shiatsu stimulation is also universal.

Also, because suction pressure (rippling palm pressure) to the abdomen produced a different heart rate response to that of standard pressure applied using gradual increase and decrease of pressure, there is a possibility that somatic responses vary depending on the shiatsu technique applied. Further study is required into effects of different techniques and amounts of pressure.

Heart rate is known to be regulated by the beta-mediated sympathetic nervous system and the parasympathetic nervous system. While it would be difficult to determine the efferent mechanism of the heart rate reduction response due to shiatsu stimulation based on the findings shown here, it is likely due either to suppression of the beta-mediated sympathetic nervous system, the stimulation of the parasympathetic nervous system, or a combination of the two. Further basic research is required.

Pulse wave was also significantly reduced immediately after stimulation of all regions. This response is probably due to stimulation of the alpha-mediated sympathetic nervous system.

It is our hope that these research results will form a basis for clarifying the effect of shiatsu stimulation on blood pressure and other cardiovascular system functions.

V. Conclusions

Study of the effects of shiatsu stimulation on the cardiovascular systems of healthy adult test subjects yielded the following results:

1. Heart rate was significantly reduced during stimulation of Point 1 of the left lateral crural region, the median line of the head, the abdominal region (small intestine region), and Point 1 of the left anterior cervical region.

2. Pulse wave was significantly reduced immediately after commencement of stimulation of Point 1 of the left lateral crural region, the median line of the head, the abdominal region (small intestine region), rippling palm pressure to the abdomen, and Point 1 of the left anterior cervical region.

Based on the above findings, it is apparent that shiatsu stimulation results in a heart rate reduction response and transitory pulse wave reduction response.

In closing, we would like to express our appreciation to the students of the Japan Shiatsu College who participated in this research. This research was carried out as a dying wish of Toru Namikoshi, former Principal of the college.

References

1 Sato A, Sato Y, Schmidt RF: The impact of somatosensory input on autonomic functions. Reviews of Physiology Biochemistry and Pharmacology 130: 1-328, 1997
2 Sato A, Goto M, Sato Y: Jiritsu kino no chosetsu. Shinkeiseishinyakuri 12 (5): 273-302, 1990 (in Japanese)
3 Namikoshi T: Kanzen zukai shiatsu ryoho fukyuban, Japan Publications, Inc., Tokyo, 1992 (in Japanese)
4 Sato A, Sato Y, Shimada F, Torigata Y: Varying changes in heart rate produced by nociceptive stimulation of skin in rats at different temperatures. Brain Research 110 (2): 301-311, 1976
5 Kimura A, Ohsawa H, Sato A, Sato Y: Somatocardiovascular reflexes in anesthetized rats with the central nervous system intact or acutely spinalized at the cervical level. Neuroscience Research 22 (3): 297-305, 1995
6 Nishijo K , Mori H et al: Jintai ni okeru taisei-shinzohansha. Riryou no Kagaku 7: 10-15, 1979 (in Japanese)