CALA

# THE PHYSIOLOGICAL BASIS OF AQUA INTERVAL TRAINING

**CHARLENE KOPANSKY**
President of CALA
President of Vitality Plus Fitness Consulting Services
B.Sc.(H) Human Kinetics, B. Ed, P.H.E. and Science
Ontario Fitness Council Ceritified
Fitness Ontario Leadership Program Trainer
National and International Presenter

**DEB MACLATCHY**
Assistant Professor, University of New Brunswi
PhD (Zoology), University of Manitoba
CALA Certified/YMCA Certified
National Presenter

## THE BASICS ABOUT INTERVAL TRAINING

Interval training is based on the concept of work to rest ratios. By considering the length of time (period) of work, the period of rest and the activities involved, leaders can maximally train each of the energy systems of the participants. The 'rest' period is a relative rest (often called active recovery or active rest), as activity continues but not at the same intensity level of the work periods.

### The Phosphate Pool.

***Training Goal: to develop the capacity of the ATP/CP pools.***

**Method:**

The phosphate pool can be overloaded by engaging specific muscles *maximally* for bouts of effort of 5 to 10 seconds. Only small amounts of lactic acid are produced and recovery is rapid. The next work period can begin after a 30 to 60 second rest period. It is important to note that the capacity of the ATP/CP pools is muscle specific. The activities selected must engage the muscles at the appropriate level for which the participant desires improved anaerobic power.

Anaerobic Glycolysis.

*Training Goal: short-term overloading of the anaerobic glycolysis system to improve physiological conditioning.*

**Method:**

The energy systems switch from the phosphate pool to anaerobic glycolysis 10 seconds into all-out activity. During a work interval using anaerobic glycolysis to produce energy, lactic acid builds up. It is important that the rest interval be long enough to clear some of the lactic acid from the muscles. Use work intervals up to a minute (depending on the fitness level of participants), with a recovery interval of 3 to 5 minutes. A good rule of thumb is a 1:4 work to rest ratio.

It is important to note that repeat bouts of training in this fashion leads to "lactate stacking". This results in higher levels of lactic acid than just one bout of "all-out" work to the point of voluntary exhaustion. Allow for enough recovery time following intense anaerobic glycolysis training to allow for the built-up lactic acid levels to be diminished. It is recommended that anaerobic training occur in the middle or end of a training session or class to avoid fatigue from setting in and hindering participants from reaching their aerobic goals. Remember that heavy anaerobic training is psychologically taxing and requires considerable motivation.

**Motivational Tips:**

**1. Let the participants know the length of time for the intervals:** this helps most people mentally prepare for the amount of work they will need to do.

**2. Use the clocks:** most pools have timing clocks that the leader can use to time the intervals. Many participants will also choose to use the clocks for their own motivation.

**3. Words of encouragement:** use verbal motivation, eg. "Keep going. Almost there. Keep those arms and legs moving..." etc.

**4. Prepare the class ahead of the intervals:** get the class ready and psyched for the intervals prior to actually beginning the intervals. Talk about intervals before the class and keep energy levels high leading into the intervals.

**5. Music:** high energy, fast(er) tempo music.

**6. Education:** ongoing education about the benefits and physiological theory of interval training can be motivating. Many participants want to know **why** the class is designed with interval training segments.

**What other motivational tips will provide encouragement for participants?**

**Safety Tips:**

It is important to ensure the safety of participants during interval training. Remind participants to avoid gripping or clutching toes and fingers to prevent cramps, give permission to work at their own level, and, most importantly, keep aerobic and anaerobic training at a level suitable to the participants. For example, modify the level of anaerobic training for classes with participants who have high blood pressure, heart/respiratory problems, or are pregnant.

**Aerobic Training.**

*Goals: (1) to provide a sufficient cardiovascular overload to stimulate increases in stroke volume, cardiac output and local circulation and (2) to enhance the aerobic capacity of specific muscles.*

Interval training is one of three training methods used to increase aerobic capacity; the other two are continuous aerobic training and Fartlek training. This workshop will concentrate on interval training.

With the correct spacing of work to rest periods, large amounts of work can be accomplished that could not be accomplished with one bout of continuous activity. Rest periods can last from a few seconds to several minutes or more depending on the desired outcome.

Variables that can change within a workout are intensity, duration of work and rest intervals, type of activity within work and rest interval, number of work intervals (repetitions) and number of sets within a class.

To optimally engage the long-term aerobic energy system the work to rest ratios are 1:1 or 1:1.5, with work intervals of at least 1 minute. The next work interval begins before complete recovery of the system has occurred. This ensures that the circulatory and aerobic metabolic stress reach near peak levels even though the work intervals are relatively short.

Interval training attempts to reach the $V_{O_{2max}}$. This is the maximum level of activity at which one can continue using the aerobic system as the ATP source. It is limited by the amount of $O_2$ supplied to our muscles via the respiratory and circulatory systems and the metabolic machinery of the muscle cells. By attempting to overload these systems during intense work bouts, measurable gains will occur within our aerobic systems. These gains will be evident in submaximal activities, such as a continuous aerobic workout, bike ride, hike, or walk on the beach. This contrasts with continuous training, which stays submaximal throughout the training period where overload is generally accomplished not by the intensity of the workout but by the duration of the exercise.

One draw back with aerobic interval training is that it may force the body to place a disproportionate stress on fast-twitch glycolytic (white) muscle fibres, rather than fast-twitch oxidative (red) fibres that are used for endurance activities. Keep aerobic work intervals at a level that does not stress the aerobic system. Over stress would prompt a switch into anaerobic glycolysis. This will occur when the activity surpasses the participant's $V_{O_{2max}}$.

## LONG-TERM GAINS FROM INTERVAL TRAINING IN AQUAFIT CLASSES

Gains from interval training affect performance in fitness classes and in daily living. The physiological gains achieved in the pool are transferred to daily activities! The following table demonstrates 'physiological' gains and/or 'life' gains resulting from interval training.

| ENERGY SYSTEM USED | PHYSIOLOGICAL GAINS | FUNCTIONAL REAL LIFE GAINS |
|---|---|---|
| Phosphate Pool | Enhancement of ATP/CP energy capacity<br>Metabolic changes in fast-twitch glycolytic (white) muscles (specific training also enhances the recruitment of the appropriate motor units used in the actual movement) | Increase in capacity for activities such as: football, weightlifting, liftng groceries or children... |
| Anaerobic Glycolysis | Metabolic changes in fast-twitch glycolytic (white) muscles (specific training also enhances the recruitment of the appropriate motor units used in the actual movement)<br>Decrease in time needed to pay off oxygen debt<br>Increase tolerance for lactic acid build-up | Increase in capacity for activities such as:<br>running two blocks for the bus, running up 4 flights of stairs, playing soccer or hockey... |
| Aerobic Oxidation | Metabolic changes in fast-twitch oxidative (red) fibres, including increased glycogen synthesis, increased fat metabolism, increased levels of oxidative enzymes, increased myoglobin (stores $O_2$), increased aerobic generation of ATP, increased blood flow to working muscles, increased $V_{O2max}$<br>The heart increases in size, cardiac output and stroke volume increase, resting heart rate decreases, BP decreases<br>The lungs increase in their diffusion capacity | Increased capacity for endurance activities such as jogging, biking, hiking, walking... |

## REFERENCES


Kopansky, C. (1993). *Basics About Aquafitness*. CALA Course Manual.

McArdle, W.D., Katch, F.L., and Katch, V.L. (1986). *Exercise Physiology: Energy, Nutrition and Human Performance*. Lea and Febiger, Philadelphia.

Previte, J.J. (1983). *Human Physiology*. McGraw-Hill Book Company, New York.

Simpkins, J. and Williams, J.I. (1987). *Advanced Human Biology*. Unwin Hyman, London.