5. PHYSICAL FINTNESS OF A JUDOIST FROM THE VIEWPOINT OF CARDIOVASCULAR FUNCTION

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Studies on the physical fitness of Judoists mainly from the anthropometric standpoint were already made prior to World War II. However, these consisted mainly of comparative studies of Judoists and non-trainees at rest, and physiologic investigations of Judoists in action were very few. Since the termination of the war, the scientific method of training has been much advocated, especially by the Association for the Scientific Studies in Judo, and physiologic studies regarding the Shime-waza[3] (choking technique), the Kansetsu-waza[4] (joint lock or dislocation technique), and Nage-waza[5] (throwing technique) have already been reported.

Furthermore, the adoption of Judo as an official event in the 1964 Olympic Games has prompted those concerned to emerge from the old method of training based on experience and perception to the new scientific method, and as a result, measurements of physical fitness of Judoists have been made[7] in order to rationalize training and thus efficiently increase the physical fitness of Judoists.

The weight system has been adopted in Judo contests in order to obviate the unfairness arising from differences in body weight, and the energetic performances by the heavy weight Judoists of the foreign teams were a great impetus in arousing interest in the problem of stamina, which was found to be somewhat lacking in Japanese Judoists. The Committee for Research in Sports Medicine was quick to perceive this and are investigating on the appropriateness of the all-out endurance running time on a treadmill as the criterion for measuring stamina[12].

The Association for Scientific Studies in Judo of the Kodokan has also taken an interest in the problem of stamina, and the present author has been conducting studies in stamina from the standpoint of cardiac function by means of Roentgen cinefluorography. The Roentgenographic method of study on the heart was also used by Sasa and associates[13] in their investigation of Shime-waza. In the present Roentgenographic study, serial changes in the cardiac shadow were observed while the experimental subject cycled at full force on a bicycle ergometer, which requires a great amount of stamina. Masuda has already reported on a similar study in which middle distance running athletes were used as experimental subjects, however, similar studies on Judoists have not yet been made.

In the present paper, physical fitness of Judoists will be discussed from the viewpoint of cardiac function. An elucidation of cardiac function from data obtained by Roentgen cinefluorography and proposals regarding cultivation of stamina based on these data, will be made in a later report[11].

METHOD OF INVESTIGATION

In order to investigate the physical fitness of Judoists from the viewpoint of cardiovascular function, a fixed load was inposed on the experimental subjects, and observations were made on the resulting physiologic changes.

1. Condition of load

(1) Load at rest.

Observation on the cardiovascular function at rest was made. Also, physiologic changes accompanying changes in posture were studied. Postural change was accomplished by the generally used postural blood pressure reflex and by the Taiken type revolving apparatus. The Taiken type revolving apparatus changes posture of the entire body by revolving around either the axis at the head level or at the hip level.

(2) Exercise load.

The treadmill and the bicycle ergometer were used for performing the required physical exercise. The inclination of the treadmill was 8.6%, and runs in three different speeds were performed: 200 m./min., 220 m./min., and 240 m./min. These running conditions were selected so that the experimental subject would reach "all-out" in approximately 4 minutes. In the bicycle ergometer exercise, the experimental subjects were made to pedal at full force until exhaustion, and his endurance time was measured together with observations on his cardiac function, results of which will be discussed in a later report.

2. Items of Measurement

(1) Measurement of arterial blood pressure.

Blood pressure of the brachial artery was measured by the Corson apparatus or by the Riva-Rocci manometer.

Blood pressure at rest was measured in a sitting position, and several measurements were made every one minute until a stable value was obtained. Blood pressure was also measured at one minute intervals, during and after exercise, and in most cases measurements were made for 30 minutes during the recovery period.

The rates of increase in systolic pressure and pulse pressure were studied in order to observe the course of the changes in blood pressure, by computing the percentage changes relative to the values at rest (0%) of systolic pressure and pulse pressure.

(2) Measurement of heart rate.

ECG was taken by sternal lead, simultaneously with blood pressure measurements, before, during and after exercsie, and measurements of the R spike during the entire course of exercise were made. Studies on the pattern of the ECG was limited to observation only.

The rate of increase in heart rate was also studied in order to observe the course of the changes in pulse rate by computing the percentage changes relative to the value at rest (0%).

(3) Other measurements of circulatory function.

The following observations were made at rest: Roentgenography of the heart (postero-anterior, right anterior oblique and left anterior oblique positions), ECG, pulse wave, blood count, circulatory function test (Harvard step-test, kneeing movement exercise), and eletrolytes in the urine.

Fundamental physical fitness measurements were made parallec to these observations.

3. Material (Experimental Subject)

As the experimental subject, a Judoist (university student) with 5 years of Judo experience was chosen. Although at the time of the experiment he was a II-dan holder he was said to be actually on the level with a III-dan holder, and much hope is laid on him as a future light weight Judo champion.

A healthy adult male of about the same age was selected as the control. Medical examination revealed no abnormalities in the circulatory system nor in other organs.

In the present investigation, various changes in the circulatory system accompanying the recovery process were mainly observed.

Table 1. Results of Physical Fitness Tests

		Judoist H. S.	Non-trainee H. E.
Sex		male	male
Age	(years)	19	24
Body height	(cm)	165.0	163.5
Body weight	(kg)	67.7	51.6
Finger stretch	(cm)	163.6	168.5
Trochanter height	(cm)	93.7	91.7
Tibiale height	(cm)	40.8	41.5
Foot length	(cm)	23.8	23.6
Chest girth (Normal)	(cm)	95.1	81.4
〃 (Maximum)	(cm)	96.5	82.7
〃 (Minimum)	(cm)	94.5	79.7
Hip girth	(cm)	90.1	80.6
Girth of upperarm (Stretched) (R)	(cm)	30.2	23.4
〃 (〃) (L)	(cm)	30.8	23.3
〃 (Flexed) (R)	(cm)	35.0	25.5
〃 (〃) (L)	(cm)	35.5	25.0
Girth of forearm (R)	(cm)	29.4	23.6
〃 (L)	(cm)	29.4	23.0
Girth of wrist (R)	(cm)	17.3	15.4
〃 (L)	(cm)	17.5	15.2
Girth of thigh (R)	(cm)	55.8	48.2
〃 (L)	(cm)	55.6	47.8
Girth of calf (R)	(cm)	38.6	35.9
〃 (L)	(cm)	37.6	35.4
Girth of ankle (R)	(cm)	21.1	19.9
〃 (L)	(cm)	21.1	19.6
Breadth of wrist	(cm)	5.74	5.45
Breadth of ankle	(cm)	7.31	7.02
Skinfold thickness of upperarm	(mm)	4.2	4.8
〃 of abdomen	(mm)	5.3	5.6
〃 of thigh	(mm)	6.5	5.7
Rohrer's Index		150.7	118.1
Relative body weight		41.0	31.6
Relative chest girth		57.6	49.8
Relative trochanter height		56.8	56.1
Oppenheimer's Index		17.4	11.6
Vital capacity	(cc)	4640	4040
Breath-holding time (Rest)	(sec)	70	36
〃 (After Exercise)	(sec)	33	13
Harvard step test		104.9	93.8
Grip strength (R)	(kg)	57.0	50.0
〃 (L)	(kg)	58.5	44.0
Back strength	(kg)	150.0	145.0
Strength of arm flexion (R)	(kg)	25.5	35.0
〃 (L)	(kg)	27.0	29.0
Strength of leg extension (R)	(kg)	45.0	63.0
〃 (L)	(kg)	44.0	64.0
Strength of index finger flexion (R)	(kg)	20.0	23.5
〃 (L)	(kg)	21.5	19.5
Strength of middle finger flexion (R)	(kg)	20.0	28.9
〃 (L)	(kg)	27.5	26.7
Strength of ring finger flexion (R)	(kg)	17.0	27.0
〃 (L)	(kg)	25.0	25.2
Strength of little finger flexion (R)	(kg)	10.0	18.5
〃 (L)	(kg)	15.5	23.3
Trunk flexibility	(cm)	+14.9	+16.4
Side step test (10sec)		19	23
Burpee test (10sec)		8 2/4	5 2/4
Vertical jump	(cm)	60.5	53.4
Work of vertical jump	(kg·m)	40.96	27.55
Initial speed of vertical jump	(m/sec)	3.44	3.24
Standing broad jump	(cm)	250	236

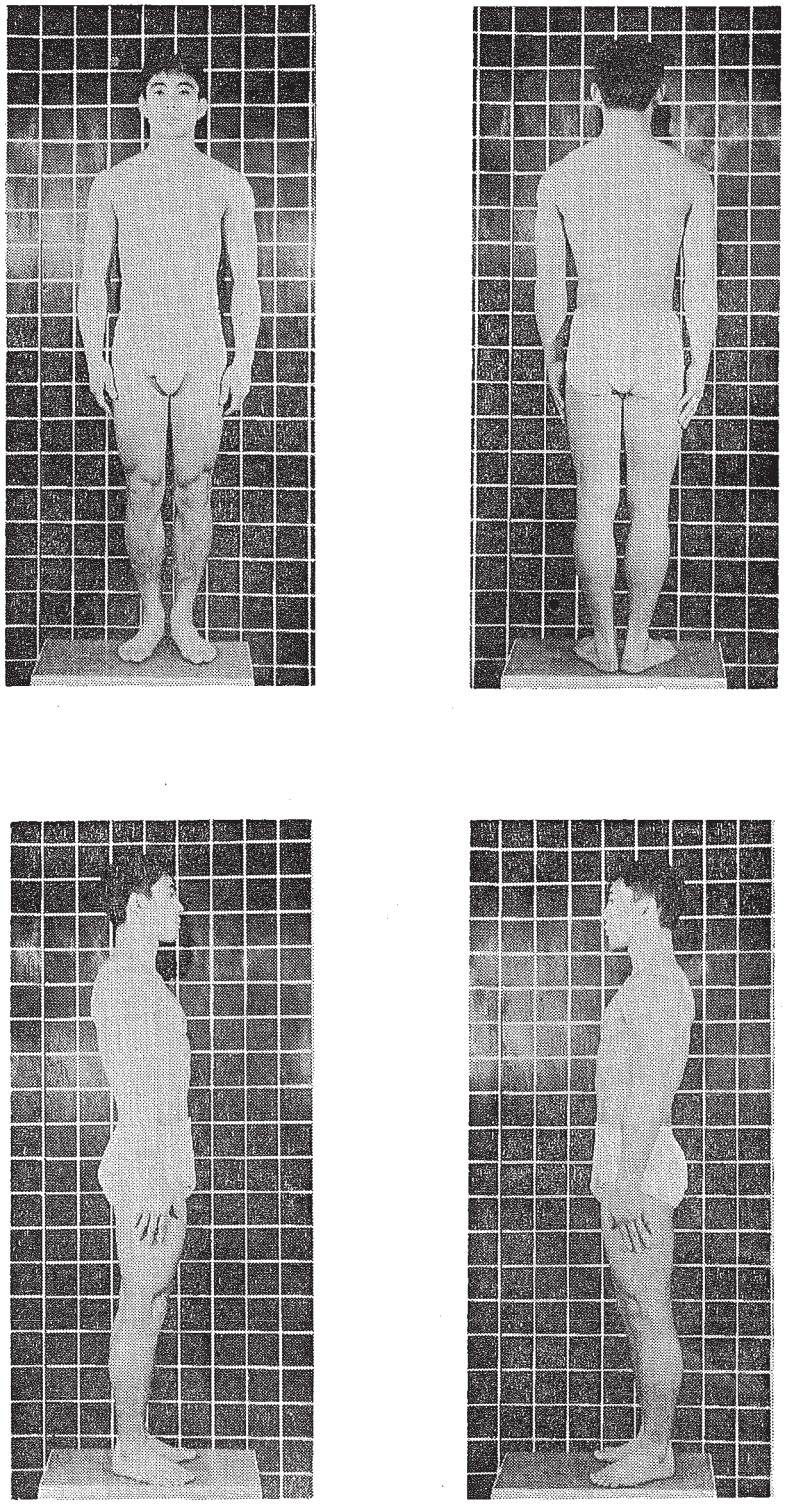


Fig. 1 Body type of Judoist of light weight class

Table 2. Resting Values of Circulo-Respiratory Functions

		Judoist	Non-trainee
		H. S.	H. E.
Sex		male	male
Age		19	24
Respiration rate	(f/min)	15	17
Ventilation	(l/min)	—	8.96
Vital capacity	(cc)	4640	4040
Breath-holding time			
Resting state	(sec)	70	36
After exercise	(sec)	33	13
Oxygen consumption	(l/min)	—	0.16
Respiratory Quotient	(O_2/CO_2)	—	0.99
Basal metabolism	(Cal/day)	1559	1363
Heart rate	(beat/min)	64	66
Harvard step test		104.9	93.8
Cardio-vascular test by kneeing movement exercise			
Rate of increase		1.56	1.59
Rate of recovery		8.81	10.18
Blood pressure			
Systolic pressure	(mm Hg)	140	118
Diastolic prassure	(mm Hg)	60	70
Pulse pressure	(mm Hg)	80	48
Postural blood pressure reflex			
Recovery time	(min)	3	2
Blood			
Erythrocytes	($\times 60^6$)	4.40	5.01
Leukocytes		8300	4900
Haemoglobin	(%)	94	84
Cardiac silhouette			
AR+AL	(cm)	4.84	4.50
MR+ML	(cm)	14.46	10.91
MR	(cm)	5.99	3.12
ML	(cm)	8.47	7.79
L	(cm)	15.67	12.26
UQ+OQ	(cm)	12.13	10.30
Area	(cm^2)	152.6	107.0
Electrocardiogram			
R-R	(sec)	0.98	0.95
P-Q	(sec)	0.17	0.19
Q-T	(sec)	0.38	0.38
QRS	(sec)	0.08	0.08
P wave in V_3	(mV)	0.18	0.14
T wave in V_3	(mV)	0.97	0.90
Pulse wave of ear			
I wave	(mV)	1.2	—
II wave	(mV)	1.0	—
Urine			
Urinary volume	(cc/hour)	78	50
Na/K		3.18	3.60
Cl/Na		1.77	1.74
Ca/Creatinine		—	0.17
pH		6.20	5.82
Ca	(mg/hour)	—	10.3
Na	(mg/hour)	493	288
K	(mg/hour)	155	80
Cl	(mg/hour)	872	494
Creatinine	(mg/hour)	—	60.0

RESULT

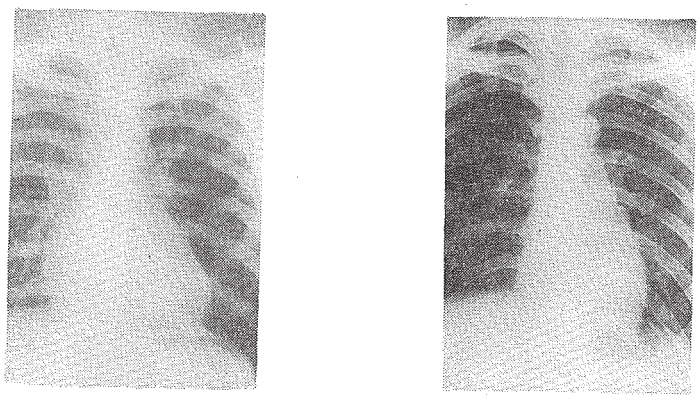
1) Basic physical fitness

Measurements of physique and basic physical fitness of the Judoist together with identical measurements made on the non-tainee control are shown in Table 1. The body height of the Judoist and that of the non-trainee were approximately identical, however, the Judoist excelled in breadth and girth measurements, consequently, the Rohrer's Index of the Judoist (150.7) was considerably higher than that of the non-trainee (118.1). The skin fold thickness of both subjects were somewhat identical, however, Oppenheimer's Index which indicates nutritional condition was higher in the Judoist (17.4) than in the non-trainee (11.6). The body type photographs of the Judoist are shown in Fig. 1.

The Judoist was not necessarily superior to the non-trainee in muscle strength and agility, however, in integrated motor performance, such as, work done in vertical jump, the Judoist was manifestly superior to the non-trainee.

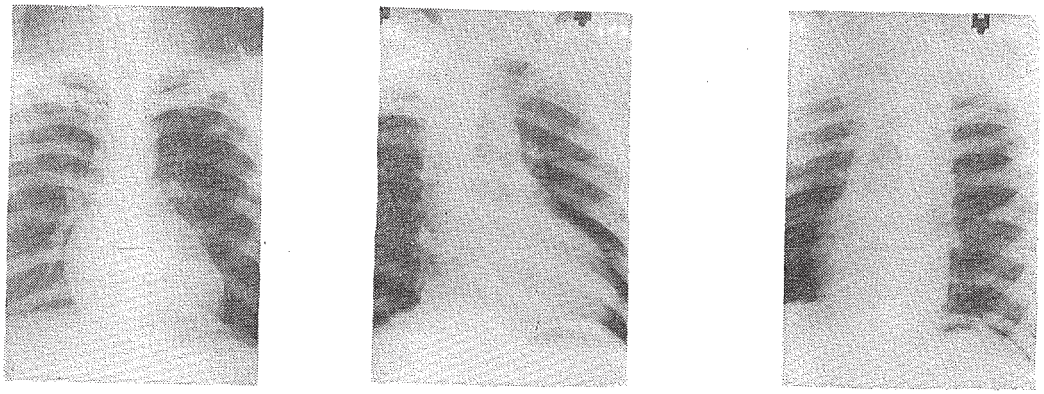
2) Circulatory and respiratory functions at rest

Measurements of the circulatory and respiratory functions of the Judoist were made, results of which are shown together with those of the non-trainee in Table 2.



Judoist Non-trainee

Fig. 2 X ray photo of a Judoist in comparison with a Non-trainee



Posterior-Antrior View Right-Anterior Oblique Position Left-Anterior Oblique Position

Fig. 3 X ray photo of a Judoist taken in various directions

The most noteworthy characteristic of the Judoist was the Roentgenographic shadow of his heart which demonstrated a typical sport heart (Fig. 2), and was in striking contrast to the cardiac shadow of the non-trainee which was rather long and narrow. The transverse diameter of the cardiac shadow of the non-trainee was 10.91 cm. and that of the Judoist was 14.46 cm. indicating a great difference between the two. The longer axis was 12.26 cm. in the non-trainee and 15.67 cm. in the Judoist, also showing a considerable difference. The area of the cardiac shadow of the non-trainee was 107.0 cm^2, whereas, that of the Judoist was 43% larger, i.e., 152.6 cm^2. Fig. 3 illustrates the cardiac shadows of the Judoist taken in the postero-anterior, right anterior oblique, and left anterior oblique positions.

Other measurements in which the Judoist excelled were the breath holding time (at rest and during exercise), and the Harvard step test. These tests disclose the co-ordinated adaptability of the body when it is exposed to physical stress, and it is characteristic of the Judoist to demonstrate superior results in these integrated appraisals, even though no significant differences are found, when compared to the non-trainee, in the results of other circulatory and respiratory function tests.

3) Change in circulatory function during postural change.

Various changes in posture were made at rest, and the resulting changes in arterial blood pressure were recorded (Fig. 4). The postural blood pressure reflex of the Judoist, both the transient drop in systolic pressure and the recovery time, compared very favorably with the excellent results obtained in the average adult[9]. When posture was altered from recumbency to a standing position by the Taiken type revolving apparatus, a drop in systolic pressure was invariably observed, regardless of whether the axis was placed at the heart level or at the hip level. A return to the resting blood pressure level was observed following this drop, and the recovery curve described was somewhat identical to that of the postural blood pressure reflex. When body posture was changed from a standing position to recumbency, systolic pressure was elevated by 4–8 mm. Hg, after which it recovered its level at rest.

The behaviour of the diastolic pressure accompanying postural change by the revolving apparatus method was different from that accompanying the conventional postural blood pressure reflex method. In the postural blood pressure reflex, changes of the diastolic pressure occur parallel to changes of the sytolic pressure, however, in the revolving apparatus method, changes of the diastolic pressure run counter to changes of the systolic pressure, i.e., when posture was changed from the recumbent position to the standing position, a rise in diastolic pressure was observed, and when posture was changed from the standing position to the recumbent position, a drop in diastolic pressure was observed. The increase in pulse pressure caused by changing posture from a standing position to a recumbent position, and the decrease caused by changing posture from a recumbent position to a standing postion are attributed, according to Masuda, to changes in peripheral resistance.

4) Changes in circulatory function during treadmill run.

The heart rate of the Judoist while performing a treadmill run at speeds of 200 m./min., 220 m./min., and 240 m./min. were measured (Fig. 5). The 4 minute run at the rate of 200 m./min. was a submaximal exercise, however, at the rate of 220 m./min. it was a maximal exercise, and the Judoist was all-out in 4 minutes. The 240 m./min. run was also a maximal exercise, however, the Judoist was all-out in 2 minutes 30 seconds, and discontinued exercise before the circulatory and respiratory functions could be fully mobilized[14].

The heart rate in the 200 m./min. run exceeded 170, 1 minute after starting the run, after which it gradually increased and reached 188 in 4 minutes. An all-out condition was not reached in this exercise, however, it is inferred from changes in heart rate that the exercise was considerably strenuous. The heart rate in the 220 m./min. run had already exceeded 170 at 1 minute following initiation of exercise and continued to increase thereafter, and after 3 minutes reached 196 and when he was all-out in 4 minutes his heart rate registered 204. In this exercise, the efficiency of the recovery process

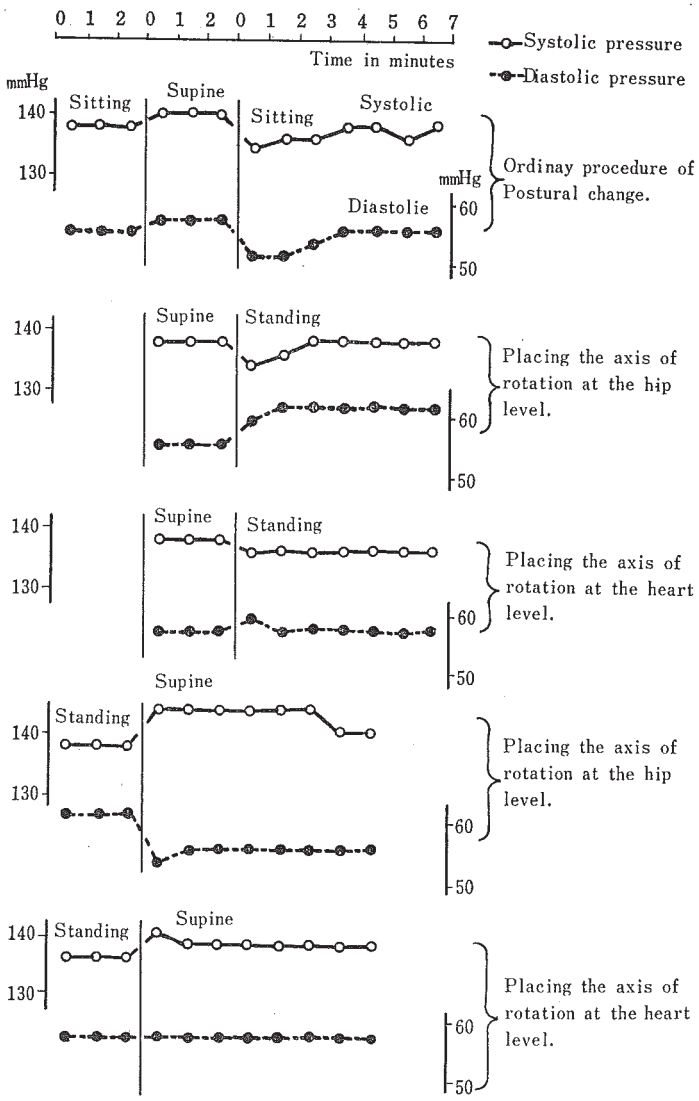


Fig. 4 Effect of postural change upon blood pressure.

was the lowest, and it may be inferred that the load on the circulatory system was very large. Since the exercise load was increased in the 240 m./min. run, it was expected that the speed of increase in heart rate would also increase, however, as seen in Fig. 5, the heart rate barely exceeded 170 at 1 minute following initiation of exercise, and thereafter, increased at approximately the same pace as that in the 200 m./min. run, and the all-out condition was reached when the heart rate registered 180 at 2 minutes 30 seconds. Judging from the comparatively low maximum heart rate (180 in this exercise, 204 in the maximal exercise of 220 m./min., and 188 in the submaximal exercise of 200 m./min.) and the comparative rapidity of recovery, the all-out in this exercise is thought to be caused by factors other than exhaustion of the circulatory system, for example, the failure of the leg muscles.

Figs. 6–7 illustrate comparisons of changes in circulatory function, between the Judoist and the non-trainee. The rate of increase in systolic pressure and also its recovery course are illustrated in

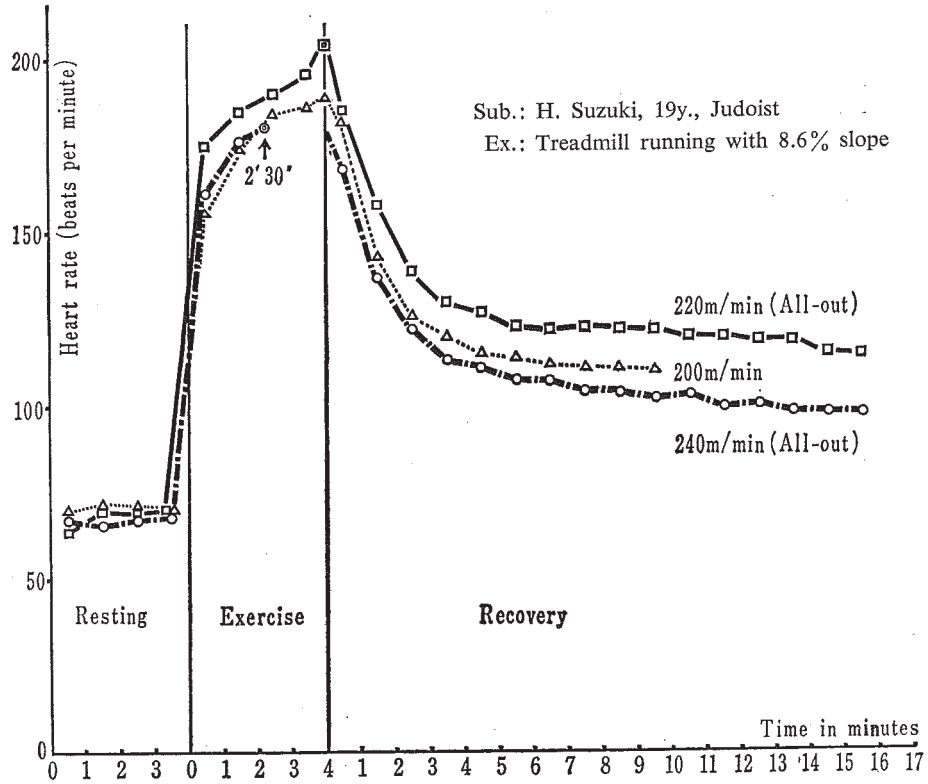


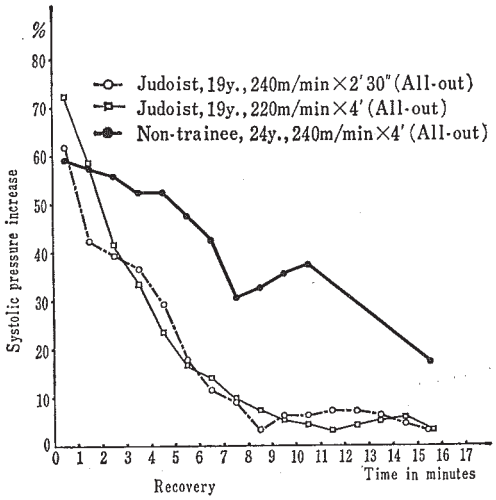
Fig. 5. Changes of heart rate according to the various speeds of treadmill running.

Fig. 6. In the Judoist a rate of increase of over 70% was seen immediately after exercise, however, in 3 minutes lowered to 40% and in 7 minutes it was reduced to less than 10%, indicating that he had already nearly recovered. In contrast to this, in the non-trainee, although the rate of increase was 60%, it was still above the 50% level after 4 minutes, after 10 minutes it was still above the 30% level, and after 15 minutes it barely went below the 20% level, demonstrating a slow course of recovery.

The rate of increase in pulse pressure and its recovery course are illustrated in Fig. 7. In both the Judoist and the non-trainee, the rates of increase were around the 200% level, and after 3 minutes, lowered to around the 100% level in both subjects, and after 10 minutes went below the 50% level in both subjects, disclosing no significant differences between the Judoist and the non-strainee regarding the rate of increase in pulse pressure and its recovery course.

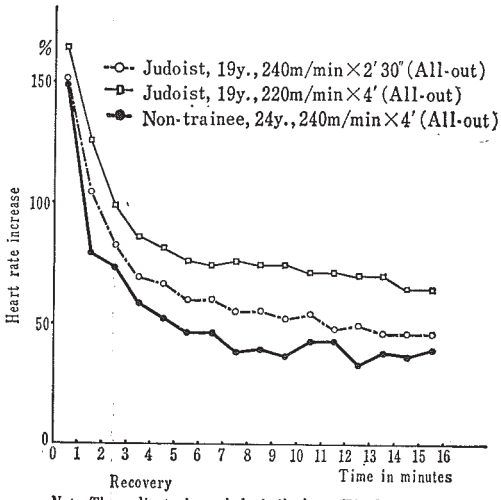
The rate of increase in heart rate and its recovery course are illustrated in Fig. 8. The rate of increase in both the Judoist and the non-trainee were around 150%, immediately after exercise. In 2 minutes, the rates were somewhat below 100% in both, and in 5 minutes were around the 50–75% level in both, also disclosing no significant defference in the serial changes of the rates of increase in the heart rate of both experimental subjects.

If it were possible to determine the efficiency of the recovery process by considering an index which would give an idea of the cardiac output per minute, it would be possible to obtain a better insight into the serial changes in the circulatory function. From this standpoint, heart rate×pulse pressure was calculated in terms of percentage of the value at rest and the result is graphically il-



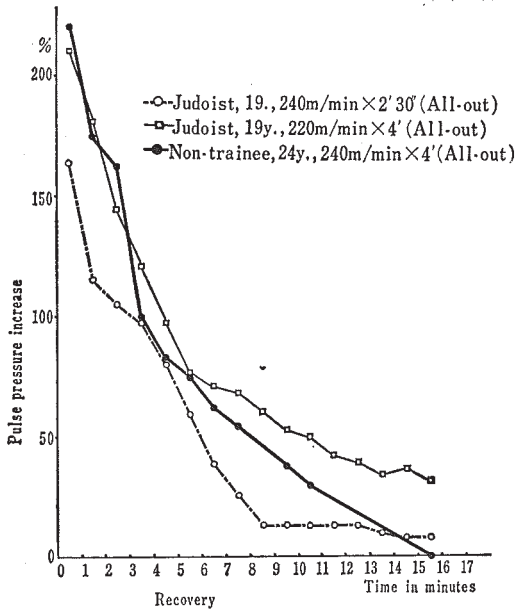
Note: The ordinate is scaled by the percentage of resting value and zero corresponds to the resting level.

Fig. 6 Recovery of systolic pressure after all-out running.



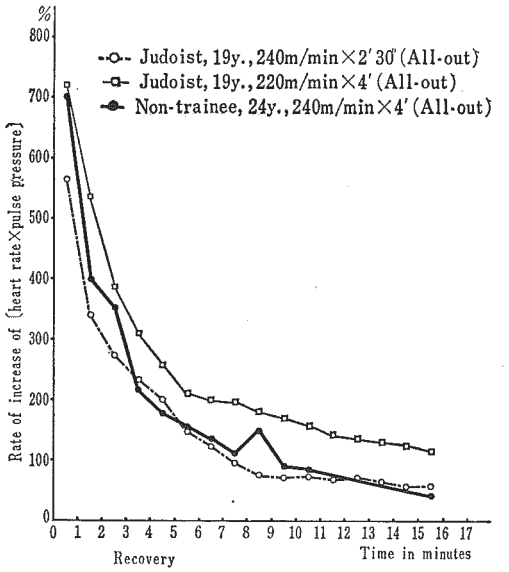
Note: The ordinate is scaled similarly to Fig.6.

Fig. 8 Recovery of heart rate all-out running.



Note: The ordinate is scaled similarly to Fig.6.

Fig. 7 Recovery of pressure after all-out running



Note: The ordinate is scaled similarly to Fig.6.

Fig. 9 Recovery in (heart rate×pulse pressure) after all-out running.

lustrated in Fig. 9. Immediately after exercise both the Judoist and the non-trainee were in the 700% level, in 3 minutes they were in the 300% level showing a rapid decrease, and in 6 minutes they were in the 200% level, showing a gradual decrease. Also, judging from the serial changes of this index, no significant difference between the Judoist and the non-trainee was noted.

DISCUSSION

The word "stamina" as applied to Judo is difficult to define. For instance, considering in its simplest form, the significance of the word "stamina" as applied to long distance running differs from that as applied to short distance running. In the former, "stamina" implies the endurance capacity of the circulatory and respiratory systems, whereas in the latter, it implies the outburst of energy with regard to muscle strength and speed. It is difficult to consider "stamina" in Judo in any specific form, for instance, from the standpoint of the duration time of a Judo performance, what is required of "stamina" is the endurance capacity of the circulatory and respiratory systems, whereas, from the standpoint of the execution of the Judo techniques, it is the outburst of energy with regard to muscle strength and speed.

In the present study stamina was considered to be a function of endurance time, and since endurance may be investigated by an analysis of the circulatory function, an approach to the problem of stamina was made from the viewpoint of circulatory function.

Cureton[2] defines the capacity of endurance as the endurance time of work possible under a load of a fixed intensity, and measured the endurance time of a treadmill run. Sasa[12] and Ikai[6] used the treadmill endurance running time as the criterion for studying capacity of endurance. The present authors appraised the endurance capacity by the ability to recover from an all-out condition. In other words, a comparative study was made on the physiologic changes accompanying the recovery course after a treadmill run from the viewpoint of circulatory function. Generally, maximal oxygen uptake is possible when nearly all of the physiologic functions of the circulatory and respiratory systems are mobilized, and according to Shindo[14], it takes approximately 4 minutes to attain this state. The present authors made investigations into the recovery process after a 4 minute treadmill run.

As illustrated in Fig. 4, heart rate increased, simultaneously, with inception of exercise and continued to increase until 4 minutes when the all-out condition was reached. At the moment of all-out, the heart rate in the Judoist was 204 per minute in the 220 m./min. run, and in the 240 m./min. (all-out in 2 minutes 30 seconds) run it was 180. At the moment of all-out in 4 minutes, the heart rate in the non-trainee was 180 in the 240 m./min. run. In another experiment[8] in which a middle distance champion runner was used, the heart rate registered 182 at the moment of all-out in 4 minutes in a 280 m./min. run. From these results, it may be inferred that the runner becomes "all-out" when the heart rate reaches 180–200.

Åstrand and associates[1] also state that the heart rate increases up to a certain limiting level, and that this level is quite unrelated to the intensity of the load or duration of the load.

When considering the capacity of endurance, the change in heart rate is generally used as the parameter in studying circulatory function, however, the change in blood pressure is also an important parameter in the study of circulatory function. Heart rate is closely related to the frequency of pulsation of the heart, whereas, blood pressure is closely related to the quantitative aspect of pulsation of the heart.

In the present study, the capacity of endurance, which is related to stamina was investigated from the viewpoint of the recovery process. Figs. 6–9 illustrate serial changes in the systolic pressure, pulse pressure, heart rate, and the index relating to heart output (heart rate$\times$pulse pressure) during the course of recovery, in terms of the percentage of the value at rest. As shown in the graphs, a difference was observed between the Judoist and the non-trainee in the recovery course of the systolic pressure (Fig. 6), however, no significant differences were found in the other measurements (Figs. 7–9). No significant difference in the heart rate at all-out was observed between the Judoist and the non-trainee. Also, the systolic blood pressure at all-out in the Judoist registered 248 mm.Hg (220 m./min. run at 4 minutes) and 220 mm.Hg (240 m./min. run at 2 minutes 30 seconds), and in the non-trainee it was 214 mm.Hg (240 m./min. raun at 4 minutes), and in another experiment in which a middle distance

champion runner was used, it was 240 mm.Hg (280 m./min. run at 4 minutes) disclosing that the systolic blood pressure at all-out was of approximately the same level in all these athletes.

The foregoing results of the investigation centering on the circulatory function during the recovery course disclosed that there was no essential difference in the capacity of physiologic adaptability to muscular activity, between the Judoist and the non-trainee. Furthermore, measurements of circulatory function at rest, also, disclosed no significant difference between the two experimental subjects. The only essential difference observed between the Judoist and the non-trainee in this experiment was the presence of sport heart in the Judoist. The significance of the sport heart is primarily an increase in the intra-cardiac blood reserve volume, which means an increase in the adaptability of the circulatory system to strenuous muscular activity. Consequently, it is presumed that the Judoist has a higher adaptability of the circulatory function in moments of great physical stress.

In considering the foregoing results, the question of why there was very little difference between the Judoist and the non-trainee arises. It may be gathered that importance has been laid only on the technical aspect in the training of light weight Judoist, and it is now keenly felt that a complete revision of the training method with more importance on the development of physical fitness be made.

CONCLUSION

In order to investigate the physical fitness of a Judoist from the viewpoint of the circulatory function, a study of the physiologic characteristics centering on an analysis of the cardiovascular response was made by the postural change and the treadmill method.

A light weight Judoist with a 5 year experience was selected as the experimental subject, and a healthy adult male of approximately identical physical characteristics was selected as the control.

The results obtained may be summarized as follows:

1) No significant differences were observed between the Judoist and the non-trainee in anthropometric measurements and also in measurements of fundamental physical fitness. However, the Judoist excelled in the integrated motor performance, such as the vertical jump.

2) Observations on the circulatory and respiratory functions, at rest, revealed a typical sport heart in the Judoist, and his cardiac shadow was remarkably larger than that of the non-trainee. The Judoist also excelled in the collective evaluation of the step test in which the body is exposed to physical stress.

3) Results of postural change, at rest, revealed that the postural blood pressure reflex of the Judoist corresponded to a typical case with excellent recovery process.

4) The treadmill run was selected as the exericse load. In the Judoist, the increase in heart rate and blood pressure at the time of all-out were 180–200 and 220–240 mm.Hg, respectively, which were comparable to the values obtained in the non-trainee control and in a middle distance running champion. The recovery process of the Judoist revealed an identical course as that of the non-trainee.

5) From the aforementioned results of the experiment, surprisingly enough, no significant difference was found, basically, between the Judoist and the non-trainee, in physical fitness. Consequently, although the importance of the technical aspect in Judo training has been well recognized, a re-appraisal of the training method is keenly felt, and it is suggested that more importance be laid on the improvement of physical fitness.

A summary of this report was read at the 17th Convention of the Japanese Society of Physical Education.

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