

## What does saliva testing show?

The only hormones that can be reliably tested in saliva are the steroid hormones including cortisol, DHEA, testosterone, progesterone and estrogens (estrone, estradiol and estriol). The molecular structure of these hormones is very important in explaining their presence in saliva as well as the reasons why you can't accurately measure them in serum.

A quick chemistry review: Steroid hormones are named for the sterane ring structure upon which they are based. The molecules are large and non-polar, which means that they are **insoluble** in water or other polar environments and are **soluble** in fat or non-polar compartments. Why is this important? Because the serum is an aqueous-like milieu and non-polar molecules cannot be present in a solution there. For this reason, the liver creates proteins that wrap around the non-polar hormones and make them soluble. These carrier proteins such as sex hormone binding globulin and albumin carry the hormone around, but the complexes are large, and the protein prevents the hormones from binding to target tissues, rendering them inactive. Only a small percentage of the hormones (1-3%) are unbound to a carrier protein at any given time.

When you test serum levels of steroid hormones, you get the total amount of the hormone present, which doesn't tell you what is available to the tissues that need it. Although saliva has high water content, it also has many mucopolysaccharides and glycoproteins that make it more favorable to non-polar molecules such as the steroidal hormones. The large protein-bound complexes are too large to pass into the saliva gland, therefore the hormones measured in saliva are unbound and bioavailable. Steroid hormones have been shown to be stable in saliva for at least two weeks at room temperature; this is most likely due to the protection by the mucopolysaccharide matrix in saliva.

Carrier proteins are primarily produced in the liver. When hormones are applied topically they are absorbed into the capillary beds, enter the blood stream, and sidestep the initial pass through the liver. In the absence of sufficient carrier protein, the lipophilic hormones attach themselves to the red blood cell membrane which is a non-polar environment made of phospholipids and cholesterol. The red blood cells deliver the hormone to the target tissues, including the saliva gland, but when blood is drawn for a serum hormone test, the hormones attached to the red blood cells are discarded. Therefore, saliva is the gold standard when it comes to monitoring topical hormone therapy.

Saliva collection is significantly easier than venipuncture, and it would be appreciably more convenient if we could test all body chemistry by simply having the patient spit into a tube, but unfortunately it is only the steroid molecules that can be accurately measured in saliva. The presence of peptide hormones (prolactin, leptin, growth hormone) and less polar molecules such as thyroid hormones in saliva does not reflect the levels available to all tissues.