AYUMETRIX

*Reinventing Diagnostics*

# SALIVA HORMONES

## CLINICAL RELEVANCE AND VALIDITY

# SALIVARY HORMONE TESTING

**A REVOLUTION IN DIAGNOSTICS**

## Saliva testing has recently received more acceptance for its application in terms of diagnosis and assessment of disease conditions, in spite of some resistance to using saliva testing for immediate treatment. It is of interest that saliva-based tests have gained a majority of attention due to the fact that the specimen collection is simple, easy and non-invasive.

The ease and convenience of sample collection and availability of recent advanced testing and analysis technologies render “whole saliva” as a system through which one can potentially learn and understand the health and wellness status of an individual. Studies have established the applications of salivary analysis in a wide range of clinical conditions[1].

In spite of being a complex biological fluid, saliva has time and again proven to be very valuable in terms of its diagnostic applications, as presented in several reports and peer-reviewed publications. Some of these studies have clearly established the convenience of saliva collection to study the role of estrogen and progesterone in ovarian function[2,3]. Salivary cortisol has now been well recognized as the “gold standard” for investigating adrenal function. Changes in diurnal rhythm of cortisol levels have been studied thoroughly in individuals with Cushing’s syndrome and a positive correlation has been established with abnormal night time salivary cortisol levels[4]. The relationship between altered circadian rhythm and breast cancer survival rates has been shown by Sephton et al in 2000[5]. There have been a number of other reports regarding altered salivary cortisol levels in various stress-related behavioral indicators[6]. Salivary testosterone levels have been shown to decrease significantly due to captivity of subjects in a military survival training study[7]. A few other studies have explored the relationship between anxiety disorders[8] and depression[9,10,11,12]with changes in salivary hormone levels. Another prospective longitudinal multicenter trial of 956 women established that a single salivary estriol measurement could predict high risk of pre-term labor in both symptomatic and asymptomatic women[13].

There have been many concerns and speculations surrounding salivary testing of hormones and other markers of interest. Due to lack of sufficient evidence in the past, hormone testing in saliva has not been able to gain much attention as a valid diagnostic aid. However, with over 500 published studies, accuracy of hormone testing in salivary samples has now been well established and validated[2,3,14,15].

At AYUMETRIX, we use the most advanced proprietary platforms with extreme care to address several standardization issues in addition to matrix differences between plasma and saliva to improve and maintain higher sensitivity of our testing and analysis methods. After extensive research, our scientific team has concluded that direct estimation of saliva hormones produces the most accurate and reliable test results with maximum hormone recovery.

Questions?

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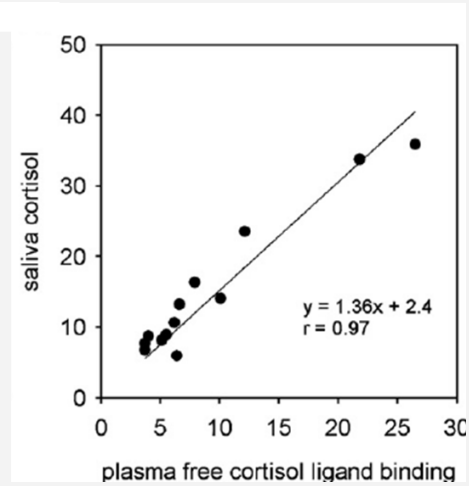
# Learn more about your patient's personal risk factors with the AYUMETRIX Salivary Hormone Test Panels

## Is there a Correlation between Salivary and Serum Hormone Levels?

There have been several arguments and questions raised about the accuracy and validity of hormone levels measured in saliva versus serum/plasma and what is the correlation, if any, between the two. Numerous studies have established a significant correlation between serum and saliva for hormone measurements. Worthman et al[16] measured salivary and serum estradiol levels in women and found that free levels of estradiol in saliva and serum are strongly correlated ($p<0.0001$). De Boever [17] found a good correlation between paired saliva and serum progesterone in healthy women during the regular menstrual cycle ($p<0.001$). In 2007, Arregger et al[18] found that salivary testosterone levels positively correlated with free serum testosterone in eugonadic men ($r=0.92$, $p=0.0001$). The study concluded that salivary testing can be used as a non-invasive approach to the diagnosis of male androgen deficiency.




## What are the Advantages and Disadvantages of Saliva Testing?

The major advantage of saliva testing is that it offers stress-free and non-invasive sample collection, which is suitable for pediatric, time-shift and behavioral studies. Specimen collection does not require any special training or equipment and subjects can collect their sample anywhere and any time in their own privacy and convenience. In addition, it has been well established that steroid hormone levels measured in saliva reflect the circulating level of free steroid rather than total levels, most of which are confounded by the presence of several binding proteins[19]. It is important to clearly understand which fraction of hormone (free or bio-available) is being measured by saliva testing. Free unbound hormone in blood underestimates the total bioavailable fraction, because it is not just the free hormone in blood, which is being delivered to the tissues. Protein-bound hormone in circulating blood is being delivered to the tissues in varying amounts, depending upon the type of hormone and the tissue. However, hormone levels in saliva represent the bioavailable fraction available to the tissues. Since this is the hormone fraction that has already been delivered to salivary glands and then diffused passively into saliva. Therefore, measuring free hormone in saliva is a better measure of the bioavailable fraction as compared to the free or protein-bound hormone in circulating blood, which "might" be delivered to the tissues.

There may also be some disadvantages in the use of saliva, depending on the testing technologies adopted by clinical laboratories. Saliva is a more difficult matrix to work with as compared to blood and may therefore require advanced steps for analysis, which may include physical or chemical disruption. Few laboratories use freeze-thaw cycles and centrifugation to break up mucins; others use dithiothreitol treatment to enhance filtration[20]. Some laboratories have been trying to use solvent extraction methods. However, extracting saliva samples significantly reduces the total steroid recovery and poses analytical problems since they are present at far lower levels in saliva than in blood circulation. Studies have shown that pretreatment of saliva and extraction methods may affect the concentrations of some steroid hormones, especially estradiol, progesterone, testosterone, cortisone and 17α-OH progesterone[21]. Direct estimation of salivary hormones produces accurate and reliable test results.

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