

## **SWEATING REGULATION DURING EXERCISE WITH ALTERED METABOLIC HEAT PRODUCTION BY COMBINING DIET-INDUCED THERMOGENESIS**

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It was reported that sweat rate depends on the total heat production during exercise rather than body temperatures (Nielsen and Nielsen, 1965). This observation is considered to be one of the bases for the hypothesis which the sweating activity is augmented by the non-thermal factor during exercise. In order to confirm this hypothesis, this study was directed to probe relationships between sweating activity, body temperature, metabolic heat production and workload during exercise with altering metabolic heat production by combining with diet induced thermogenesis (DIT). Experiments were carried out in three conditions on three different days in a climatic chamber set at 30°C with relative humidity of 40%. The five young male volunteers participated in the sequential experiments as follows. In the first experimental day (Condition E), the subjects rested in a sitting position for more than 50 min without food intake and then moved onto a bicycle ergometer placed on a bed balance and exercised at the workload of 50 W for 50 min. In the second experimental day (Condition E+D), the subjects ingested an 800 kcal meal 90 min before commencing with the exercise session at the workload of 50 W. In the third experimental day (Condition E-D), the workload was adjusted so that the metabolic heat production during exercise was offset by the diet by monitoring the oxygen consumption ( $\text{Vo}_2$ ) minute by minute using respiromonitor (AE280, Minato, Japan). The whole body sweat rate was recorded as a rate of body weight loss by using bed balance. Local sweat rate was measured on a flexor area of bilateral forearms according to capacitance hygrometry. The temperatures of esophageal ( $T_{\text{es}}$ ), tympanic ( $T_{\text{ty}}$ ), and skin surface ( $T_{\text{s}}$ : chest, arm, thigh and calf) were continuously recorded by thermistors.  $T_{\text{es}}$ ,  $T_{\text{ty}}$ ,  $\text{Vo}_2$  and HR were greater in Conditions E+D and E-D than in Condition E in the resting period immediately prior to exercise. After the onset of exercise, the degree of the increase in  $\text{Vo}_2$  was greater in Condition E+D than in Condition E. In Condition E-D, the workload decreased on average to 35.8 W. The degree of increase in  $T_{\text{es}}$ ,  $T_{\text{ty}}$  and mean body temperature calculated from  $T_{\text{es}}$  or  $T_{\text{ty}}$  and  $T_{\text{s}}$  from the baseline of the resting period (without DIT) was greater in Condition E+D than in Condition E. On the other hand, the degree of increase in body weight loss and forearm sweat rate in Condition E+D corresponded with those in Condition E. However those sweat rates decreased in Condition E-D as compared with those in the other Conditions. The sweat rate correlated closer to the workload rather than the body temperature or metabolic heat production. These results reinforced the hypothesis that non-thermal mechanism facilitates the sweating activity during exercise.

Nielsen, B. and Nielsen, M. (1965) On the regulation of sweat secretion in exercise. *Acta Physiol Scand.* 64(4):314-22.

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