

A common logistic system for the receptor of mineralocorticoids mediated inhibition of the hypothalamic pole of the adrenal pituitary in older people

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Abstract: In the present paper, we introduced the four parameters generalized log-logistic distribution using quadrature rank transmutation map to develop a transmuted four parameters common log-logistic distributions. Also the function of reliability for the four generalized log-logistic distributions is obtained. The continuous case of pdf and cdf for four parameters common log-logistic distributions are traditional. We looked at 10 fit men and 10 old men at the base of cortisol levels when the mineralocorticoid receptor mostly regulates the activity of the HPA axis.. In case of ACTH and Cortisol, both values are were significantly higher in older men compared with young men after fludrocortisone. Lastly, we suggest that the implementation part fits with the probability distribution and the outcome is well linked with the medical report.. This paper will be very useful for medical field in future.

Keywords: ACTH, Cortisol, log-logistic distribution

Mathematical subject classification: 62H_{xx}; 62N0₅; 90B25.

1. Introduction

The distribution of logistics is very useful in the field of analyzing survival. The probability density function (pdf) in its simplest form is given by

$$f(y) = \frac{1}{(1+y)^2} \quad y > 0 \quad \text{--- (1)}$$

Shah and Dave examined the distribution in some details [5]. Tadikamalla and Johnson [6], O'Quigley and Struther [3]. Ragab and Green [4]. Balakrishnan, Malik and Puthenpura [1] studied the logistical model with pdf given by the distribution

$$f(y; \alpha, \beta) = \frac{\beta \alpha^\beta y^{\beta-1}}{(\alpha^\beta + \alpha^\beta)^2} \quad y > 0, \alpha > 0, \beta \geq 1 \quad \text{--- (2)}$$

Where α is the parameter of the scale and β is the parameter of the form.

Olapade (2010) studied four parameters widespread logistics distribution given by pdf

$$f(y) = \frac{\beta \theta \alpha^\theta y^{\beta-1}}{(\alpha + y^\beta)^{\theta+1}} \quad y > 0, \alpha > 0, \beta \geq 1, \theta > 0 \quad \text{--- (3)}$$

Where $\theta > 0$ is the extra shape parameter with location parameter $\mu = 0$. He established its properties and stated that some theorems relating it to some other distributions.

Aryal [6] transmuted the log logistic model of Balakrishnan, Malik and Puthenpura [5] and obtained its mathematical properties and demonstrated its flexibility in the reliability analysis.

2. Mathematical Model and Assumptions

If a random variable X implements four wide ranging logistical classification parameters with probability function noted in [3] and accumulated probability function in [3]

$$F(y) = 1 - \left(\frac{\alpha}{\alpha + \alpha^\beta} \right)^\theta \quad \alpha > 0 \quad \text{--- (4)}$$

Where the scale parameter is α , shape parameters are θ and β . The corresponding transmuted four parameters widespread log-logistic distribution, using the quadratic rank map is given by

$$M(y) = (1 + \lambda) M(y) - \lambda M^2(y), [\lambda] \leq 1 \quad \text{--- (5) is given by}$$

$$M(y) = \frac{(\alpha + \alpha^\beta)^\theta y^{\beta-1} \{ (1 - \lambda)(\alpha + \alpha^\beta)^\theta + 2\lambda \alpha^\theta \}}{(\alpha + \alpha^\beta)^{2\theta+1}}, y > 0 \quad \text{--- (6)}$$

and the corresponding pdf is given by

$$h(y) = \frac{\beta\theta\alpha^\theta y^{\beta-1}\{(1-\lambda)(\alpha + \alpha^\beta)^\theta + 2\lambda\alpha^\theta\}}{(\alpha + \alpha^\beta)^{2\theta+1}}, y > 0 \quad \text{--- (7)}$$

The parameter $\lambda > 0$ is the transmutation parameter.

Because of the analytical structure, the widespread logistic distribution of the transmuted four Parameters can be a useful model to describe the failure time of a given system. The function $r(t)$ reliability is defined by the probability that a component will not fail before t ,

$$r(t) = 1 - F(t).$$

The function of reliability of the widespread log-logistic distribution of the transmuted four parameters is given by

$$r(t) = \frac{(1-\lambda)\alpha^\theta(\alpha + t^\beta)^\theta + \lambda\alpha^{2\theta}}{(\alpha + t^\beta)^{2\theta}}$$

3. Applications

Placebo versus Fludrocortisone

Fludrocortisone significantly reduces the levels of all two hormones in both age groups compared to placebo. However, variance analysis revealed a major effect of 'treatment' and a substantial correlation of 'treatment 3 times' for Adrenocorticotrophic hormone delta values, cortisol, and 11-deoxycortisol $F(3, 16) 1/4 9.22, p 1/4.001$ 'treatment 3 times'. Comparison tests showed that fludrocortisone decreased the delta values of all three hormones substantially during the second period between 6PM and 9 PM compared to placebo.

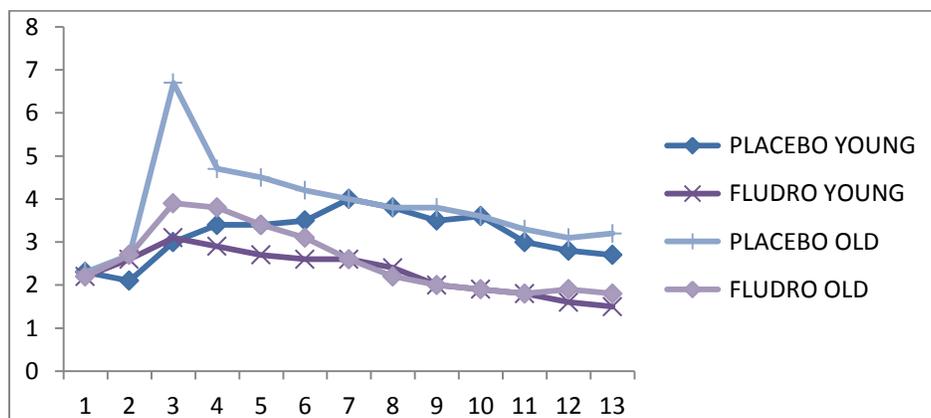


Figure 3.1. Mean ACTH 6 SEM (standard mean error) levels in active young and old men after chemical

treatment with 3 g of metyrapone at 2 PM and additional placebo or 1/2 mg of fludrocortisone p.o. At 3:00

a.m. Placebo: 1/4 metyrapone; Flu 1/4 fludrocortisone

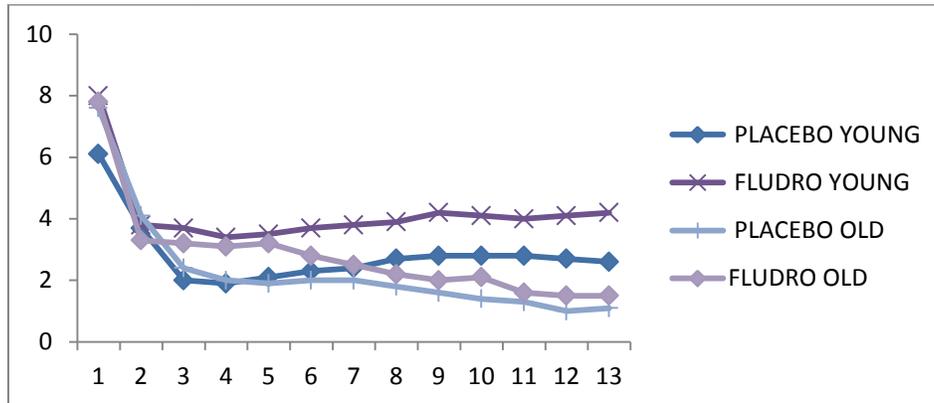


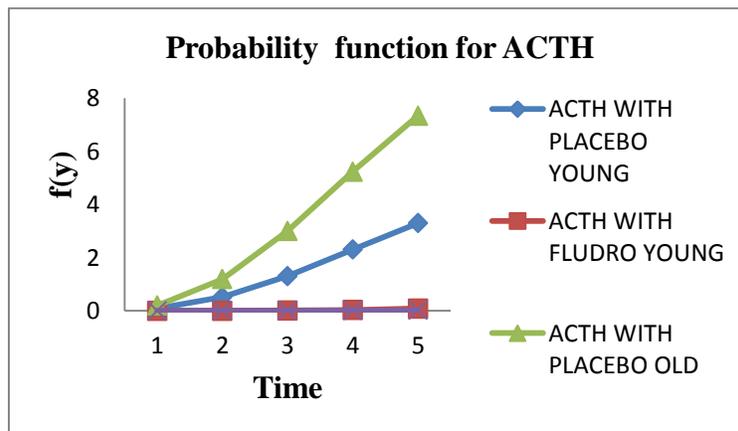
Figure 3.2. Mean cortisol concentrations 6 standard mean error after chemical treatment around 2 pm with 3 gram metyrapone and supplementary placebo or 1/2 mg fludrocortisone p.o. In safe ,older and younger people. Around 3'o clock 1/4 metyrapone; 1/4 placebo; 1/4 fludrocortisone flu.

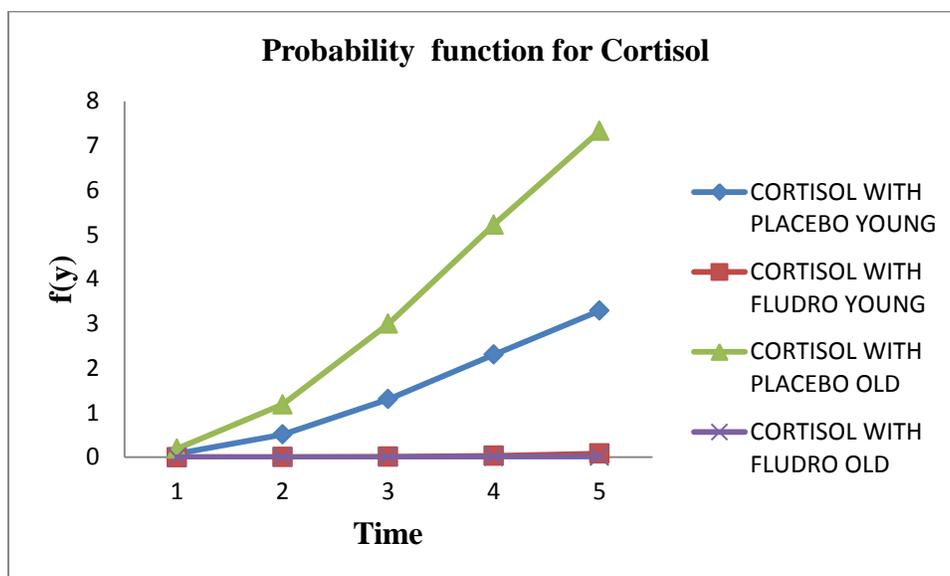
4. Older people versus young people

For young men, the inhibitory effect on fludrocortisones hormone levels was higher than older men. MANOVA showed a major association with 3-time age treatment of ACTH and cortisol and 11 delta deoxycortisol values.

ACTH values in the older group are significantly higher (see fig3.1) relative to young people in both conditions in the first group (see fig3.2). In addition, variations in age were observed for delta cortisol and 11- deoxycortisols levels in both placebo time intervals, suggesting higher concentrations after metyrapone in elderly participants (Contrast studies P, .05). In the Cortisones state, the discrepancies between young and old participants with higher concentrations in elderly participants for delta cortisol and 11- deoxycortisol were only important within the period.

5. Mathematical results





6. Conclusion

We introduced a new generalization of the four generalised log-logistic distribution parameters in this paper called the widespread log-logistic distribution of the four transmuted parameters. For both ACTH and Cortisol, we have plotted the probability density function. The secretion level of both for health fit and old men was also discussed. Lastly we conclude that the application part is well fitted with a probability model and the conclusion is compared with the medical report.

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Conflict of Interests

The authors declare that there is no conflict of interests.

References

- [1]Balakrishnan, N.,Malik,H.J., and Puthenpura, S.(1987). Best linear unbiased estimation of location and scale parameters of the log-logistic distribution.Communications in statistics – Theory and methods .Vol 12. Pp 3477-3495.
- [2]Kalman B, Spencer RL. Rapid corticosteroid-dependent regulation of mineralocorticoid receptor protein expression in rat brain.Endocrinol. 2002;143:4184–4195.
- [3]O’Quigley,J., and Struthers,L.(1982). Survival model based upon the logistic distribution. Computer programmes in Biomedicine Vol 15 Pp 3-12.
- [4]Ragab,A. and Green ,J. (1984) .On order statistics from the Log-logistic distribution and their properties. Communications in statistics –Theory and methods .Vol 13.Pp 2713-2724.
- [5]Shah,B.K and Dave,P.H. (1963), A note on log-logistic distribution .Journal of mathematical Sciences of University of Baroda .Vol12.Pp 21-22.

[6]Tadikamalla, P.R and Johnson, N.L (1982). Systems of frequency curves generated by the transformation of logistic variables .BiometrikaVol 69 Pp461-465.

[7]Wolf OT, Convit A, de Leon MJ, Caraos C, Qadri SF. Basal hypothalamus-pituitary-adrenal axisactivity and corticotropin feedback in young and older men: relationships to magnetic resonance imaging-derived hippocampus and cingulated gyrus volumes. Neuroendocrinol.2002; 75:241–249.