

*Medical and Physiological  
Aspects of Headstand*

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## **MEDICAL AND PHYSIOLOGICAL ASPECTS OF HEADSTAND**

**by Dr. F. Chandra**

The subject of this article is the famous headstand posture and some current theories about the production of its effects of which there are an enormous number. The definitive work was published by Dr. Rao in the Journal of Applied Physiology (Ref. 1 & 2).

The first point he considered was that when one goes into the headstand position, about 400 to 500 ml of blood flows from the legs down towards the head. He measured blood pressure in the leg and found that it fell from about 200 to 10 mm Hg., average pressure. In the neck and arm however pressure rose by 20% (from about 90 mm Hg., to 108 mm Hg., mean blood pressure).

One might expect that this increased blood pressure would cause an influx of blood to the brain (which could cause problems). In fact this is not so, there is an auto-regulating mechanism in the brain to restrict the cerebral blood flow. Thus under different conditions of blood pressure in the neck, the blood flow through the brain remains relatively constant; there is no danger of a sudden dilatation damaging blood vessels with weak walls, for example, provided that the mean blood pressure in the neck does not exceed 160 mm Hg.

We think that the excess blood from the legs is diverted to muscles that are active, including those of the back, abdomen and arms, and the brain blood flow remains much the same. However one finds many claims that the head-down position has mental as well as physical effects. A majority of those who have been practicing headstand long enough to be accustomed to the position, feel marked benefit from it. They report that after the posture they feel more clear mentally, have an improved memory, and have other beneficial effects. What might be the cause?

A recent report (Ref. 3) outlines a method of measuring and locating cerebral blood flow by radioactive isotope tracing. The isotope is injected into the arteries of the neck and monitored as it flows through the brain by up to thirty detectors positioned on the scalp. Results firstly confirmed what was known before, namely that the total blood flow remains constant despite variations in mental activity. This seems surprising as one expects there to be a difference in cerebral blood flow between a somnolent state and one of intense mental activity. Secondly, different thinking patterns produce different patterns of blood flow. Thus when a subject was given a visual task to perform, the blood flow to the visual cortex increased and that to other areas decreased.

So the pattern can change: the shunting mechanism diverts blood from inactive parts of the brain towards the areas stimulated. It does this by causing the relevant small arteries to dilate, facilitating blood flow, and by constricting others. For

example a reading task would not only involve the eyes and increase blood flow through the visual cortex, but would also stimulate the speech areas, and one would find an increase in the quantity of radio-active label flowing through those areas.

Thus although the total blood flow through the brain is constant, it seems that some sensitive switching mechanism is directing increased local flow into activated areas. It is likely that the efficiency of this system is critical and any failure of it to respond smoothly and sensitively could cause problems. Not major problems such as a stroke; but things such as the higher intellectual functions could be interfered with by an artery failing to open, or opening only slowly when an increase in blood supply is required, or failing to subsequently constrict properly. All this is speculative but based on some experimental evidence.

How might one re-open a blood vessel, that had been closed down to shunt blood elsewhere, and then failed to re-open? One way presumably is for the blood pressure to be raised, but chronic hypertension generates problems. What we think is that in the head-down position, where blood pressure in the neck is increased, but only temporarily, by about 20%, there is not an increased blood flow through the whole brain, but a general opening up of those blood vessels which were comparatively closed. Thus one net result after the headstand is probably a base-line opening of blood vessels, resulting in an improved pattern of blood flow. This will not immediately remove the cause of the sluggishness in the shunting mechanism and perhaps in the future the problem will return. But if one is using the head-down position regularly once or twice a day, then the mechanism is "set" by the temporary effects of the headstand for optimal concentration during the ensuing few hours on mental tasks. This is my present opinion about the operation of the head-down position on the brain.

The head-down position is also a good exercise as it makes us contract at the same time, opposing sets of muscles by voluntary effort (initiated by the cortex of the brain). The usual way of exercising a muscle is by bending a joint: one muscle is contracted and a reflex arc through the spinal cord relaxes its antagonist. As soon as a message is sent to contract one muscle, another is automatically sent to relax the opposing muscle so that the joint can move. However we sometimes need to contract both sets of muscles to turn the trunk or limb into a solid column, to support ourselves for example. Thus if we consider the headstand position, to prevent the legs collapsing at the knee or hip and to prevent the back from collapsing in various possible ways, agonist and antagonist muscles on both sides of the body must be kept in mild contraction to convert one's body into a pillar that will be able to remain vertical. The arms are of course an exception as one is using them as a support but bent, and not as straight, rigid columns. However elsewhere many muscles are exercised in pairs, so this form of exercise may be considered efficient in this sense.

One way to decide the severity of an exercise is to measure the oxygen

consumption required for it. It has been found that the oxygen consumption in the headstand is only 50% more than that needed to stand upright. We can say therefore that the headstand position is certainly not heavy exercise. It is in the light to moderate category, perhaps as a good light exercise.

There are other effects caused by the increase of blood pressure in the neck. In the neck the carotid artery divides into the external carotid which supplies the face and external structures, and the internal carotid which goes into the brain. At that junctions there is a high-pressure receptor, sensitive to arterial blood pressure. Now the blood pressure in any vessel is dependent on two main factors, firstly the cardiac output, which is the amount of blood that the heart pumps into the circulation per minute, and will vary with such things as the heart rate and the force of the contraction of the heart muscle (and will also increase when any muscular activity is carried out by 'massaging' the blood back to the heart). Secondly the arterial blood pressure depends on the peripheral resistance, that is the resistance to the flow of blood through the smaller arteries, which will vary with such factors as the size of the vessel, its cross sectional area and its state of contraction or dilation. The overall balance is maintained by messages passing through the nerves from receptors to the brain.

Now this pressure receptor follows the usual physiological pattern of the body in trying to return to normal some function which has become abnormal. So when in the headstand position blood pressure has risen by 20%, this pressure body is stimulated and sends signals to the brain to try to reduce the blood pressure. This can be effected either by slowing of the heart, or by dilation of blood vessels to drain blood away from the neck. Both these effects have been recorded, and in the headstand, blood vessels especially in certain muscles, open to drain away blood. However the significant factor is the fall in pulse rate (from 80/min to 65/min are typical figures). Even rising from a chair and walking round a room will raise the pulse by perhaps 10 beats/min., yet here is a light to moderate exercise that actually reduces the pulse rate. This is true of nearly any head-down position in Yoga where the carotid body is stimulated, since when the head goes below the heart blood tends to flood into the neck, stimulating the baroreceptor there which will tend to slow the heart.

It is possible that this could have therapeutic use in cases of heart disease where the damage is not too severe, but nobody has tried it out. A few people who have had a mild coronary thrombosis, where the heart is not badly damaged, still suffer a lot of anginal pain for some unknown reason. Usually those with angina have damaged hearts, but there are some people with little damage who still have a lot of pain as soon as they start moving around. They have problems with lack of exercise, obesity and so on, because they either take no exercise, or have to take drugs to ease the pain. Now an exercise which slows the heart instead of making it work hard may be of use here since it is possible that in many cases pain is dependent on the rate of the heart beat. Of course if the heart races there will be angina, but here is an exercise which

slows the pulse, so it may allow someone to take exercise who would usually incur angina by doing so. This is speculation, but it seems reasonable.

One interesting exception is the shoulderstand position. For some obscure reason, although blood is rushing into the neck just as in the headstand, the pulse rises. However the evidence for this came from experiments with only two subjects so one would like to confirm this finding with a larger number of tests. One possible explanation is that when this posture is performed well the chin sinks into the neck and may cause a pressure which counteracts the expansion of the bulb of the baroreceptor. This is very theoretical.

For the experimental work on headstand the subjects, who were accustomed to doing it, held the position for three minutes. Although this is a short time, it showed very clearly the fall in pulse rate. It may be that when using shoulderstand the effect is slower and the subjects should hold the position for a longer time, we need to do more work on this. In fact some of the textbooks advise holding headstand and shoulderstand for up to half an hour, and I knew a Swami in London who used to do this. He was 60 years old but still very healthy.

Another effect of stimulating the carotid pressure organ is the sending of inhibitory messages to the reticular formation of the brain. Every message which comes into the brain and registers in the consciousness sends a subsidiary relay to the reticular formation. All sensory afferent nerves, which tell us what our toes are feeling for example, send branches to the reticular formation. It does not register sensations as such; messages that convey information (about what is going on) go beyond the reticular formation up to the cortex. The reticular formation when stimulated sends nondescript awakening impulses to the cortex to keep one awake, so that when the bombardment falls off one tends to become sleepy.

Now it is found that stimulation of the baroreceptor in the neck dulls the reticular formation and calms it down (Ref. 4). Thus the headstand promotes an improved pattern of blood flow through the brain, but at the same time quiets down the reticular formation. Practice of headstand does not make people sleepy; but there are many claims that practiced before going to bed, it helps cure insomnia, and this seems to be the reason.

An interesting fact about this or indeed any light/moderate exercise is that it burns mostly fat, at least 50% (in the dog it is 75%). It used to be said that one should take glucose to provide energy for exercise because one burns glucose. However this is only true for heavy exercise such as sprinting 100 yards when one goes over to practically 100% glucose consumption. There are reasons for this such as the ability to metabolise glucose without oxygen when one's body is short of oxygen, but the point is that this headstand exercise burns up fat. Thus it may help you to stay slim (even if it will not actually make you slim).

There is some work published in India which claims that Yoga exercises reduce weight; but unfortunately no parallel controls were used, and one cannot pay too much attention to it, as almost any conclusion is possible.

There are more, clearly helpful, effects of the headstand. If one considers the secretions at the bottom of the lungs, clearly it is difficult to cough these up in an erect position. If one can hold the head-down position for long enough, say several minutes, the secretions can drain headwards under the influence of gravity, and reach larger bronchioles, from which they can more easily be coughed up when one is upright again. Physiotherapists use a similar manoeuvre: they lean patients with phlegm over the bed, and thump their backs to encourage them to cough it up. One does not recommend this position for someone with a severe chest complaint obviously, but it is a bonus of the head-down position.

Furthermore as one goes up into the headstand, one goes through an approximation of a stage of the knee-chest position used for correcting retroversion of the uterus. Under the influence of gravity and the way in which the body is positioned, the womb gradually twists and assumes at least a median position, if not the correct position. It would seem to me that in the head-stand the full force of gravity of the womb, and probably the way in which one goes up into the headstand tend to bring the womb forward and bring it into the correct position. Whether the effect persists no work has yet shown, but it is a theoretical possibility that it may help retroversion.

Thirdly a doctor has shown (Ref. 5) that the coming together of the walls of a vein when that vein is emptied seems to stimulate the release of anti-coagulants. This is perhaps a defence mechanism; if a vein is collapsed for too long it is likely that there will be a roughening of the surfaces which may cause clotting.

So if someone with varicose veins practices headstand, two things happen. First, the veins are emptied of stagnant blood temporarily - when normal posture is resumed fresh blood will re-fill the veins. Second, it is possible that the release of anti-coagulants is stimulated, helping to prevent clotting which is quite common in varicose veins. This has not been used therapeutically or tested clinically.

Fourthly, there are also low pressure sensors around the heart which react to pressures of about a few mm Hg. One of the effects of stimulating these receptors is that a message then passes through nerves to the pituitary to decrease the release of anti-diuretic hormone. It is the release of this hormone which prevents us having to get up during the night several times to pass water. So the message sent by these low pressure sensors seems to be that there is too much fluid in the body - thus anti-diuretic hormone release is decreased and one passes more urine. One is not going to hold the head-down position long enough for this, but it is an example of the multitudinous effects one can find related to this exercise, and this is a fairly

superficial analysis.

There is an effect of the headstand which I cannot explain. I have known three or four teachers in London who said they had migraine for many years before starting headstand (as they were beginning Yoga they started mainly with shoulderstand). When they concentrated mainly on shoulderstand they found at first that the severity of the attacks was increased. Later it gradually decreased and eventually all three were free of migraine. One has now had two years free of migraine having previously suffered frequent attacks for five or six years, the other two have had six to nine months without an attack. Whether this is a true effect of the head-down positions one cannot say, but I mention it as an observation. Another exercise which is said to help with migraine is shavasana, the corpse position, so both these may be worth recommending to a person complaining of migraine.

In time I hope we will have papers published showing what does happen, as distinct from what is likely to happen, in some of the host of physiological changes engendered by the headstand, but at the moment this is all I can say.

*Question:*

My husband broke his right leg, and has been in traction for six to seven weeks and the bed was tipped up on a box. Would the reasons for this be the same?

*Answer:*

There are two reasons for that. One is that with the head down the traction one can exert without pulling the patient out of bed is greater. Secondly some people have problems with the neck and also with the blood flow to the brain, and the tilted position eases the blood flow to the brain through gravity.

*Question:*

When should one not practice headstand?

*Answer:*

This is a useful Question. Let me go through some cases.

- a] If a woman has a heavy period it is possible that in the inverted position a drop of blood may drip through the fallopian tube into the peritoneal cavity. Blood is an irritant to the peritoneum and one would suffer a mild chemical peritonitis which is an unpleasant thing. So most books will say that women with periods should not perform headstand. I have not known it to happen, but it is theoretically possible.
- b] There is no general reason why one should not practice headstand in the first three months of pregnancy. An exception to this is a tendency to abortion. Any woman who has lost several babies must be very careful of any increase of pressure on the abdomen which could start vaginal bleeding.

Headstand may even help if only temporarily, to bring a retroverted womb out of the pelvis. A womb may become trapped in the pelvis as it grows, it is a rare

complication but this exercise may assist release. After three months however the womb is out of the pelvis and one should phase out headstand. The centre of gravity is changing as the weight increases and this will also make it difficult to balance. There are still many useful exercises one can use; breathing, back strengthening, perineal stretching and so on. One does not need to stop practicing Yoga during pregnancy, one simply changes the pattern of practice.

c) Although the brain itself has a protective mechanism to prevent an in-rush of blood, the outside of the head and perhaps the retinal veins of the eye may not. Any tendency for detachment of the retina may possibly be aggravated by the head-down position therefore. Again, I have never heard of a case of this.

People with extreme short sightedness are very prone to retinal detachment which if severe can blind, so any teacher with pupils who are myopic should be very careful. It might be advisable to tell them not to practice headstand because if someone did incur a detached retina and claimed that Yoga was the cause, it would be difficult to disprove this in a court. In some Local Authorities in London people entering Yoga classes are actually given a form to fill in stating that they do not have certain disorders such as epilepsy, high blood pressure and so on before they are allowed to enter the class, and this is mainly for reasons of medico-legal liability.

d) High blood pressure is a clear contra-indication. The auto-regulation which safeguards the brain from surges of blood operates between mean blood pressures of 60 - 160 mm Hg. Now if there is a raised blood pressure - say 220 mm systolic, which would make the mean pressure much higher than 160 mm - the operation of this mechanism becomes doubtful. If it should fail completely, when one went into the headstand position blood would rush into the brain. This might not do damage at all, however there could be a weak blood vessel somewhere.

e) If one has just finished Pranayama, breathing against resistance with retention, then the blood carbon dioxide level will have risen from about 4.5% to as much as 6.5%. One effect of this is dilation of the blood vessels in the brain. In this situation the auto-regulating system cannot control the blood flow, so that if one were to stand on one's head without allowing the body time to adjust, there would be nothing to stop blood pouring into the brain. This is presumably why Patanjali in his classic treatise on Yoga (Ref. 7) puts the practice of Asanas Pranayama and not the reverse.

f) It is often said that head-down positions should not be used when one has an ear infection. If the infection is otitis media, with a discharge from the middle ear, if it is draining properly, I cannot see any reason against headstand. Again if the infection is otitis externa, beyond the drum, I cannot see why this would be a contra-indication. Arteriosclerosis causing slow deafness without disturbance of balance is another condition where I can see no reason for or against practicing headstand.

- g) When one starts to practice headstand, temporary congestion of the sinus is quite common even when there is no sinus trouble. This is because the venous return is decreased, especially with shoulderstand where one is pressing on veins. As one becomes used to the posture this effect gradually disappears; generally chronic sinus trouble is not a contra-indication. The maxillary sinus is a hollow box with mucous membrane producing fluid which drains out of an aperture. This aperture is half way up the wall of the box and one has to rely on ciliary action to sweep the fluid out. If one has an infection here, then lying down in different positions and head-down postures may help to drain the sinus.
- H) Menières syndrome is a contra-indication but this is because often the balance is very poor and one may fall from the position. No one seems to know what causes this syndrome - whether it is vascular or due to an increase in fluid in the vestibular endolymphatic system and so on. I do not think that headstand would cause primary difficulties. Anyone with this, or any other condition causing vertigo and poor balance should avoid headstand and practice only shoulderstand, and similar inverted postures which use a wide base for good support.
- I) In principle I would tell anyone who has suffered concussion and after effects, to avoid headstand and shoulderstand too. This is because the post-concussive syndrome is very variable; it can last for four or five weeks or it can persist for several years. The Lancet published the results of a series of post-mortem examinations on jockeys who had fallen from their horses at some time, suffered concussion and apparently recovered. In many cases substantial and previously undetected brain damage was found (Ref. 6).

*Question:*

Does the headstand affect the pituitary gland?

*Answer:*

The hard facts are not easy to obtain and I know of no experimental work on this. It has only recently been discovered that the pituitary is controlled by the hypothalamus and it is not therefore the "master gland." Since the pituitary stimulating hormones control the adrenal, the thyroid, the sex glands and so on, it was thought that by monitoring the pituitary stimulating hormones to the various glands, one could observe the activity of the pituitary; whether it was responding to increased blood supply for example. However the pituitary is "switched on" by hormones released from the hypothalamus such as the thyroid releasing hormone. This acts on the pituitary to produce the thyrotropic hormone which acts on the thyroid to produce thyroid hormone which acts on all the cells.

So we need to be concerned not with the pituitary but with what triggers and sets it, and this is considered to be the hypothalamus area, at the moment. Maybe in ten years even more control systems will be discovered, but this is what is known now. It may well be the case that both the pituitary and the hypothalamic area will receive a better blood flow as a result of headstand, but one cannot draw any conclusion from this alone.

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Publications in print or preparation include:-

1. YOGA: Some Basic Principles. by Ian Rawlinson.
2. Medical and Physiological aspects of Headstand. by Dr. F. Chandra.
3. Introduction to the Philosophy of Patanjali — Lecture 1. by Francois Lorin.
4. Therapeutical Importance of Yoga Practices. by Dr. M. V. Bhole.
5. Introduction to the Philosophy of Patanjali — Lecture 2. by Francois Lorin.
6. Medical and Physiological Aspects of Yoga. by Dr. F. Chandra.