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Mini Review

Swimming and aqua pole-walking

Miyashita Mitsumasa*

The Division of Physical and Health Education, The University of Tokyo, Tokyo, Japan

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***Corresponding author:** Miyashita Mitsumasa, The division of Physical and Health Education, The University of Tokyo, Tokyo, Japan, Tel: +81-03-3812-0164; Fax: +81-03-3812-0164;
E-mail: mm1192@tcn-catv.ne.jp

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Drag force

The drag forces were measured during towing swimmers in static prone positions at various speeds. The drag force mostly depends on towing speed, and body position; the head above water or the head underwater. The towing forces were similar on small Japanese and large white swimmers at the same speed. It was estimated that the larger, highly-trained white swimmer was able to control their body position to reduce water resistance as effectively as possible [1].

Speed variation

A new apparatus was developed to measure continuous swimming speed in crawl stroke. Two pullies were set on the pool sides apart 25 m. A nylon cord was strung between two pullies. When the cord traveled 5 cm, the time elapsed could be recorded via 3 holes of the pully to the light sensor. The new pressure sensor plates were fixed to the right and the left palms of swimmer, to detect the hand action whether moving in air or in water during swimming crawl stroke. Swimming speed varied from around 1.2 m/s to 2.0 m/s during a single cycle stroke of front crawl. But speed fluctuation did not necessarily relate to the arm actions; the left and/or right arm action [2].

Since steady speed is economical during swimming, steady speed can improve the record, in addition to the increase of propulsive forces. The speed variation during a single cycle of breast stroke was great (0.5 m/s to 2.0 m/s), so that breast stroke consumes more energy to swim than the front crawl stroke [3].

Waves caused by swimmers

The wave heights caused by swimmers were recorded by the use of a capacity wave height meter. This meter was set in a swimming pool. Wave powers increase curve-linearly with swimming speed. But there are great differences among the individuals in order from recreational swimmers, middle class swimmers to elite swimmers. The wave power of the elite swimmer was least at same swimming speed [4].

Our research results suggest that the swimming fast is required in crawl stroke as follows;

1) To minimize the fluctuation of swimming speed during a single cycle stroke,

2) To take an ideal body position to reduce water resistance,

3) To acquire a swimming style of making fewer waves.

The current swimmers can swim faster

The reasons why the current swimmers can swim faster than the swimmers of 30~40 years ago are estimated as follows;

(1) **Swimmer's physical ability**

① Body height of the young people increased more than 10cm on average since the end of the World War II.

② The current swimmers have the larger musculature through resistance training than the past swimmers.

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③ The current swimmers have the better ability of aerobic and anaerobic power through the high intensity interval training (HIIT) than the past swimmers.

(2) **Environments were changed**

① The overflow of the current swimming pool sides is so flat that water easily flows over the wall to absorb the waves, and the size and design of the floats between lanes can absorb the waves.

② The current inclined starting stand is designed for the swimmer to start with the forces of legs and arms and the swimmer pushes his or her body with greater force into the water

③ The materials and design of the swimming wears were extremely improved to decrease the water resistance.

Aqua pole walking

Aqua-pole walking is a good exercise for individuals having serious problems in their legs, because gravity force is reduced by buoyancy. I tried to produce the specially designed poles made of stainless steel. The part of the pole grip automatically floats vertically. Aqua-pole walking is recommended not only for improving cardiovascular functions and body composition, but also the increasing cerebral blood flow in water to reduce the progressive decline of cognitive function with aging [5].

Physical condition changes from good health, poor health, illness to death, depending on the living styles, such as physical activity, nutrition, aging, accident etc. As a final remarks. I would like to say that human movement sciences can contribute to the improvement of athletic performance, and also to enhancement of health.

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