急激な負荷変化に関する予測が呼吸循環応答に及ぼす影響

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Effects of Prediction Induced by Prior and Different Instructions about Abrupt Change of Workload on The Cardiorespiratory Responses to Exercise

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ABSTRACT

To study the effect of prediction induced by prior and different instructions about an abrupt change of workload on the cardiorespiratory responses to the ensuing exercise, fifteen healthy volunteers performed the same bicycling exercise under three conditions in which the instructions about the load change were *no, true, or false*. The workload of the bicycling exercise in all three conditions was stepwisely increased from 40 % to 50% of maximal oxygen uptake level at 5 min after the start of exercise. Before the change of workload, both *true* and *false* conditions elicited the same magnitude of anticipatory increase in minute ventilation, heart rate, and mean arterial blood pressure（MAP）, whereas the *no* condition had no effects. After the increase of workload, three conditions produced different responses in the hemoglobin oxygenation（oxy-Hb）and the index of muscle blood flow（MBF）in the exercising thigh muscles measured by near-infrared spectroscopy. The magnitude of the reduced oxy-Hb in response to the abrupt increase of

workload was lower in the *true* condition than other conditions. Concurrently, the MBF in *true* condition was significantly increased more than other conditions. The less reduction of oxy-HB and the higher MBF in the *true* condition resulted in the lowest increase of MAP. These results suggest that the predictive and voluntary control resulting from the prior and different instructions about load change can modify the cardiorespiratory adjustment to the ensuing exercise.

要　旨

負荷変化に関する予測が運動時の呼吸循環応答に及ぼす影響を明らかにするため，負荷変化について，正しく教示されているTrue条件，逆の教示が与えられているFalse条件，負荷変化に関する教示のないNo条件を設定し，同一負荷の自転車作業を15名の被験者が3回繰り返した．作業負荷は，運動開始5分目に40％$\dot{V}O_{2max}$から50％$\dot{V}O_{2max}$へステップ状に上昇させるように設定した．TrueとFalse条件では，負荷変化前に予期応答がみられ，換気量，心拍数，平均血圧が両条件共に同程度上昇していた．教示条件に対応した呼吸循環応答は，負荷変化後の筋血流量，酸素化ヘモグロビン，平均血圧に現れていた．正しく負荷変化を予測できるTrue条件では，NoやFalse条件に比べ，活動筋血流量が確保され，その結果酸素化ヘモグロビンの低下も少なく，昇圧反応も抑えられていた．このように負荷変化に関する予測の相違が同一強度の運動であっても，その呼吸循環応答を変調することが明らかとなった．