**EFFECTS OF VERBAL FEEDBACK ON MOVEMENT EFFICIENCY DURING SWIMMING ERGOMETRY**

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**Abstract**

**Introduction.** The aim of the study was to ascertain the physiological effects of verbal feedback on changes in the movement efficiency of a dry-land swimming ergometry task (butterfly stroke). **Material and methods.** The study involved 100 healthy and physically active males (1st year university students majoring in physical education) that were untrained in swimming (19.56 ± 1.32 years of age, 181.23 ± 4.35 cm in height, and 70.54 ± 8.6 kg in weight). The sample was randomised into two groups (control and experimental). In the first trial, both groups executed the butterfly stroke on a Weba Sport swim ergometer with no augmented feedback. In a second trial, the experimental group was provided with verbal cues relating kinesthetic information on task execution. Trial duration was 10 min, with the first 5 min devoted to the swimming task and the remaining 5 min serving as a cool-down. Variables under consideration included physiological cost, rate of recovery, heart rate recovery, estimated recovery time, and work output. **Results.** No improvement in the variables related to the physiological cost was observed in the verbal feedback condition although a significant increase in work output was observed in the experimental group (p < 0.05). **Conclusions.** An improvement in work output without modulating the physiological cost of work suggests that appropriately prepared verbal cues may enhance performance in a swimming ergometry task.

**Key words:** swimming, verbal information, kinesthetic information, physiological cost, work output

**Introduction**

The optimisation of exercise technique by enhancing movement efficiency has been the subject of extensive scientific research over a number of years. New research directions have emerged as investigators search for ways to enhance motor performance and mechanical economy [1]. This body of research is grounded in the concept that humans continually update motor patterns as a result of numerous forms of feedback [2]. Among various sources of feedback, intrinsic feedback involves exteroceptive or proprioceptive information that is processed to adjust movement as well as compare task execution with a priori motor imagery [3]. This feedback is provided by the neuromuscular sense organs, including the vestibular apparatus which aids balance and spatial orientation, muscle spindles that detect changes in muscle length and velocity, and the Golgi tendon organs which sense changes in muscle tension. Another source of feedback is termed as extrinsic and acquired from external stimuli such as verbal or visual cues. Increased experience with intrinsic and extrinsic feedback allows for enhanced movement execution in ever more complex movement structures [2].

A key benefit in the optimisation of a movement structure is that it allows the performer to complete a movement task with ever decreasing energy expenditure [4]. The increasingly efficient execution of a movement at minimised physiological cost can thus be treated as an example of movement efficiency. This principle generally governs the underlying concept of technique. In sports that are based on the continuous repetition of a task (e.g., swimming), long-term and continuous practice reduces the homeostatic disturbance evoked by such movement and also automates its execution [5]. This in effect improves force production and movement precision with a concomitant reduction in energy expenditure resulting in improved performance [6].

While enhanced movement efficiency is an inherent goal of any form of repeated practice or training, it can be significantly encumbered if a task is performed in an abnormal environment or modulated by external conditions, as is the case with swimming. For example, both perception and sensory information (intrinsic feedback) can be disturbed during swimming by not only the inherent physical characteristics of water (e.g., temperature, pressure, and density) but also the introduction of new forces (e.g., buoyancy and drag) [7]. In such conditions, it has been suggested that intrinsic feedback could be supplemented with extrinsic feedback to strengthen the kinesthetic feedback loops [8]. The introduction of such kinesthetic information...