A Study of Mathematical Model for Entropy – Based Measure of Uncertainty for ACTH as an Influential Control of Genetics Expression in Adrenal Glands

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Abstract:
In this paper, we look at a dual description of life distributions based on entropy that is realistic to past lifetimes. The formula for $\overline{H}$ (t) is used, The formula for past entropy of the Weibull distribution is found and used for the Application portion, which extends the improbability about its previous. Using mathematical models, we discovered various probability density functions and cumulative distribution functions for cortisol and androgen development. Finally, we conclude that the corresponding mathematical results have been obtained, and the medical solutions have been analysed.

Keywords: ACTH, Cortisol, Information entropy, GH, Reversed hazard feature, residual lifetime
Mathematical subject classification:$62H_{xx}; 62NO_5$

1. Introduction

Let Y be a non-negative, totally continuous random variable that describes an object's or an alive organism's random lifetime. The probability density function of Y is called f(y), the cumulative distribution function is called F(y), and the survival function is called (y) = 1-F. (y). The Shannon information index, also known as the differential entropy, is a classic measure of uncertainty for Y. defined as H = - E[log f(Y)]

$$= -\int_0^{\infty} f(y)\log f(y)dy \qquad (1.1)$$

The natural logarithm is denoted by log. Since the classic contributions by [13] and [19], the properties and virtues of H have been thoroughly investigated. A number of generalizations of (1.1) have also been proposed. The use of differential entropy as a measure of uncertainty in residual lifetime distributions has received a lot of attention in recent years. According to [5,] the discrete entropy of [Y / Y > t] is the residual entropy of a random lifetime Yi at time t. Conditional on B denotes a random variable of the same distribution as [Y / B]. Formally, the residual entropy of Y

is given by for all t > 0.H(t) = $-\int_t^{\infty} \frac{f(y)}{\bar{F}(t)}\log\frac{f(y)}{\bar{F}(t)}dy$

$$= \log \bar{F}(t) - \frac{1}{\bar{F}(t)}\int_t^{\infty} f(y)\log f(y)dy$$

$$=1 - \frac{1}{\bar{F}(t)} \int_t^{\infty} f(y)\log r(y)dy \quad (1.2)$$

Where r(t) = $\frac{f(t)}{\bar{F}(t)}$ is Y's failure rate or hazard feature. H(t) tests the uncertainty regarding an item's remaining existence given that it has lived up to time t. [1,5, 6, 7,8,11,12] have obtained various findings concerning H (t) in recent years. However, it's reasonable to say that in certain real-world situations, uncertainty extends not only to the future but also to the past. Look for a system whose state is only checked at predetermined intervals. The uncertainty is dependent on the past if the unit is inspected for the first time at time t and found to be down. Specifically, when (0, t) did it fail. As a consequence, it seems natural to have a definition of uncertainty that is close to residual entropy but refers to the present rather than the future. We'll assume F(0+) > 0 from now on without losing generality.

Assume that Y is a random lifetime, and that the PDF of [Y / Y t] is $\frac{f(y)}{F(t)}$ 0 < y< t . For all t > 0, the discrete entropy of [Y / Y t] will be called past entropy at time t of Y and denoted by $\overline{H}$ (t) = -

$$\int_0^t \frac{f(y)}{F(t)} \log \frac{f(y)}{F(t)} dy \quad (1.3)$$

Provided that an object has been discovered to be defective at time t, note that (t) [-∞, +∞]. $\overline{H}$ (t) expresses the degree of doubt regarding its previous life.

For the past entropy from (1.3), we have the following expressions:

$$\overline{H}\,(t) = \log F(t) - \frac{1}{F(t)} \int_0^t f(y)\log f(y)dy$$

$$= 1 - \frac{1}{F(t)} \int_0^t f(y)\log \tau(y)dy \quad (1.4)$$

Where $\tau(t) = \frac{f(t)}{F(t)}$ is the reversed hazard feature, also known as the reversed failure rate In reliability theory and survival analysis [2] and [3,] the role is getting more attention. Its function is dual to that of r(t), as some authors have pointed out (see, for example, [10]). r(t). Indeed, as will be seen in the following, the function of r(t) in the analysis of residual entropy performed by [5] is analogous to that of r(t) in the analysis of past entropy. The following relationship, which is a direct product of (1.4), will be used in the report.

$$\frac{d}{dt}\overline{H}\,(t) = \tau(t)\,[1 - \overline{H}\,(t) - \log \tau(t)\,] \quad (1.5)$$

II.APPLICATION

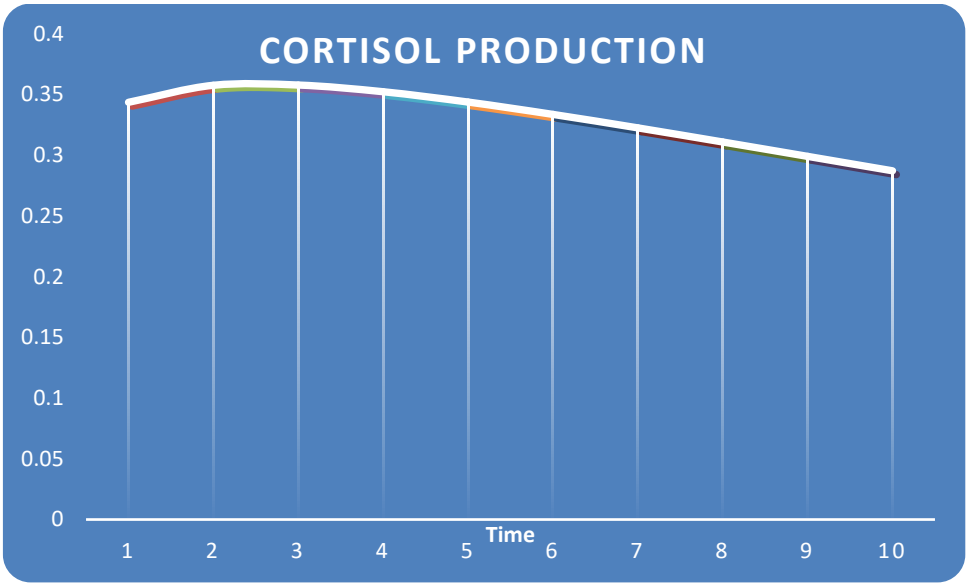


Fig (1): Outcome of Adrenocorticotropic hormone on cortisol fabrication in Human Fetal cubicles with respect to time. Human Adrenal cells were treated with or without adrenocorticotropic hormone for a set period of time, and cortisol was measured in the medium using an ELISA test. In renocorticotropic hormone-untreated adrenal cells, cortisol levels were comparable to protein levels. Statistics is measured with the aid of statistical tools.

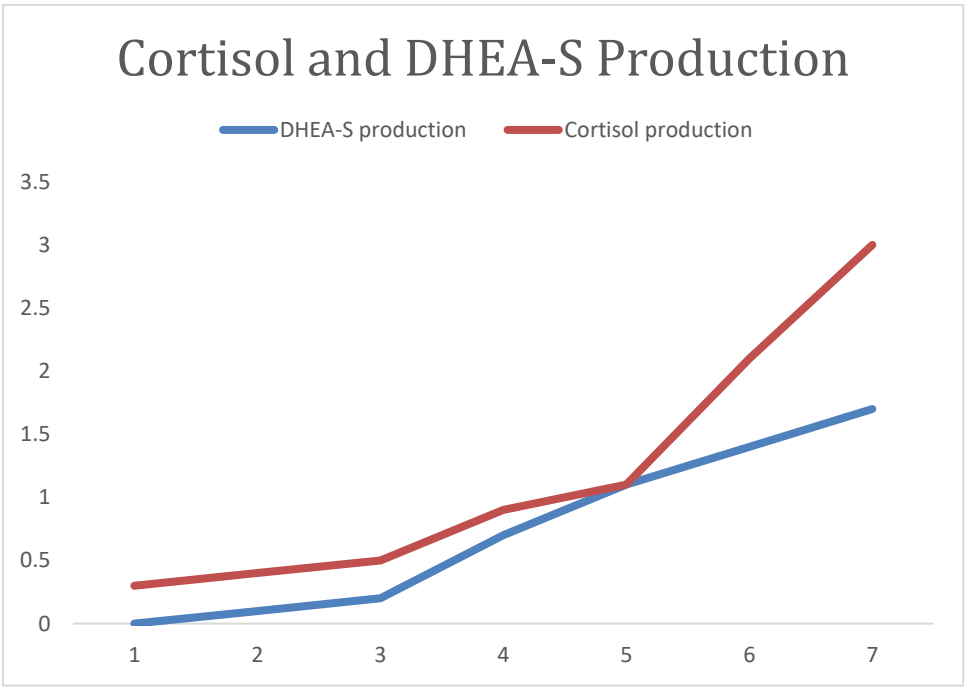


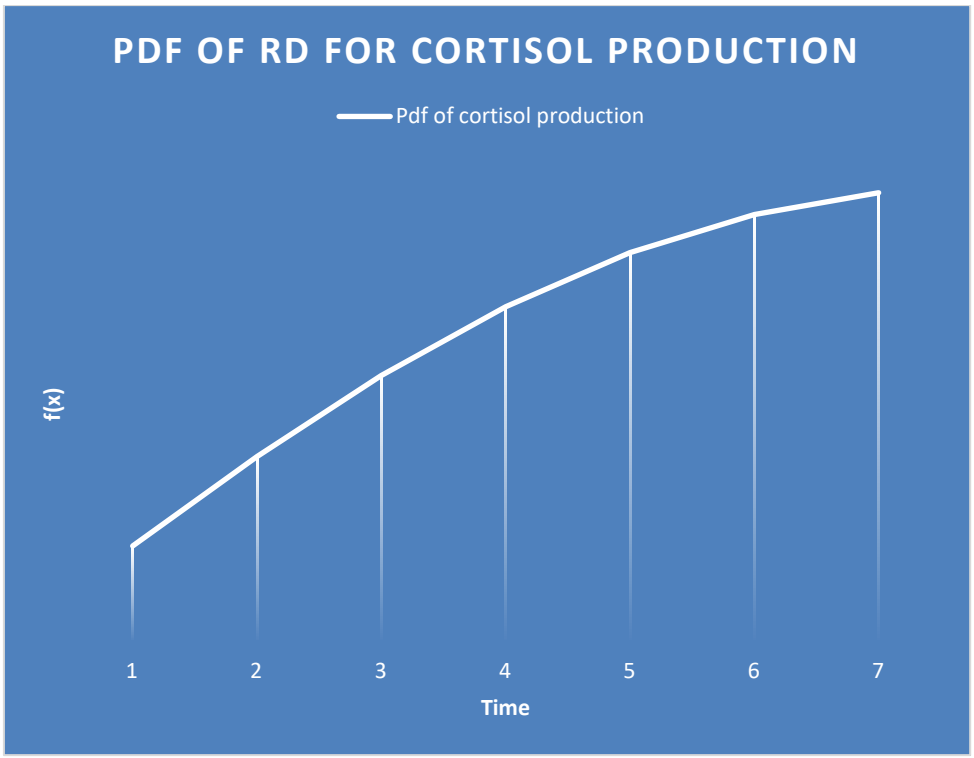
Fig (2): Outcome of Adrenocorticotropic hormone on cortisol and Dehydroepiandrosterone-Sulfate production in fetal adrenal cells with respect to time. The human fetal cells were altered to one percent low serum average overnight before the conduction of the experiment. Cells were treated with adrenocorticotropic hormone for a set amount of time until medium cortisol and Dehydroepiandrosterone-Sulfate were measured.

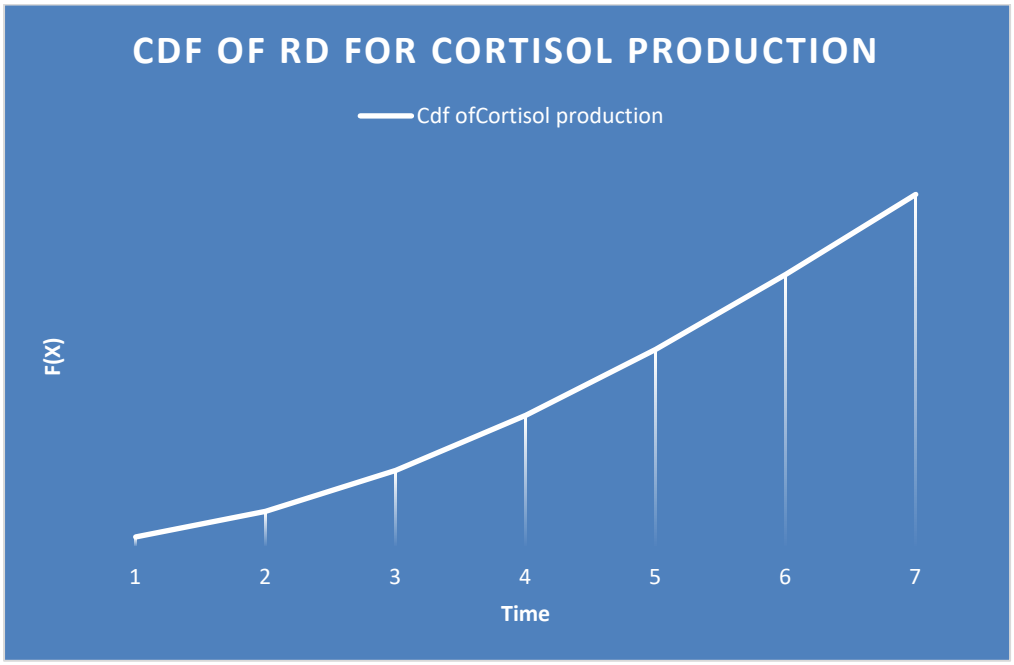
III.DISCUSSION

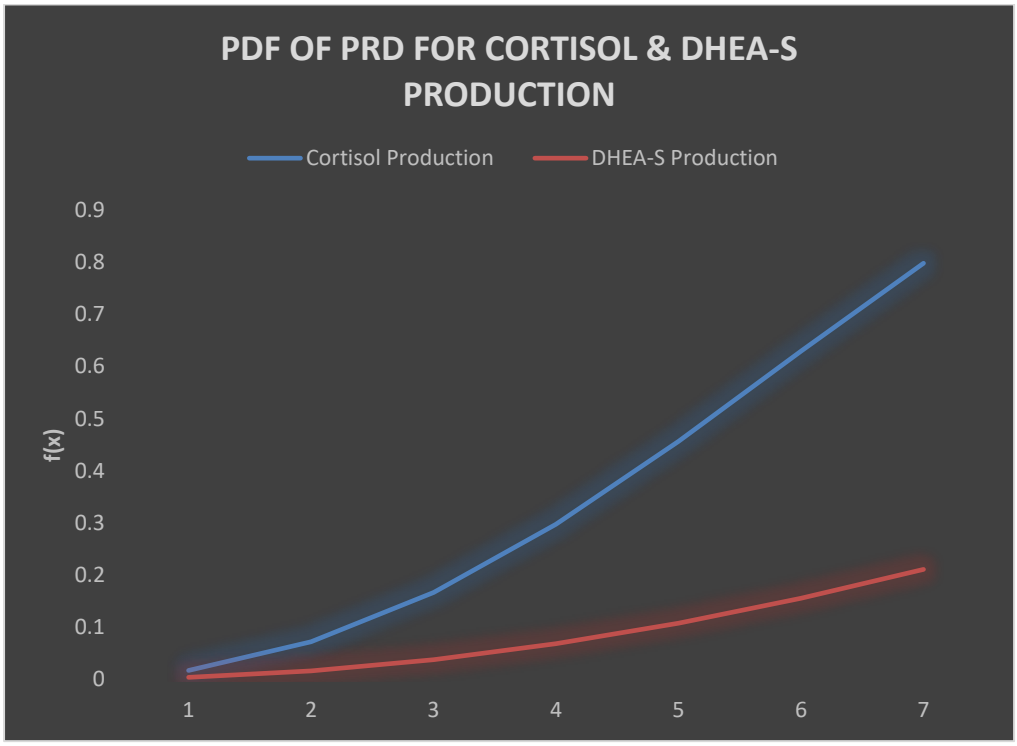
The most important measure of adrenal steroidogenesis is adrenocorticotropic hormone, which has been shown to assess aldosterone, cortisol, and Dehydroepiandrosterone-sulpate secretion. In addition to steroidogenic enzymes, other gene targets have been discovered. To demonstrate how Adrenocorticotropic hormone affects genomics, we used primary cultures of human adrenocorticol cells as models in this paper. The activation of genes encoding steroidogenic enzymes is part of the chronic reaction to adrenocorticotropic hormone, according to research in foetal and adult adrenal cells from a variety of organisms. The microarray technique was used to prove these gene targets in adult and foetal adrenal cells in the current debate.

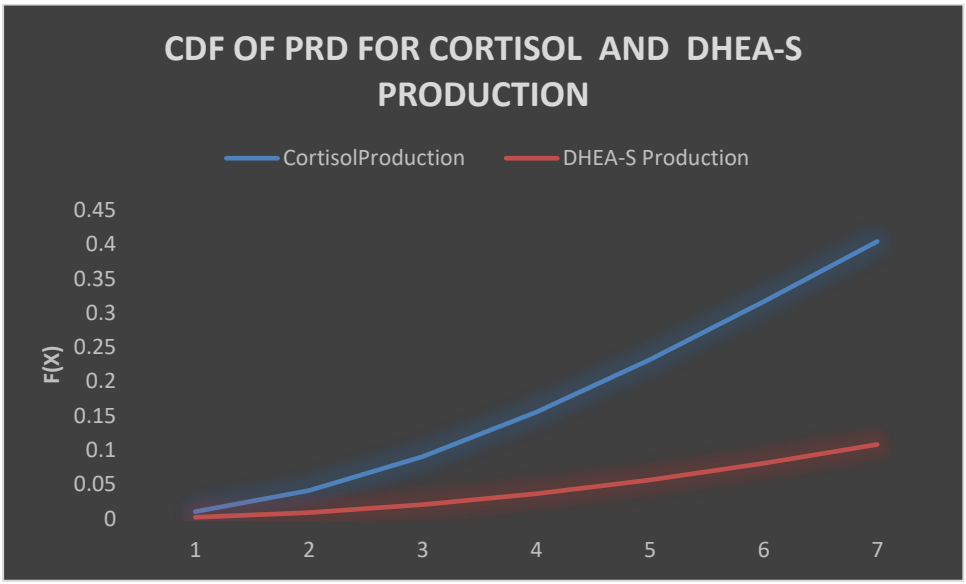
Adrenocorticotropic hormone therapy increased all steroidogenic enzymes needed for cortisol secretion. Adrenal cells were given Adrenocorticotropic hormone for twenty-four hours in this study, and five hundred and eighty-eight genes appeared to increase significantly. One of the genes that has increased in human foetal adrenal is the Gonadotropin Releasing Hormone Receptor gene. According to the previous discussion, Gonadotropin Releasing Hormone Receptor transcript was also induced in foetal adrenal after adrenocorticotropic hormone therapy, implying that it controls adrenocorticotropic hormone [14,15]. A chain of large Adrenocorticotropic hormone target genes emerged from a comparison of these distinct models. Because of the current discussion's use of a long-term procedure (48 hours), Adrenocorticotropic hormone (ACTH) delays gene expression by more than four times its normal rate. In both adult and foetal adrenal cells, only the home domain only protein Y is visible. It was discovered as a possible tumour suppressor gene in lung tumours. The development of cardiac disease was linked to a newly discovered Home domain-only protein [16,17].

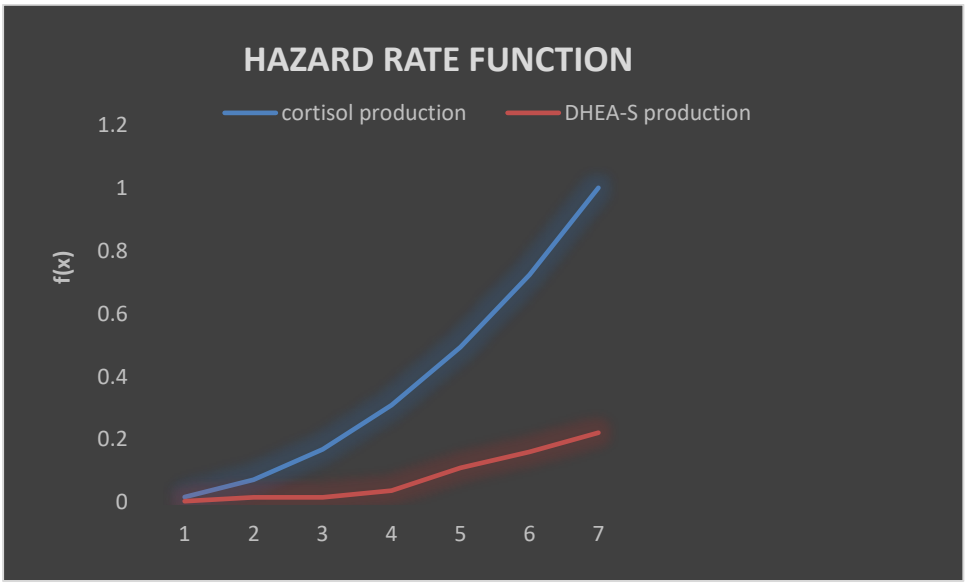
IV.MATHEMATICAL RESULTS




CDF OF RD FOR CORTISOL PRODUCTION
Cdf ofCortisol production
F(X)
1
2
3
4
5
6
7
Time


PDF OF PRD FOR CORTISOL & DHEA-S PRODUCTION
Cortisol Production
DHEA-S Production
f(x)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
6
7





V. CONCLUSION

In the residual life time distribution, the Shannon entropy can be used to reduce improbability. In this paper, we look at a dual characterization of life distributions based on entropy that is applied to the previous lifespan. For Cortisol and Dehydroepiandrosterone-Sulfate productions due to Adrenocorticotropic Hormone Stimulation, we obtained probability density functions and cumulative distribution functions of residual life time distributions, as well as a Hazard rate function. The genomic impact of adrenocorticotropic hormone in human adult and foetal adrenal cells were also addressed. Finally, we conclude that the implementation component is coinciding with mathematical models and conclusion is contrasted with medical solutions. This paper will be extremely useful in the medical and engineering fields in the future.

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Conflict of Interests

There are no conflicts of interest declared by the writers.

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