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EIW Distribution for Arginine Vasopressin in Normal Women and Men

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Abstract: ***In this paper we determine a greater sensitivity of the HPA axis to low-dose PHYSO in normal men than in normal women, which likely is mediated by increased secretion of AVP. The lack of difference in side effects between the two groups of subjects and the lack of significant correlations between presence or absence of side effects and hormone responses in either group suggest that the increased hormone responses in the men were due to increased responsivity of central cholinergic systems and not to a nonspecific stress response. A length-biased of the exponentiated inverted Weibull (EIW) distribution, is named as the length-biased exponentiated inverted Weibull (LBEIW). Some probability functions are derived, including the moments of this distribution. The length-biased inverted Weibull (LBIW) distribution is presented as a special case of the LBEIW distribution and Maximum likelihood estimation method is employed to parameter estimation.***

Keywords: ACTH, AVP, CRH, PHYSO, EIW, LPEIW

Notation:
t : Time of the variable
s(t) : Survival function of EIW distribution plasma tool
ACTH, plasma cortical, plasma AVP
h(t) : Hazard rate of plasma ACTH, plasma cortical, plasma AVP
g(x) :pdf of the variable.

1. Mathematical Model

Weibull distribution is perhaps the most widely used distribution to analyze the lifetime data. This distribution provides vast impact of reliability and quality control, such as ball bearings, automobile components, concrete bridges, de- mography, actuarial study, and electrical insulation. It is also used in biological and medical applications. Hence, applications to the lifetime or durability of manufactured items are common.

Let T be a random variable with Weibull distribution. Its probability den- sity function (pdf) takes the form:

$$f(t) = \lambda\beta(\lambda t)^{\beta-1} \exp\{-(\lambda t)^{\beta}\}; t > 0,$$

where $\lambda > 0$ and $\beta > 0$ are scale and shape parameters, respectively. This distribution includes especially the exponential and the Rayleigh distributions as special cases where $\beta = 1$ and $\beta = 2$, respectively. The Weibull distribution has a distribution function of the form:

$$F(t) = 1 - \exp\{-(\lambda t)^{\beta}\}.$$

The survival function and hazard rate are, respectively,
$S(t) = \exp\{-(\lambda t)^{\beta}\}$
and
$h(t) = \lambda\beta(\lambda t)^{\beta-1}$.

The hazard rate has several forms, e.g., decreasing, constant, increasing, bath- tub shape, W shape, etc. The Weibull hazard rate is monotone increasing if $\beta > 1$, monotone decreasing if $\beta < 1$, and constant when $\beta = 1$. The Weibull distribution is fairly flexible in providing a good description of many types of lifetime data [2] such as complete data, censored data. Censored data.

The EIW distribution was proposed by Flaih et al. The EIW generalizes the IW distribution and it has two shape parameters. If X has EIW distribution, its distribution function takes the following form:

$$F(x) = \{\exp(-x^{-\beta})\}^{\theta}; x > 0, \beta > 0, \theta > 0$$

The pdf of X is:

$$f(x) = \theta\beta\, x^{-(\beta+1)}\{\exp(-x^{-\beta})\}^{\theta}$$

The hazard rate of the EIW distribution is given by:

$$h(x) = \frac{\theta\beta\, x^{-(\beta+1)}\{\exp(-x^{-\beta})\}^{\theta}}{1 - \{\exp(-x^{-\beta})\}^{\theta}}.$$

2. Application

Fourteen normal women and 14 normal men matched on age and race were studied four times in the Clinical Studies Suite of Allegheny General Hospital. Age- and race-matching were done because of their relationship to HPA axis function. The subjects were recruited from hospital employees, their families and friends, and through public service announcements. The absence of past or present psychiatric illness in each subject was determined with the Structured Clinical Interview for DSMIII- R, Nonpatient Version.

The 14 female subjects had a mean age of 34.8 ± 9.0 years (22–52 years). Twelve were caucasian, and two were black. Twelve were premenopausal (two on contraceptive medication), one was perimenopausal, and one was postmenopausal. The latter two patients were taking conjugated estrogens, 0.625 to 1.25 mg per day.

None of the subjects was receiving thyroid replacement. Eleven women were nonsmokers; three smoked 15 to 20 cigarettes per day. The 14 male subjects had a mean age of 35.4 ± 9.3 years (22–52 years), and their race was identical

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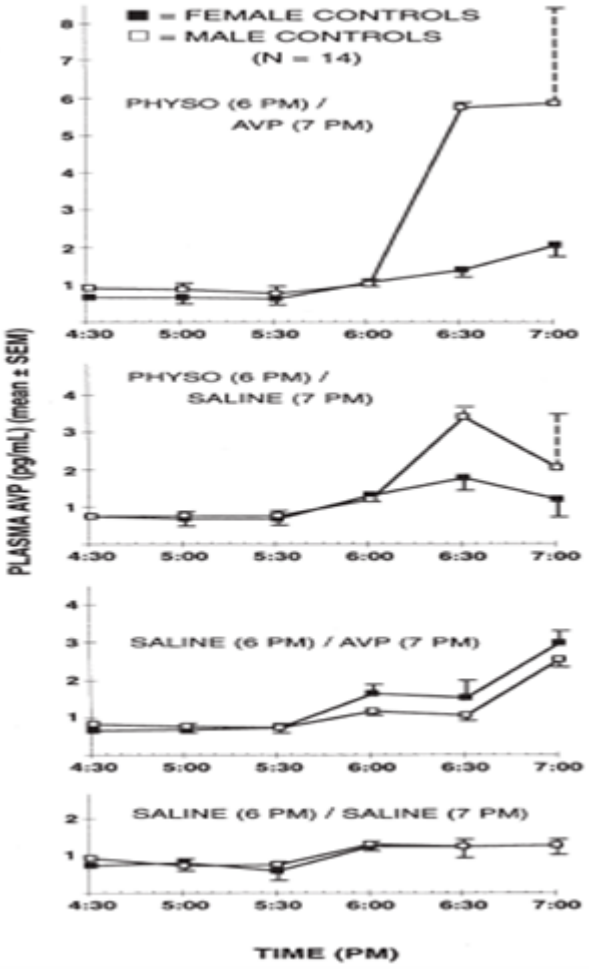
to that of the female subjects to whom they were matched. Ten men were nonsmokers, two smoked 10 cigarettes per day, and two smoked 15 to 20 cigarettes per day.

The following figure present the mean (6SEM) ACTH1-39, cortisol, and AVP values, respectively, at each time point for the female and matched male controls on the four test days. Afternoon baseline ACTH1-39, cortisol, and AVP did not vary systematically across the four test and baseline hormone coefficients of variation across the four days for both subject groups were all ,5.5%. The fact that the afternoon, baseline values of these stress-responsive hormones were not higher on the first or second test days.



Muscarinic neurotransmission appears to be involved in cholinergic stimulation of AVP secretion because scopolamine, a centrally active muscarinic cholinergic antagonist, blocked the AVP response to PHYSO in normal men, but mecamylamine, a centrally active nicotinic antagonist, did not (Pascualy et al. 1995). Of putative relevance is the cholinergic basal forebrain complex, which projects, among other areas, to the amygdala and hippocampus, important areas for stimulation and negative feedback, respectively, of the HPA axis (Fibiger et al. and Wainer et al), but it is difficult to propose a detailed neurophysiological and neuroanatomical model for our results.

3. Conclusion

In this paper the length-biased of inverted Weibull (BIW) distribution is used for find the hazard rate of AVP secretion differentially in young adult women and men. And also pdf of AVP by using EIW distribution formula.

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