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Influence of Native Place on Forearm Blood Flow at Rest and During Exercise in Dry and Humid Heat

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The purpose of this study was to determine whether peripheral circulation in man varies according to the native country or region of the subject.

METHODS

Eight healthy male volunteers participated in this study. Their physical characteristics are summarized in Table 1. The subjects were divided into two groups according to their native place.

Group A: This group was made up of four subjects (MM, SS, KS, SO) who were born and grown up in the Kanto district or in the Tohoku district. All of them had been living in Chiba prefecture for at least three and a half years.

Group B: This group was made up of four subjects (NY, HS, YM, SR). Subjects NY, HS and YM were born and grown up in the southern part of Kyushu. Subject SR was a Formosan and was born and grown up in that country. Three of the subjects had come to Chiba prefecture a year or less prior to examination. Subject YM had come to Chiba two

Table 1. Physical characteristics of the subjects.

subject	age (yrs)	height (cm)	weight (kg)	BSA (m^2)	D (g/ml)	$\dot{V}o_2max$ (ml/min)	native place
Group A							
MM	23	176.5	75.9	1.875	1.058	3029	Tokyo
SS	22	175.0	55.8	1.626	1.073	3479	Iwate
KS	23	171.5	51.7	1.551	1.080	3574	Tokyo
SO	22	173.5	67.8	1.763	1.061	3255	Tokyo
mean	23	174.1	62.8	1.704	1.068	3334	
SD	0.6	2.14	11.09	0.1440	0.0103	243.5	
Group B							
NY	19	166.0	56.1	1.574	1.076	2963	Kagoshima
HS	19	180.0	69.3	1.824	1.075	3355	Kagoshima
YM	21	178.0	72.3	1.845	1.076	3200	Kumamoto
SR	28	164.0	60.1	1.610	1.057	2760	Formosa
mean	22	172.0	64.5	1.713	1.071	3070	
SD	4.3	8.16	7.61	0.1410	0.0093	261.8	

BSA (body surface area), D (body density), and $\dot{V}o_2max$ (maximum oxygen uptake) were calculated by the prediction equations as previously described (Katsuura *et al.*, 1982).
SD=standard deviation.
Differences between group means were not significant ($P>0.05$) for all items.

and a half years ago.

All experiments were conducted in a climatic chamber at air temperatures and relative air humidities of 25℃—50%, 40℃—25%, and 40℃—75%. The subjects, dressed only in shorts, sat on a bicycle ergometer for 45 min. They then performed two successive exercises at loads of 50W and 100W for 15 min respectively. After exercise they remained sitting for 15 min to recover from the exercise.

Forearm blood flow (FBF) was measured by venous occlusion plethysmography with a mercury-in-rubber circumference gauge (Whitney, 1953). Rectal temperature (T_r) was also measured. Measurements were taken every three minutes throughout the experiment after 30 min of rest.

The experiment was undertaken during fall and winter.

RESULTS AND DISCUSSION

Figure 1 shows mean responses of FBF for groups A and B during the experiments at each of the ambient conditions. Mean values of FBF and T_r for both groups are given in Table 2. Statistical significance between two groups was calculated by means of the t-test.

FBF under hot conditions was found to be much higher than that in cool condition for both groups throughout the experiment. The highest FBF was observed under humid heat condition for both groups. This tendency is consistent with the report of Nadel *et al.* (1979).

In the present study, FBF for group B (native places being the southern part of Kyushu or Formosa) was found to be significantly ($P<0.05$ or 0.01) higher than that for group A (native places being the Kanto or Tohoku districts) under all conditions except during 100-W exercise and a recovery period in cool condition. We also found that T_r for group B was significantly ($P<0.05$ or 0.01) lower than that for group A under all conditions except for one occasion. These facts mean that FBF

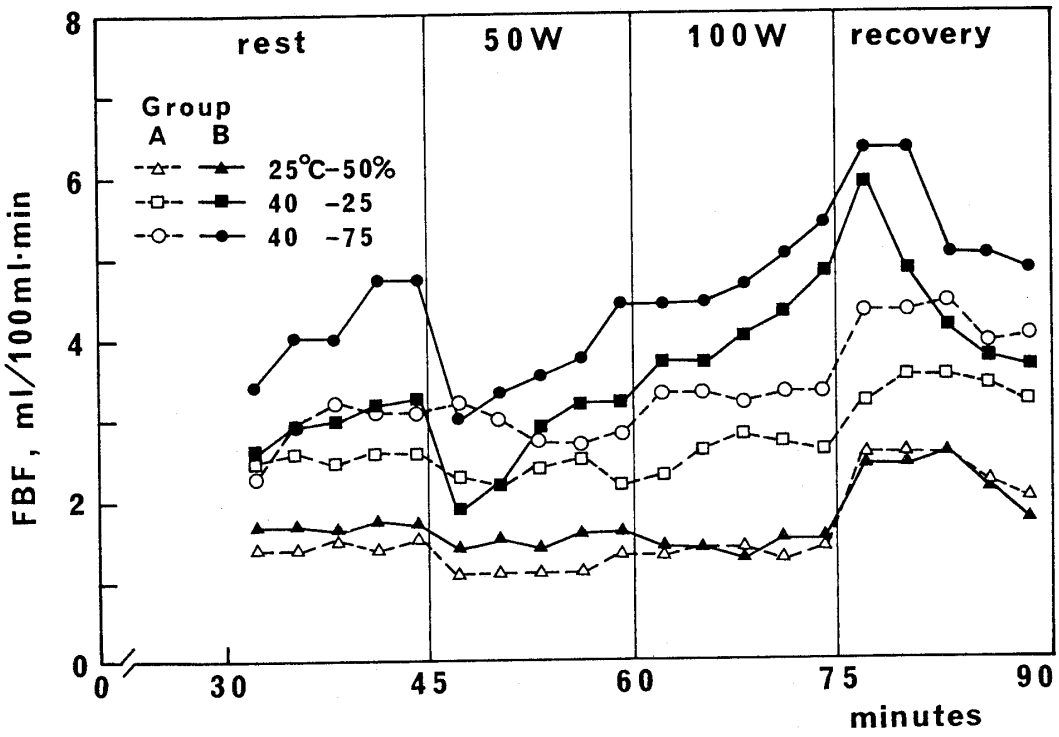

Fig. 1 Mean responses of forearm blood flow (FBF) for groups A and B during the experiments at each of the ambient conditions of 25°C-50%, 40°C-25% and 40° C-75%.

Table 2. Mean values of forearm blood flow (FBF) and rectal temperature (Tr) for both groups at rest, during exercise of 50 W and 100W, and recovery from the exercise at each environment of 25°C-50%, 40°C-25%, and 40°C-75%.

condition (n=20)	FBF (ml/100ml·min)			Tr (°C)		
	group A		group B	group A		group B
25°C-50%						
rest	1.43±0.188	**	1.68±0.208	37.61±0.264	**	37.09±0.140
50W	1.16±0.203	**	1.48±0.198	37.60±0.247	**	37.05±0.156
100W	1.36±0.065		1.43±0.184	37.69±0.240	**	37.20±0.137
recovery	2.40±0.437		2.32±0.564	37.82±0.253	**	37.42±0.133
40°C-25%						
rest	2.55±0.347	*	3.00±0.533	37.63±0.209	**	37.34±0.419
50W	2.32±0.322	*	2.69±0.683	37.67±0.212	*	37.42±0.411
100W	2.60±0.387	**	4.11±1.271	37.84±0.293		37.64±0.364
recovery	3.36±0.487	**	4.41±1.137	38.12±0.331	*	37.89±0.325
40°C-75%						
rest	2.95±0.487	**	4.15±0.805	37.68±0.301	**	37.09±0.193
50W	2.89±0.468	**	3.59±0.697	37.76±0.379	**	37.24±0.283
100W	3.29±0.315	**	4.76±0.900	38.12±0.407	**	37.63±0.270
recovery	4.24±0.724	**	5.18±1.162	38.65±0.432	**	38.24±0.305

Values are means±SD. * $P<0.05$, ** $P<0.01$; refers to probability of difference in values between group A and group B.

for group B at a given internal temperature was much higher than that for group A.

The physical data of the two groups were about the same as shown in Table 1. Therefore, the differences of FBF observed in the two groups may be accounted for by differences in their state of heat acclimatization. Fox *et al.* (1963) found that FBF was higher at a given oral temperature following passive heat acclimatization than before acclimatization. Roberts *et al.* (1977) also reported that heat acclimatization enhanced FBF at a given level of internal temperature.

The present results may indicate that peripheral circulation is varied among populations who have lived in different regions or climates.

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