The Effects of Yoga Åsanas on Blood Pressure
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Abstract

This article explores the concept of “the blood pressure,” describing the normal variations in pressure found throughout the circulation, and the factors responsible for these variations. The effects on the blood pressure of Yoga åsanas, such as inverted postures and forward bends, are discussed. Abnormally high (hypertension) and low (hypotension) arterial pressures are considered with reference to Hatha-Yoga practice.

The cardiovascular system consists of a circuit of tubes (blood vessels) containing a viscous fluid (blood) under pressure. This pressure, which is needed in order to drive the blood around the system, is generated by the pumping activity of the heart.

The pressure is not the same at all points around the circuit. Firstly, it varies because of the pulsatile nature of the heart’s pumping action. The pressure in the arteries is highest when the heart is contracting to expel most of the left ventricle’s content into the aorta. This value is known as the systolic arterial pressure (systole = the heart’s contraction phase). The pressure in the arteries then falls somewhat as the heart refills ready for the next contraction. The lowest value is the diastolic pressure (diastole = the heart’s filling phase). The pressure in the arteries then falls somewhat as the heart refills ready for the next contraction. The lowest value is the diastolic pressure (diastole = the heart’s filling phase). Conventionally, the arterial blood pressure (“the blood pressure”) is quoted as the systolic value over the diastolic value. An example of a typical normal blood pressure reading at rest would be 120/80, where the units are mm Hg (millimeters of mercury). Normal systolic pressure can range from about 100 to about 130 mm Hg at rest; the diastolic pressure is usually around 30–40 mm Hg below the systolic. These units are used whether the reading is taken using the traditional mercury-filled sphygmomanometer or a more modern electronic digital device.

Secondly, the pressure of the blood varies according to where it is measured around the circuit. It is high in the aorta (at rest reaching 120 mm Hg, using the example above), and then falls sharply as the blood flows through the extensive network of smallest arteries, the arterioles. This is due to the narrow diameter and high resistance to flow of these arteriolar vessels. By the time the blood arrives at the capillary beds that supply the tissues, the pressure has dropped to around 20 mm Hg. As the blood returns through the venous system to the heart, the pressure continues to fall to almost zero as it flows into the right atrium.

In addition to the pressure fluctuations outlined above, the blood pressure in any part of the body depends on the relative vertical position of that part with respect to the heart. When one is upright, the blood pressure in vessels below the heart is augmented by the hydrostatic pressure of the vertical “column” of blood between them and the heart. An artery lying 10 cm below the heart will have a blood pressure about 13 mm Hg higher than in the aorta at heart level, since the density of mercury (Hg) is about 13 times that of blood. Thus when standing, the arteries in the feet will contain blood at a pressure of about 100 mm Hg higher than at heart level—or, for example, 210/170 when the heart level pressure is 120/80 mm Hg. For the same reasons, arteries lying above the heart will have a lower pressure. The pressure in arteries in the head will be around...
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The blood pressure within a population varies around a mean value, but asymmetrically, with more people having values above the mean than below it. Age and ethnic background are influencing factors—blood pressure rises in older age; there is also some evidence that the African-American population in the United States has higher blood pressure than the Caucasian population. It is difficult to define what constitutes a “normal” blood pressure. The World Health Organization recommends that an arterial pressure of 160/95 mm Hg should be considered the criterion for the diagnosis of hypertension (abnormally high arterial blood pressure). However, the Framingham study, a long-term project in the United States, suggests that 160/95 is definitely hypertensive, and that values between 140/90 and 160/95 should be viewed as borderline. These criteria for hypertension apply to the fully relaxed resting state. During intense physical exercise it is normal for the systolic pressure to approach or exceed 200 mm Hg.

Hypertension can be primary (sometimes called “essential” hypertension) or secondary to another medical condition, for example kidney disease. Over 90% of cases are primary. Causation seems to be multifactorial. Genetic factors may be involved, although the relevant genes have not yet been identified. Other factors include low birth weight, obesity, high intake of alcohol or salt, and stress. Hypotension is the term used to describe abnormally low arterial blood pressure. This has many causes, being associated with hemorrhage, clinical shock, and heart disease, amongst others. Postural hypotension is a fairly common condition that can present in the Yoga class. Normally the arterial blood pressure rises on standing up from lying, or coming up from a head-down position. This pressure change is brought about by an increased venous return to the heart due to reflex vasoconstriction (narrowing of blood vessels by the activation of the smooth muscle layer in their walls). Vasoconstriction occurs in order to maintain an adequate perfusion of the brain, counteracting the hydrostatic effect of the head now being above the heart. In postural hypotension this mechanism fails to maintain an adequate blood flow to the brain, resulting in light-headedness and even fainting. There are many causes of postural hypotension, including pregnancy, diabetes, and heart problems. It is also a side effect of some types of medication. In most cases mild postural hypotension can be managed in the Yoga class by taking extra time to come up from a lying or head-down position. It may be necessary also to avoid standing still for too long a period, as blood then tends to pool in the leg veins, with the resulting drop in the venous return to the heart triggering a hypotensive response.

The typical “normal” blood pressure of 120/80 mm Hg refers to the arterial blood pressure at rest. Exercise of any kind causes the systolic blood pressure to rise. This ensures sufficient blood flow to the extensive skeletal muscle capillary beds, while maintaining adequate perfusion to the brain. In subjects with normal resting arterial pressures (normotensive subjects), the
blood pressure during very strenuous exercise can rise to values of 245/160 mm Hg or more without harmful effects.8 The type of exercise influences the extent and nature of these changes. Static exercise, where muscles are held in sustained contraction, tends to raise the diastolic blood pressure more than dynamic exercise, where the muscles are contracted and relaxed in a rhythmic sequence.9 Such a rise in diastolic pressure can put a strain on the heart. This has important implications with respect to Yoga practices, where āsanas may be performed in static or dynamic ways. Yoga practitioners who are hypertensive at rest will probably have even higher blood pressure during an exercise sequence. The extent of this increase will be proportionate to the effort required to practice, and in static postures to hold, the āsana. This is the reason why hypertensive practitioners are advised normally to refrain from the stronger forms of practice, and to refrain from holding static postures for long periods. However, while strenuous exertion is contraindicated, regular mild exercise is known to have a beneficial effect in essential hypertension.10

Inverted postures form part of many Yoga practice programs. The half shoulder stand (viparītā-karaṇī-mudrā) and full shoulder stand (sarvāṅgāsana), together with headstand (śīrṣāsana), and other inverted balances, all involve the positioning of the head below the heart, as do standing forward bends, such as uttānāsana and pārśvottānāsana. These postures cause a significant rise in both the systolic and diastolic arterial pressures compared to resting values. In a study of 50 normotensive men and women, body inversion caused systolic pressure (measured at the level of the heart) to rise from a mean value of 114 mm Hg to nearly 140 mm Hg, while diastolic values increased from 76 to 91 mm Hg. The changes (which were also accompanied by a marked rise in intraocular pressure) continued throughout the 3-minute duration of the inversion.11 Calculated values for the blood pressure in the head during headstand (śīrṣāsana) are 150/110 mm Hg in a normotensive individual.12 Such a hypertensive response raises concern about the possible consequences of inverted postures for Yoga practitioners with high blood pressure. The Framingham study reported that people with hypertension had a sixfold increase in stroke, compared to normotensive people. There was also a threefold increase in deaths due either to coronary artery disease or cardiac failure.13

Many Yoga teachers do advise hypertensive students to refrain from inverted and head-down postures as a matter of course, even when the condition is stabilized by medication.14 However, others still recommend the use of inversions as being specifically indicated in the treatment of hypertension.15 16 Most practitioners would agree that such “head-down” postures experientially do confer important calming and mind-quietening benefits when used regularly, but it is hard to see how such admittedly stress-reducing practices can counteract the well-recognized physiological effects of inversion on arterial pressure.

The author gratefully acknowledges the expert advice and assistance of Emeritus Professor William F. M. Wallace, B.Sc. M.D., F.R.C.P., F.R.C.A., of the Queen’s University of Belfast, U.K., in the preparation of this article.

Endnotes
6. Ibid., p. 730.
7. Ibid., p. 730.
10. Ibid., p. 275.
11. Ibid., p. 278.

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