A considerable amount of research has been accumulated over the past 50 years on the effects of aquatic immersion on the human body, much of which began during the period NASA was planning to put an astronaut into space using aquatic immersion as a proxy for weightlessness.

These effects were profound and spurred further research on the cardiovascular, pulmonary, and renal effects of aquatic immersion. This research, however, was not focused on the effects of aquatic exercise. To this day, there are several important questions that remain either underexplored or unexplored about the place of aquatic exercise in the management of important health issues such as cardiovascular disease, diabetes, obesity, respiratory disease, and chronic neurologic diseases such as multiple sclerosis, Parkinsonism, and the late effects of polio.

This is a tragic lack of research for the industry, as the research that has been completed demonstrates a great potential for human health benefit across a wide range of diseases that cause untold economic cost upon societies across the globe.

**SWIMMING FOR HEART HEALTH**

Non-communicable diseases cause 60 per cent of all deaths worldwide and nearly half of these are from cardiovascular disease. In fact, cardiovascular disease is the leading cause of death in the U.S. (one in every three deaths is from heart disease and stroke, equal to 2,200 deaths per day\(^1\)), and the second in Canada (every seven minutes someone dies from heart disease or stroke\(^2\)). The larger issue at hand, however, is these conditions are also the leading causes of disability, preventing people from working and enjoying family activities. Cardiovascular disease is also incredibly expensive—both heart
The factors that lead to cardiovascular disease are well publicized: smoking, hypertension, lack of physical fitness, diet, obesity, blood lipids, carbohydrate metabolism, and insulin sensitivity. Exercise is touted as a major health-promoting activity to reduce the potential risks of developing cardiovascular disease; swimming is often included within these recommendations, however, there has only been a small body of research assessing the impact of aquatic exercise and swimming upon cardiovascular risk factors.

Studies show swimming can help lower blood pressure
Swimming has been shown in several studies to lower blood pressure significantly, especially in hypertensive individuals. Interestingly, some research has demonstrated a slight rise in blood pressure in...
normotensive individuals, but these blood pressure elevations did not exceed current standards for hypertension. Overall, the literature certainly supports the belief that a program of regular aquatic exercise (swimming) produces a beneficial effect upon blood pressure regulation, especially in hypertensive individuals.

In the late '80s, research started to emerge demonstrating the cardiovascular system was capable of responding positively to a program of swim training in previously sedentary middle-aged individuals. The responses included an increase in the ability of the arteries to dilate during exercise, whereas in sedentary individuals this ability is greatly reduced as the arterial system loses its elasticity without exercise. This loss in elasticity is a precursor to hypertension, which further raises the risk of cardiovascular disease.

More recent research has both supported and expanded these findings. For example, a study published in the American Journal of Cardiology showed a 12-week swimming exercise program, comprising a group of previously sedentary individuals, produced more than a 20 per cent increase in arterial compliance, a measure of arterial elasticity, and also a significant decrease in blood pressure compared to their control group (see Figures 1 and 2 on page 69). An earlier study by this group of researchers compared regular middle-aged and older runners and swimmers with sedentary controls and showed that swimmers and runners both had major positive differences from sedentary controls in arterial compliance. These are important findings, as the ability of the vascular tree to quickly respond to the increased demands of exercise are extremely important in reducing the work of the heart in circulating blood throughout the body and reducing the risks of hypertension and cardiovascular disease.

AQUATIC VERSUS LAND-BASED EXERCISE

Obesity has long been noted as a risk factor for cardiovascular disease, although it is less significant a risk than inactivity. In several studies, swimming and aquatic activity did not seem to produce as significant an effect on weight loss and per cent body fat as land-based activity did. Further, swimming did not seem to produce significant increases in high-density lipoprotein cholesterol (HDL-C) when compared to land-based exercise as has been noted both in young and older swimmers compared to their land-exercising peers.

Other studies, however, have shown when exercise intensity and duration are matched completely, both forms of exercise may be expected to produce both weight loss and an increase in lean body mass. These and other studies have also shown swimming and other aquatic exercises do produce a decrease in total cholesterol and low-density lipoproteins (LDL-C). Aquatic exercise and swimming are useful forms of exercise in obesity, especially because of the off-loading produced by buoyancy. Although an active aquatic exercise program may not produce major weight loss, such programs will produce an increase in overall fitness, muscle strength, balance, and perceived quality of life.

REDUCING THE RISK OF DEVELOPING INSULIN RESISTANCE

Linked with obesity and inactivity is a much higher likelihood of developing insulin resistance, a precursor to diabetes, one of the fastest-growing chronic diseases. The U.S. Centers for Disease Control (CDC) estimates if current trends are not intercepted, within the next four decades, the number of adults with diabetes...
could double or even triple, increasing the prevalence from the current one in nine adults to three adults out of nine.16

Aquatic exercise can be helpful in reducing the risk of developing insulin resistance or decreasing insulin resistance if already present as it lowers fasting insulin levels while raising insulin sensitivity. It has also been shown to reduce the level of hemoglobin (A1c), a measure of average blood glucose levels over time.4,11,17 These findings can be important reasons to promote aquatics to those at risk of developing diabetes or those who have been diagnosed with it.

PROMOTING AQUATICS FOR BETTER HEALTH

While all of the above effects of aquatic exercise and activity seem to be receiving increased recognition within the lay press and medicine, there remains a dramatic underuse of aquatic facilities for health promotion and maintenance.

Unfortunately, many aquatic facilities often lack imaginative programming for adults in need of healthful aquatic activity and physicians are unaware of the many potential health and cost-saving benefits of aquatics. Given the rates of cardiovascular disease, cardiac debility, obesity and diabetes, and their many medical complications, the costs of these health issues may eventually become unsustainable. Therefore, the industry must do a better job to increase public and professional awareness to the benefits of aquatic exercise, not only for the betterment of public health, but also for the pool and spa industry.

NOTES:
1 See "Be One in a Million this American Heart Month," CDC Features 2012 (Accessed Jan. 30, 2012). For more information, visit http://www.cdc.gov/features/HeartMonth/.
6 See “Effects of One-Year Swimming Training on Blood Pressure and Insulin Sensitivity in Mild Hypertensive Young...
AQUATIC FITNESS


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