Body Mass Index and Salivary Estradiol

David T Zava, PhD and Mark S Newman, MS
ZRT Laboratory, Beaverton, Oregon, United States, 97008

Background

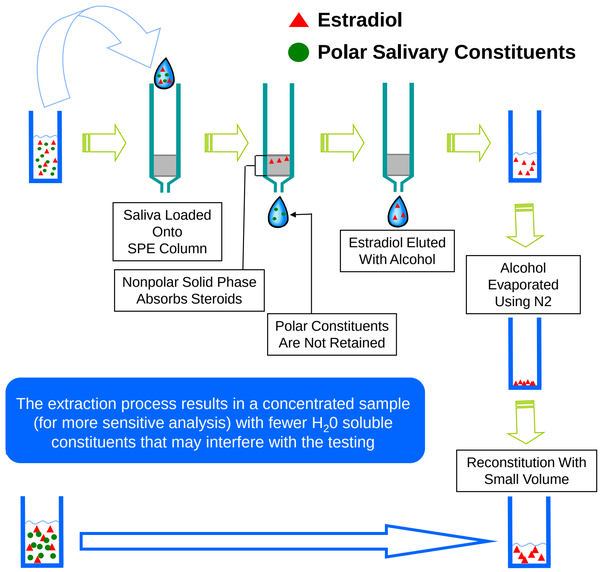
Skepticism surrounds the reliability of direct serum and salivary estradiol assays in postmenopausal women with very low levels of this hormone. In postmenopausal women serum estradiol has been shown to correlate strongly with body mass index (BMI), but only when the serum was first extracted then analyzed by gas chromatography/tandem mass spectrometry. This correlation was much less significant with other more conventional direct enzymeimmunoassays (EIA) due to interfering substances that can cause false-high estradiol levels. This same high background noise is also present in some salivary assays for estradiol, causing poor precision and accuracy, particularly in postmenopausal women with very low levels of estradiol.

Objective

Saliva provides a convenient, stress free, and patient-convenient method of testing steroid hormones; however, many of the commercially available direct assays lack precision at the very low levels of estradiol found commonly in anovulatory and postmenopausal women as well as men. With saliva extraction followed by concentration, the extremely low estradiol levels found in postmenopausal women can be detected with accuracy using a commercially available non-radioactive EIA. Using this ultra-sensitive salivary estradiol assay we have examined the relationship between salivary estradiol and BMI.

Materials and Methods

We used an automated EIA, following solid phase (C18 column chromatography) extraction, to measure estradiol levels in morning saliva samples from 12,049 premenopausal (day 19-21 of the menstrual cycle) and 16,034 postmenopausal women, not using exogenous hormones.

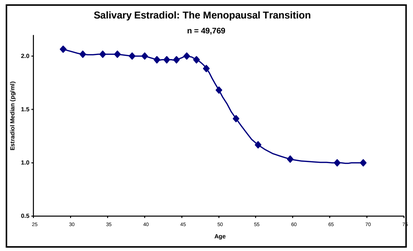


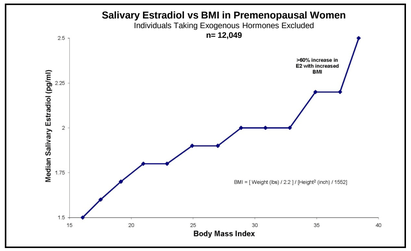
The extraction process results in a concentrated sample (for more sensitive analysis) with fewer H_20 soluble constituents that may interfere with the testing

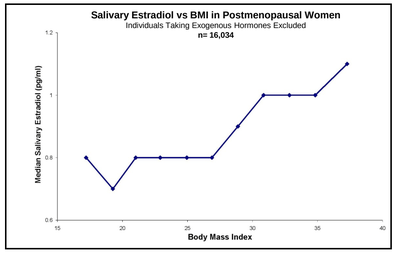
Results

Our extraction assay is linear from 0.5 to 1300 pg/mL estradiol, and the mean recovery for the extraction is 95.7%. Lower limit of detection is 0.35 pg/mL and functional sensitivity of the assay 0.7 pg/mL, allowing reliable assessments in the postmenopausal range. Mean (SD) estradiol levels (pg/mL) were 0.91 (0.88) for postmenopausal women, and 2.01 (1.37) for premenopausal women.

Salivary estradiol levels correlated positively with body mass index in both luteal phase premenopausal (R=0.36, P<0.001) and postmenopausal (R=0.022, P <0.005) women. This finding in premenopausal women confirms published research that suggests that follicular phase free estradiol levels decrease, but luteal phase levels increase, as BMI increases.







Conclusion

Our automated extraction/EIA method allows reliable salivary estradiol level determinations to be carried out in postmenopausal women, and can help elucidate the complex relationship between bioavailable estradiol and risk of breast cancer, cardiovascular disease, and osteoporosis.

References

1. Potischman N, Swanson CA, Siiteri P, Hoover RN. Reversal of relation between body mass and endogenous estrogen concentrations with menopausal status. J Natl Cancer Inst. 1996 Jun 5;88(11):756-8
2. Thomas HV, Key TJ, Allen DS, Moore JW, Dowsett M, Fentiman IS, Wang DY Re: Reversal of relation between body mass and endogenous estrogen concentrations with menopausal status. J Natl Cancer Inst. 1997 Mar 5;89(5):396-8.
3. Kaye SA, Folsom AR, Soler JT, Prineas RJ, Potter JD. Associations of body mass and fat distribution with sex hormone concentrations in postmenopausal women. Int J Epidemiol. 1991 Mar;20(1):151-6.