

水泳による体力育成のための牽引泳の有用性について

柴田 義晴*・五十嵐 愛**・北川 幸夫***・米津 光治****
健康・スポーツ科学分野

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Abstract

The purpose of this study was to clarify the utility of tethered swim as a training method for physical strength and fitness promotion, through investigating the exercise characteristics of tethered swimming by means of stationary swimming. 4 female and 2 male college students were participated in this investigation as subjects. As a result, the characteristics of tethered swimming and the efficacy of swimming as physical strength and fitness promotion method were obtained as follows:

1) The heart rate (HR) of Interval tethered swimming (ITS) at the load of 6kg (35sec. swims and 20sec.breaks) showed significantly higher ($p<0.05$) compared with free swimming (FS). ITS loaded with 6kg load showed the load at which improvement in endurance can be anticipated in both physiologic indexes (HR: 155.2 ± 4.5 bpm, BLA: 2.9 ± 0.2 mmol) as well as perceptual indexes (RPE: 13.2 ± 0.9). Stroke rate (SR) and Stroke length (SL) during ITS showed a slight difference but not significant compared with FS and almost steadily transition after the second time. ITS did not seem to cause a disruption of stroke mechanics.

2) In the case of 4TS, The loads at 4kg for male and 3kg for female showed physiological exercise and strengths (HR: 164.0 ± 9.9 bpm, 150.3 ± 5.9 bpm, BLA: 4.3 ± 0.2 , 3.5 ± 0.7 mmol, RPE: 14.5 ± 0.7 , 13.3 ± 0.9), which could anticipate improvement in endurance at the same time 4TS, the loads at 5kg for male and 4kg for female showed the tendency of gradual increase due the fact that the exercise strengths did not reach a steady position. It seems to be lacking in improvement of endurance with the loads at 3kg for male and 2kg for female. 4TS did not seem to cause the disruption of swimming in any of the trials though it suggested the presence of load that was approximate FS in between 4kg and 5kg caused by fluctuation of SR and SL.

3) In assisted swimming, there was no affection using muscles in observation of EMG. It appeared that assisted swimming similar to the loads at 3kg for male and 2kg for female. In the case of resisted swimming, there was no affection using muscles in observation of EMG as well. In the observance of iEMG, showed significantly higher ($p<0.05$) compared with 5kg for male and 4kg for female.

The above findings suggested that, in tethered swimming, depending upon the setting of traction load, it was possible to establish the exercise strength that could expect endurance effects without breaking the stroke mechanics. Also suggested was the possibility that the appropriate traction load could be obtained from the maximum traction force. Thus, with tethered swimming, it is possible to set the appropriate load according to the swimming level, and therefore, tethered swimming can be utilized as a training method for physical strength and fitness promotion.

Key words: Tethered swimming, Training method, Utility, Physiological index, Stroke mechanics

Department of Health and Sports Science, Tokyo Gakugei University, 4-1-1 Nukuikita-machi, Koganei-shi, Tokyo 184-8501, Japan

要旨: 本研究は、牽引泳の運動学的特性を明らかにすることによって、牽引泳を用いた水泳の体力育成法を開発することを目的とした。そのため、健康や体力育成を目指して日常的に水泳を行っている者を対象に負荷設定を変えた牽引

泳を行わせ分析した。その結果、以下に示したように、牽引泳が水泳の運動特性を棄損することなく、持久的トレーニングとして運動強度を見出すことができることから、体力育成法として活用できる可能性が示唆された。

- 1) インターバル牽引泳では、通常泳に比較してHRが有意 ($p < 0.05$) に高かったが、3回目以降全体を通してほぼ一定に推移した。また、HR ($155.2 \pm 4.5\text{bpm}$)、BLA ($3.9 \pm 0.2\text{mmol}$) およびRPE (13.2 ± 0.9) とともに持久力の向上が期待できる負荷を示した。
- 2) 4分間牽引泳では、牽引負荷が男子の4kg、女子の3kgにおいて、それぞれ (HR: $164.0 \pm 9.9\text{bpm}$, $150.3 \pm 5.9\text{bpm}$, BLA: $4.3 \pm 0.2\text{mmol}$, $3.5 \pm 0.7\text{mmol}$, RPE: 14.5 ± 0.7 , 13.3 ± 0.9) 持久力の向上が期待できる値を示した。また、EMGの放電様相からいずれの試技も泳ぎ方の崩壊は認められなかったが、男子の5kg、女子の4kgではiEMGの正規化によるFSとの比較において過大値を示した。
- 3) アシステッド泳は、泳ぎ方の崩壊をもたらすEMGは認められず、iEMGでは男子の3kg、女子の2kg時の筋活動量に近似した値を示した。レジステッド泳は、同様に泳ぎ方の崩壊をもたらすようなEMGは認められなかったが、iEMGが男子の5kg、女子の4kg時の筋活動量を超える値を示した。

以上のことから、牽引泳では、牽引負荷選定によって泳ぎ方を崩壊することなく、持久的効果が期待される運動強度の設定が可能であると考えられる。すなわち、牽引泳は個々の泳力レベルに応じた適正な負荷設定が可能で、幅広い水泳実践者に活用できる運動であり、ひいては水泳による体力育成法としての活用が期待される。

* 東京学芸大学 健康・スポーツ科学講座 (184-8501 小金井市貫井北町4-1-1)

** 東京学芸大学大学院

*** 日本女子体育大学

**** 文教大学