

## 運動トレーニングが若年女性の熱放散反応に及ぼす影響

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### Effects of Physical Training on Heat Loss Responses in Young Women

by

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#### ABSTRACT

To examine the effects of physical training on heat loss responses of young women in relation to menstrual cycles, 11 physically trained ( T group ) and 13 untrained ( U group ) women were exposed to passive heating [ by placing the lower legs and feet in a 42 °C water bath for 60 min while sitting in a warm ( 30 °C, 45%RH ) chamber ] in their mid-follicular and mid-luteal phases. Female hormones on the experimental day increased from the mid-follicular to mid-luteal phase in the T and U groups, but the magnitude of increase was significantly lower in the T group. During the passive heating, rectal (  $T_{re}$  ) and mean skin temperatures were significantly lower in the T group than in the U group regardless of the menstrual phase. Although  $T_{re}$  and mean body (  $T_b$  ) temperatures before and during the heating increased from the mid-follicular to the mid-luteal phase in

the U groups, the tendency was not observed in the T group. Therefore the group differences of  $T_{re}$  and  $T_b$  were more remarkable in the mid-luteal phase. The increase of skin blood flow measured by laser-Doppler flowmetry (%LDF) did not differ between the groups regardless of body site and menstrual phase. Local sweating rate ( $m_{sw}$ ) was significantly greater in the T group than in the U group on chest, back and forearm (but not on forehead and thigh) in the both menstrual phases, but no menstrual phase-related differences were observed in either group. Analysis of the relationship of the frequency of sweat expulsion ( $F_{sw}$ ) -  $T_b$ ,  $m_{sw}$  -  $F_{sw}$  or %LDF -  $T_b$  suggested that in women physical training improves sweating and vasodilation functions, and central and peripheral mechanisms in the sweating function and central rather than peripheral mechanism in the vasodilation function. The improvement of the central mechanism in the both functions by physical training was more marked in the mid-luteal than the mid-follicular phase (due to the marked group difference of the female hormones in the mid-luteal phase). The improvement of peripheral mechanisms was greater in the sweating rather than the vasodilation function, and its magnitude differed with body site.

## 要 旨

本研究では、運動鍛錬者11名(T群)と同非鍛錬者13名(U群)の卵胞中期と黄体中期に30・45%RH環境下で下肢温浴(42℃)を60分間負荷し、運動トレーニングが熱放散反応に及ぼす影響を検討した。実験当日の血中女性ホルモンは、T・U群とも卵胞中期から黄体中期に有意に増加したものの、その増加度はT群がU群より有意に小さかった。下肢温浴中における直腸温( $T_{re}$ )および平均皮膚温は、卵胞中期と黄体中期ともT群がU群より有意に低かった。下肢温浴前・中の $T_{re}$ および平均体温( $T_b$ )は、U群では黄体中期に卵胞中期より有意に上昇したものの、T群にはその傾向がみられなかったため、黄体中期でそれらの群差がより顕著になった。前額・胸・背・前腕・大腿の皮膚血流量変化率(%LDF)の経時的变化には卵胞中期と黄体中期とも運動トレーニングの影響はみられなかった。下肢温浴終了直前10分間の局所発汗量( $m_{sw}$ )は、両性周期と

も胸・背・前腕でT群がU群より有意に高かった。汗の拍出頻度( $F_{sw}$ ) -  $T_b$ ,  $m_{sw}$  -  $F_{sw}$ , %LDF -  $T_b$ の対応関係の検討から、女性の運動トレーニングは発汗・皮膚血管拡張機能を改善し、その改善は発汗機能では中枢機構および末梢機構の両活動性の亢進に、皮膚血管拡張機能では末梢より中枢機構の亢進に、それぞれ起因することが示唆された。さらに、運動トレーニングに伴う中枢機構の改善は、黄体中期における女性ホルモンの顕著な群差に起因し、発汗・皮膚血管拡張機能とも黄体中期により顕著になった。運動トレーニングに伴う末梢機構の改善には、発汗・皮膚血管拡張機能とも身体部位差が存在する可能性が示唆された。