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A STUDY ON WEIBULL-G EXPONENTIAL DISTRIBUTION MODEL FOR SECRETION OF GNRH IN BEEF COWS

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ABSTRACT. In this present study, categorized data were analyzed by Weibull-G exponential distribution model, LH concentrations of the $\mathrm{PGF}_{2\alpha}$ reatment were analyzed by test- fix-best method with treatment ($\mathrm{PGF2}_{2\alpha}$) and time (0, 4, 8, 16, 32, 64hrs) as a main effect. GnRH induced in LH concentrations 10hr after $\mathrm{PGF2}_{2\alpha}$treatment was analyzed my effectiveness factor with treatment ($\mathrm{PGF2}_{2\alpha}$) and time (0, 4, 8, 16, 32, 64hrs) as a main effect. Area under the response curve and GnRH induced peak amplitude were analyzed by Weibull-G exponential distribution model. Using Mathematical Modeling by Weibull-G exponential distribution, the LH concentration remained relatively constant and similar for anestrous and cyclic cows. LH concentrations increased after $\mathrm{PGF2}_{2\alpha}$in both cyclic and anestrous cows but the increase was greater in anestrous cows where the predictability is easier considering the sample mathematically than the process of practical implementation which is a monotone process. It is concluded that the Weibull-G exponential distribution model is well fitted to analyze medical data mathematically. It is useful for medical professionals.

1. INTRODUCTION

The exponential distribution (ED) (Gupta and Kundu [2]), has a wide range of applications including life testing experiments, reliability analysis, applied

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statistics and clinical studies. This distribution is a special case of the two parameter Weibull distribution with the shape parameter equal to 1. The origin and other aspects of this distribution can be found in (Gupta and Kundu [3]). A random variable X is said to have the exponential distribution (ED) with parameters $\lambda > 0$ if it's probability density function (pdf) is given by

$$g(x) = \lambda e^{-\lambda x}, x > 0\,,$$

while the cumulative distribution function (cdf) is given by

$$G(x) = 1 - e^{-\lambda x}, x > 0.$$

The survival function is given by the equation

$$S(x) = 1 - G(x) = e^{-\lambda x}, x > 0,$$

and the hazard function is

$$h(x) = \lambda.L$$

Weibull distribution introduced by (Weibull [6]) is a popular distribution for modeling phenomenon with monotonic failure rates. But this distribution does not provide a good fit to data sets with bathtub shaped or upside-down bathtub shaped (unimodal) failure rates, often encountered in reliability, engineering and biological studies. Hence a number of new distributions modeling the data in a better way have been constructed in literature as ramifications of Weibull distribution.

2. Mathematical model and Assumptions

The three parameters Weibull-G exponential distribution (WGED) has been studied in this section. The cumulative distribution function (cdf) of the Weibull-G exponential distribution (WGED) is given by

$$F(x; a, b, \lambda) = 1 - e^{-a[e^{\lambda x}-1]^b}, a, b, \lambda > 0\,. \tag{2.1}$$

The pdf corresponding to equation (2.1) is given by

$$f(x; a, b, \lambda) = ab\lambda e^{\lambda x}[e^{\lambda x} - 1]^{b-1} e^{-a[e^{\lambda x}-1]^b}, \lambda > 0, \tag{2.2}$$

where $a, b > 0$ and $\lambda > 0$ are two additional shape parameters. We denote by $X \sim WGED(a, b, \lambda)$ a random variable having the pdf equation (2.2). The survival function, $S(x)$, hazard rate function, $h(x)$, reversed hazard rate function,

$r(x)$ and cumulative hazard rate function $H(x)$ of X, are given by

$$S(x;a,b,\lambda) = 1 - F(x;a,b,\lambda) = e^{-a[e^{\lambda x}-1]^b}, x > 0$$

$$h(x;a,b,\lambda) = ab\lambda e^{\lambda x}[e^{\lambda x} - 1]^{b-1}, x > 0$$

$$r(x;a,b,\lambda) = \frac{ab\lambda e^{\lambda x}[e^{\lambda x} - 1]^{b-1} e^{-a[e^{\lambda x}-1]^b}}{1 - e^{-a[e^{\lambda x}-1]^b}}, x > 0$$

and

$$H(x;a,b,\lambda) = \int_0^\infty h(x;a,b,\lambda)dx = a[e^{e^{\lambda x}} - 1]^b,$$

respectively.

3. Applications

In addition to its well established role of causing luteolysis, prostaglandin $F2_{2\alpha}$ ($PGF2_{2\alpha}$) has been show to enhance fertility in cattle. In a study involving 5000 dariy cows, [5] reported a higher calving rate (69% vs. 60%) in $PGF2_{2\alpha}$ treated cows than in untreated cows. $PGF2_{2\alpha}$ may exert a fertility effect by stimulating a release of luteinizing hormone upon demise of the corpus luteum and reduced and reduced progesterone concentrations reported that equine LH and follicle stimulating hormone (FSH) concentrations were elevated in pituitary and jugular venous blood after the administration of the synthetic $PGF2_{2\alpha}$luprostiol. The objective to determine if $PGF2_{2\alpha}$: (1) would cause a release of PH in the absence of progesterone in anestrous cows; (2) would affect the gonadotropin releasing hormone (GnRH)-induced LH release) would affect the GnRH - induced ovulation response of previously anestrous cows.

GnRH, another compound that exerts a fertility effect, has been demonstrated to hasten the first postpartum ovulation in beef cows. Although it has been shown that GnRH induced a high proportion of anestrous cows to ovulate (approximately 65%) the majority (approximately 85 %) had subnormal luteal phases. Subnormal luteal phases have also been identified in humans, other primates and sheep. Suggested caused of subnormal luteal phases in cattle include a premature release of $PGF2_{2\alpha}$. Another cause that has been identifies in humans and sheep is a preovulatory LH surge of less duration than a spontaneous LH surge; [4]. The objective of experiment was to determine if the profile of the preovulatory LH surge was associated with the occurrence of subnormal luteal phases in cattle [1,6].

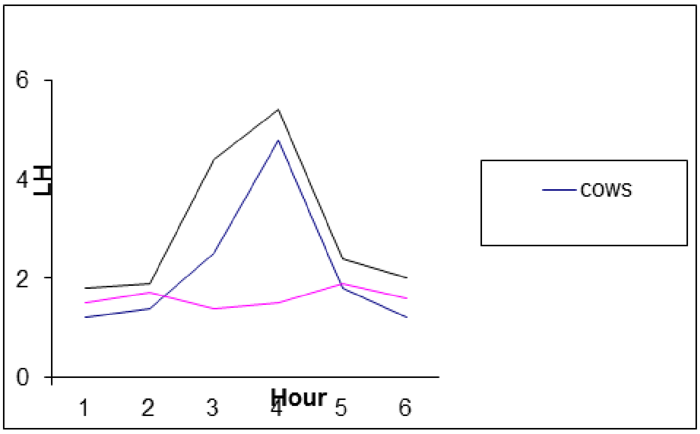

FIGURE 1. LH function

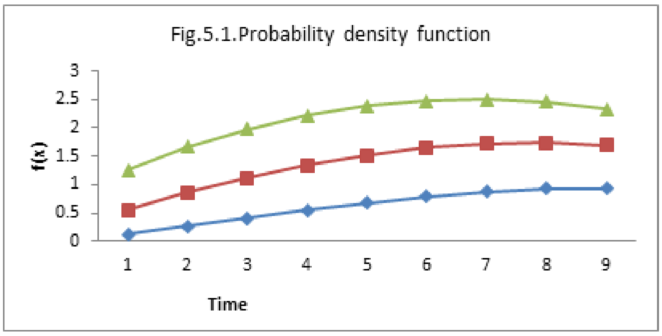

FIGURE 2. Probability density function

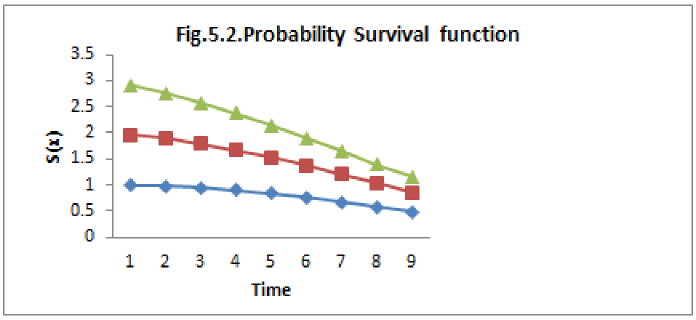

FIGURE 3. Probability Survival function

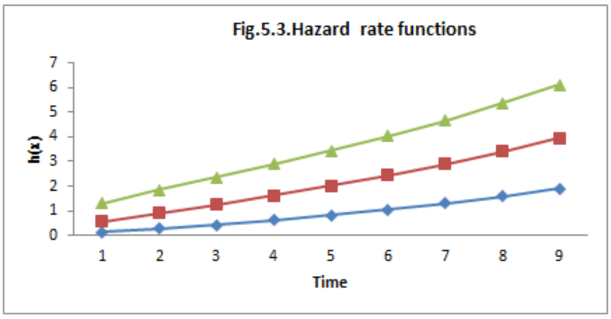

FIGURE 4. Hazard rate functions

4. CONCLUSIONS

In this present study, Categorized data were analyzed by Weibull-G exponential distribution model, LH concentrations of the PGF$2_{2\alpha}$ treatment were analyzed by test- fix-best method with treatment (PGF$2_{2\alpha}$) and time (0, 4, 8, 16, 32, 64hrs) as a main effect. GnRH induced in LH concentrations 10hr after PGF$2_{2\alpha}$ treatments were analyzed my effectiveness factor with treatment (PGF$2_{2\alpha}$) and time (0, 4, 8, 16, 32, 64hrs) as a main effect. Area under the response curve (determined mathematically) and GnRH induced peak amplitude were analyzed by Weibull-G exponential distribution model. Using Mathematical Modeling by Weibull-G exponential distribution, the LH concentration remained relatively constant and similar for anestrous and cyclic cows. LH concentrations increased after PGF$2_{2\alpha}$ in both cyclic and anestrous cows but the increase was greater in anestrous cows where the predictability is easier considering the sample mathematically than the process of practical implementation which is a monotone process. It is concluded that the Weibull-G exponential distribution model is well fitted to analyze medical data mathematically. It is useful for medical professionals.

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