

# Women's Health and Scuba Diving

By Susan Cook

For many, the idea of scuba diving conjures up thoughts of Jacques Cousteau's Calypso adventures or Lloyd Bridges in Sea Hunt. This is a sport that was designed for only the most macho male. After all, who but the most thrill-seeking of men would suit up in heavy gear to take them to the depths of the ocean? As of the year 2000, there were 854,052 certified PADI divers worldwide (PADI c). Thirty-five percent of those "macho male" divers were women (PADI c).

The sport of recreational diving has evolved in the last two decades. There is better equipment for divers, better training, and better accessibility to diving training. The sport is no longer thought of only for the thrill-seeker, but for anyone, any age, and any sex. Organizations such as PADI (Professional Association of Diving Professionals) and DAN (Diver's Alert Network) have been instrumental in conducting research to support the health and safety of the recreational diver. In particular, DAN has teamed with the medical community in their pursuit of diving health and safety. Their mission statement reads:

"Divers Alert Network (DAN), a nonprofit organization, exists to provide expert information and advice for the benefit of the diving public. DAN's historical and primary function is to provide emergency medical advice and assistance for underwater diving injuries, to work to prevent injuries and to promote diving safety. Second, DAN promotes and supports underwater diving research and education particularly as it relates to the improvement of diving safety, medical treatment and first aid. Third, DAN strives to provide the most accurate, up-to-date and unbiased information on issues of common concern to the diving public, primarily, but not exclusively, for diving safety. DAN is *Your Dive Safety Association*" (DAN c).

While most of the research in diving health and safety pertains to all divers, there have been recent studies that also investigate the specific diving health concerns of women. To understand the express concerns related to the health of female divers, the general health and safety of all divers, including women, must be identified. First of all diving, like all sports, requires a certain level of training and physical conditioning. Think about scuba – self contained underwater breathing apparatus. To submerge underwater at depths of 100 feet or more with a life-support system strapped to the back suggests the need for professional training and physical conditioning.

Starting with the basics, each diver should maintain a regular program of proper nutrition and exercise. Before initial training, it's also a good idea to have a complete physical and physician's approval for the class. As with any sport, the stamina required to successfully complete (and enjoy!) a dive is directly related to one's physical conditioning. This includes eating a balanced diet, maintaining a regular cardiovascular fitness program, and getting enough rest. It is not shark attacks but heart attacks and other circulatory problems that are "likely the leading cause of death while scuba diving" (Francis a). It's also important to monitor one's mental health. A diver must enter the water with a clear mind and focus to ensure a safe dive. One general rule of thumb to follow in diving is if you don't feel well, don't dive.

There are also some common sense guidelines to diving. Never use alcohol, drugs, or tobacco prior to diving. The effects of pressure at depth can increase the effect of alcohol and drugs (PADI b). Avoid smoking. If a diver smokes, he should abstain several hours before and after the dive because smoking significantly decreases the

efficiency of the circulatory and respiratory systems (PADI b). Another benefit to not smoking is that “healthy lungs eliminate dissolved nitrogen from the bloodstream preventing decompression illness” (Francis b).

There are some dive-specific related conditions that every diver must know. They are lung over expansion, decompression illness (DCI), and squeeze. The most common of these is the squeeze. This occurs while descending in the water. As the surrounding pressure increases with depth, the air spaces in the body compress. This creates a pressure imbalance as the pressure outside is greater than the pressure inside. This occurs most frequently in the ears and sinus cavities but can also occur in a tooth filling. One of the most important skills a new diver will learn is how to clear these air spaces by holding one’s nose and blowing, thus adding air to these pockets. A diver with an ear infection or sinus congestion should not dive because it will be difficult to clear these air pockets. A potential burst eardrum is not worth with the risk.

Lung over expansion injuries can be life-threatening complications that may occur if the diver holds his breath while diving. The lungs will respond easily to pressure changes as long as the diver continuously breathes to keep the pressure equalized. “If the diver holds his breath or air traps within a section of the lung, as hydrostatic pressure declines expanding air will almost always cause lung-expansion injuries.” ( PADI a) The golden rule of diving is to never hold your breath.

Decompression illness occurs when the nitrogen trapped in body tissues is not released slowly. During a dive, “increased pressure causes nitrogen from the air to dissolve in body tissue” (PADI a). The extent of the nitrogen absorption varies based on the health of the diver and the length and depth of the dive. As the diver ascends,

surrounding pressure decreases. “Nitrogen can’t stay dissolved in the body so it begins to come out of solution” (PADI a). Since the body doesn’t use nitrogen, what goes in must come out. If a diver ascends too quickly, the body can’t eliminate the nitrogen fast enough. As it dissolves, the excess forms bubbles in the blood vessels and tissues. The result can be “paralysis, shock, dizziness, difficulty breathing, joint and limb pain, unconsciousness, and death” (PADI a). In addition to adhering to one’s training, a diver can help to prevent DCI by avoiding dehydration. The recommendation is to drink four quarts of water a day when diving in tropical climates. “Dehydration makes your blood thicker, so it flows more slowly and doesn’t carry nitrogen to the lungs as quickly” (Francis a). The primary treatment administered for DCI is spending time in a recompression chamber. Basically, the diver is put back under pressure to help the body to reabsorb the nitrogen bubbles in the tissues.

### **Health Related Issues for Women**

Specific health-related issues for women are diving while pregnant, diving during menstruation, women and decompression sickness, breast implants and diving, and finding properly fitted scuba equipment. While there hasn’t been an abundance of research on these topics, there is valuable information available that all female divers should know.

The main concern of diving while pregnant is whether doing so will affect the fetus. Researchers know there isn’t the possibility of a squeeze occurring on the fetus because amniotic fluid completely surrounds the fetus – thus there are no air spaces in which a squeeze can occur (McComb). However, fluid retention occurring in the mother during pregnancy may cause nasopharyngeal swelling, which can lead to nose and ear

stuffiness (DAN b). This could put the mother at greater risk for an ear or sinus squeeze. Another area of concern is with lung-expansion injuries. Research indicates the fetus will not be directly affected since the fetus doesn't breathe air. However, if the mother gets an air embolism, treatment in a recompression chamber is usually required. This could be risky for the fetus. A "fetus exposed to very high oxygen pressures especially late in gestation, may theoretically be at risk for an eye condition called retrolental fibroplasias" ( Martin). It has been observed that "hyperbaric oxygen causes decreased placental and umbilical blood flow to the fetus, due to oxygen vasoconstriction (McComb)". This would be the same concern for a pregnant woman who develops DCI and requires treatment in a recompression chamber. In addition, studies on pregnant sheep revealed that if DCI occurred late in the pregnancy and was untreated, the lambs were stillborn. This study also showed that nitrogen bubbles that formed in the fetus could lead to birth defects by interfering with normal development (Martin)

Other studies regarding diving and pregnancy relate to post-natal issues.

Returning to diving after giving birth should be directed by one's physician. Both the diver and physician must consider the physical conditioning required to scuba dive, in particular for women who gave birth by C-section. "Given the need to regain some measure of lost conditioning, coupled with wound healing, and the significant weight-bearing load of carrying dive gear, it's advisable to wait at least eight weeks after a C-section before returning to diving" (DAN b). An issue for women who choose to breast feed their infant is whether it is safe to scuba dive while breast feeding. Fortunately, research has shown that although nitrogen accumulates in body tissues and fluids, they

are quickly eliminated after the dive. There may be insignificant amounts of nitrogen remaining in the breast milk, but this poses no threat to the baby (DAN b)

Since there have been limited studies on the effects of scuba diving while pregnant, the recommendation by the Hyperbaric Medical Society is don't dive while pregnant (PADI b). The concern then is for women who are diving and are unaware of their pregnancy. The recommendation for this group of women is for "a second trimester ultrasound (sonogram) with emphasis on limb and spinal development and with good detailing of the cardiac structures and the configuration of the great vessels around the heart - - aorta, pulmonary arteries, etc. (DAN b)".

In general, diving while menstruating doesn't seem to pose problems, but there are some factors of which women should be aware. First of all, there is no evidence to show that a woman who dives while menstruating is at increased risk of shark attacks. The average blood lost is very little and usually occurs over several days. It is also known that "many shark species are not attracted to the blood and other debris found in menstrual flow" (DAN b).

One issue to consider that could have an impact on the health of the female diver is that during menstruation there is increased fluid retention and swelling in the tissues. While it hasn't been proven, it is possible that this could make it harder to get rid of the nitrogen absorbed in the tissues during a dive (Allison).

The use of oral contraception while diving during menstruation is one matter that drew attention of both DAN and the British Hyperbaric Association. In their study, 956 female divers with DCI were evaluated. Of those, thirty-eight percent were menstruating at the time of the DCI accident. Eighty-five percent of that group was

found to be on oral contraceptives. While this study doesn't provide conclusive evidence, it's recommended that women on oral contraceptives limit their dive exposure during menstruation to help prevent DCI (Allison).

Women who are suffering from premenstrual syndrome may want to take a cautious approach to diving during this time. PMS can cause depression, slower mental alertness, emotional distress or irritability, headaches, and bloating. Some women will take Midol to relieve some of these symptoms. The danger of taking this medicine while diving is that it contains both a diuretic and caffeine. This can lead to dehydration if the diver doesn't consciously drink additional water and dehydration can contribute to DCI (Shelanski).

Lastly, there is no evidence that using tampons while diving is dangerous from the exposure to the increased pressure during a dive. The most common sense approach to diving while menstruating is if the diver is experiencing physical or emotional discomfort, don't dive.

Women and an increased risk of DCI is one topic that has been heavily debated. Some believe that women are more susceptible to DCI because of a higher percentage of body fat, lesser ability to withstand physical endurance due to smaller lung capacity, and less tolerance to cold temperatures (PADI a)

To date, there hasn't been any evidence that a greater percentage of body fat poses a risk for DCI although some theorize that increased body fat creates more tissue in which nitrogen will store (Scubasource).

The concern about a female's physical endurance is unfounded. One's physical abilities are not directly related to one's sex but rather the physical conditioning of that

person; and although females have smaller lung capacity on average, they also utilize less air while diving.

While females may have less tolerance to cold temperatures, wearing the proper wetsuit and gear can eliminate this concern (Lurie).

In fact, statistics show that a greater percentage of men get DCI than women, a fact that could simply reveal that men have more aggressive dive behaviors (DAN a)

One issue for some women is whether breast implants will present a risk in diving. In a study conducted by DAN, three types of implants were put in a hyperbaric chamber and exposed to simulated recreational dive times and depths. Of the three types of implants tested, silicone, saline, and silicone-saline, there was a “1-4 percent increase in bubble size in both saline and silicone gel implants... The least volume change occurred in the saline-filled implant, because nitrogen is less soluble in saline than silicone.”(DAN a) The bubbles that formed in the implants are not likely to damage the implants or the “surrounding tissue”. If gas bubbles form in the implants, they dissolve over time. One non-medical consideration in diving with large implants is that silicone implants are heavier than water and may affect one’s buoyancy in the water. An adjustment of the diver’s gear or weights may be required to achieve neutral buoyancy (DAN b).

The last area of concern for women’s health and scuba diving relates to scuba equipment. Until recently, most scuba gear has been designed to fit men. Women were forced to gear up with improperly fitted equipment. Since the equipment worn in this sport is essentially one’s life support, properly fitted equipment directly impacts the



health and safety of female divers. Some of the more common complaint are regarding the wetsuit and BCD (buoyancy control device).

It's important to have a properly fitted wetsuit. This piece of equipment serves as the diver's exposure suit to prevent cuts and scrapes, and also is the primary equipment that helps to prevent heat loss in the water. The way the wetsuit works is that water is trapped inside the suit. With tight seals at the bottom, wrists, and neck, the water remains inside the suit being constantly warmed by the diver's own body temperature. If the suit doesn't fit properly and the seals aren't tight enough, fresh water will flow through the suit and will not be warmed by the body. This will cool the diver and if allowed to occur too long, could lead to hypothermia.

The BCD is worn like a vest over the wetsuit. It contains an expandable bladder that is inflated or deflated to control buoyancy in the water. Some of features that make a BCD more female-friendly are better inflator grips, better oral inflator mouthpieces, and strap adjustments that are easier to use. All of these improvements in a women's BCD make it easier for the female diver to work this piece of equipment. It's a matter of safety to have well fitted and easy to use equipment while diving.

As more women are joining the sport of scuba diving, the research on women and diving is becoming more prevalent, but there is still much research yet to be done. The best guide to follow for general diving health still remains if you don't feel well, don't dive.

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