

# ACCEPTANCE SAMPLING FOR THE INFLUENCE OF TRH USING CRISP AND FUZZY GAMMA DISTRIBUTION

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## ABSTRACT:

*Acceptance sampling is a vital branch of study in Statistical Quality Control. While applying theoretical developments related to acceptance sampling in real life situations quite often problems of different kinds are faced by practitioners. In this paper we compare the Acceptance probability of Phosphatidic acid by the influence of TRH in GH3 Pituitary Cells by Using Gamma distribution with crisp and fuzzy parameter. The results are consistent and we have shown that crisp Gamma distribution lies in Fuzzy Gamma distribution*

**Key words:** Acceptance Sampling, Fuzzy gamma distribution, TRH, Phosphatidic acid

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## 1. INTRODUCTION

The term sampling inspection plan, is used when the quality of product is evaluated by inspecting samples rather than by total inspects, which required cost and time .Acceptance Sampling is one of the major component of the field of Statistical Quality Control. It is primarily used for the inspection of incoming or outgoing samples.

Acceptance sampling is classified into acceptance sampling plans by attributes and by variables. Acceptance sampling by attributes consists of different types of sampling plans, viz., single sampling plan, double sampling plan, multiple sampling plan, sequential sampling plan, continuous sampling plan, chain sampling plan and skip-lot sampling plan. The single sampling plan (SSP) by attributes is a commonly used and simple procedure. A single sampling plan is given by two parameters, the sample size  $n$  and the acceptance number  $c$ , which are to be determined based on the given requirements. Such determination of the parameters, in general, is termed as “designing of single sampling plans by attributes”.

Acceptance sampling is used for quality assurance and in recent years, it has become typical to work with suppliers to improve the process performance. Single sampling plan for attribute is one of the widely used acceptance sampling methods for acceptance or rejection of the sample based on a single sample.

Classical acceptance sampling plans have been studied by many researchers S. S. Gupta et al [1], [2], Soundararajan, V.[3], Hald, A.[6], M. Aslam et al [12], [13]. Single sampling by attributes using membership functions were discussed by Kanagawa and Ohta et al [8], [9],[11] and Grzegorzewski[7]. Sampling plan by attributes for vague data were considered by Hryniewicz [10].

The present studies were undertaken to determine whether increased  $32P$  orthophosphate accumulation in Phosphatidic acid in GH3 cells in response to TRH stimulation was secondary to prior hormone activated inositol phosphatide breakdown. The results presented here demonstrate that TRH rapidly promotes the phosphodiester hydrolysis of PtdIns-4-5 and PtdIns-4-P and the appearance of diacylglycerol and corresponding inositol polyphosphates in intact GH3 cells.

**2. NOTATIONS**

N	-	Sample Size
c	-	Acceptance number
$\lambda$	-	Scale Parameter of Gamma distribution
r	-	Shape Parameter of gamma distribution
$\bar{p}$	-	Probability of acceptance
$\bar{\mu}$	-	$\frac{r}{\lambda}$
Y	-	$\frac{n\mu}{r + n\mu}$
$\lambda[\alpha]$	-	$\alpha$ cut of Scale Parameter
$r[\alpha]$	-	$\alpha$ cut of Shape parameter
$\bar{p}[\alpha]$	-	$\alpha$ cut of the Acceptance Probability

**3. ACCEPTANCE SAMPLING PLAN FOR CRISP GAMMA DISTRIBUTION**

The single sampling attributes plan (n, c) is considered with the probability of acceptance based on the Poisson model with the average probability of acceptance is given by  $P = \sum_{x=0}^c \frac{e^{-\lambda} \lambda^x}{x!}$  and if p follows a Gamma

distribution with density function  $f(t, \lambda, r) = \frac{\lambda^r t^{(r-1)} e^{-\lambda t}}{\Gamma(r)}$ ,  $t \geq 0$ , Then The average probability of acceptance

P is approximately obtained by

$$\begin{aligned}
 P &= \int_0^1 P_{(n,p)}(t) f(t) dt \\
 &= \sum_{x=0}^n \frac{n^x \lambda^{\alpha} \overline{r+x}}{x!(n+\pi)^{(r+x)} \bar{r}} \\
 &= \sum_{x=0}^c \binom{r+x-1}{r-1} \left( \frac{\lambda}{n+\lambda} \right)^r \left( \frac{n}{n+\lambda} \right)^x \\
 &= \sum_{x=0}^c \binom{r+x-1}{r-1} \left( \frac{r}{r+n\mu} \right)^r \left( \frac{n\mu}{r+n\mu} \right)^x
 \end{aligned}$$

Where  $\mu = \frac{r}{\lambda}$

$$P = \sum_{x=0}^c \binom{r+x-1}{r-1} (1-y)^r y^x$$

Where  $y = \frac{n\mu}{r+n\mu}$

#### 4. ACCEPTANCE SAMPLING PLAN FOR FUZZY GAMMA DISTRIBUTION

If  $\lambda$  and  $r$  are unknown we must estimate them from a random sample and we obtain a fuzzy estimator  $\bar{\lambda}$  for  $\lambda$  and  $\bar{r}$  for  $r$ . Now consider the probability density function of fuzzy gamma distribution for the fuzzy numbers  $\bar{\lambda}$  and  $\bar{r}$ ,

$$\bar{f}(t, \lambda, r) = \frac{\lambda^r t^{(r-1)} e^{-\lambda t}}{\Gamma(r)},$$

$$t \geq 0, \lambda \in \bar{\lambda}[\alpha], r \in \bar{r}[\alpha]$$

The Fuzzy Acceptance Probability by gamma Distribution is defined by

$$P = \sum_{x=0}^c \binom{r+x-1}{r-1} (1-y)^r y^x$$

Where  $y = \frac{n\mu}{r+n\mu}$  and  $\lambda \in \bar{\lambda}[\alpha], r \in \bar{r}[\alpha]$

and  $P = [P_1[\alpha], P_2[\alpha]]$

Where

$$P_1[\alpha] = \text{Min} \left\{ \sum_{x=0}^c \binom{r+x-1}{r-1} (1-y)^r y^x \right\}$$

$$P_2[\alpha] = \text{Max} \left\{ \sum_{x=0}^c \binom{r+x-1}{r-1} (1-y)^r y^x \right\}$$

Where  $y = \frac{n\mu}{r+n\mu}$  and  $\lambda \in \bar{\lambda}[\alpha], r \in \bar{r}[\alpha]$

#### 5. APPLICATION

Activation by TRH of PtdIns-4,4-p2 and PtdIns-4-P hydrolysis was evident at 5sec and maximal by 10-15sec of hormone treatment [4], [5]. Hence TRH stimulated polyphosphoinositide breakdown is a very proximal event linked to receptor occupancy and may play a significant role in transducing the TRH signal. The study described here were designed to establish whether increased labeling of phosphatidic acid resulted from prior hormone induced breakdown of and inositol phosphatide. GH3 cells were prelabeled with  $^{32}\text{P}$  orthophosphate or myo - 3H inositol. Addition of TRH resulted in the rapid disappearance of labeled polyphosphoinositides, whereas levels of phosphatidylinositol and other phospholipids remained unchanged TRH promoted polyphosphoinositide breakdown was evident by 5s and maximum of 15 s of hormone treatment.

The hypothalamic tripeptide, thyrotropin-releasing hormone, acutely stimulates pituitary prolactin and thyrotropin secretion. Pituitary receptors for TRH have been characterized in radioligand binding studies and evidence for their cell-surface membrane localization has been presented

Samples were incubated with 0.1mc/ml of  $^{32}\text{P}$  orthophosphate for 1Hr. Following the pre incubation, duplicate Samples were treated with 1Um TRH for the indicated times .A second pair of dishes was treated with water for the same period of time. The percentage levels of phosphatidic acid were calculated. TRH treatment also rapidly increased  $^{32}\text{P}$  PA levels in long term labeled cultures. Hormone stimulation of PA accumulation occurred more slowly than hormone induced ZPtdIns-4, 5-P2 and PtdIns-4P breakdown. In several experiments a lag of 10-15 s

following TRH addition was observed. A Maximal stimulation of PA accumulation was evident by 1 min of treatment.

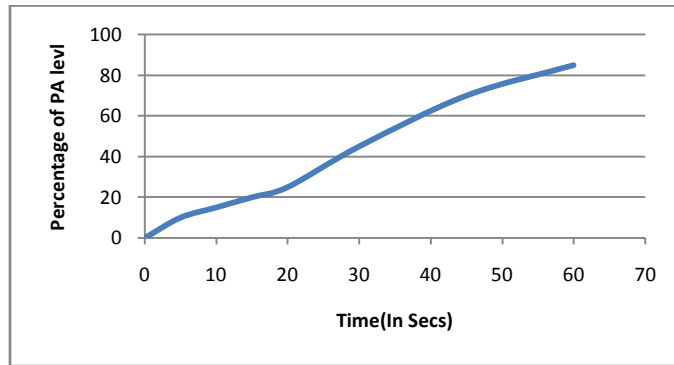


Fig 5.1. Percentage of Phosphatidic acid increasing

**5.1 Solution by Crisp Gamma distribution**

From that Experiment the scale and shape parameter of the Gamma Distribution are  $\lambda = 0.048$  ,  $r = 2.056$  . Assume that the Acceptance number  $C = 1$ , we get Table 5.1

Number of Samples	Values of Y	Probability of Acceptance
3	0.984252	0.000594335
4	0.988142	0.000332527
5	0.992063	0.000146038
6	0.993377	0.000100748
7	0.994318	7.35726E-05
8	0.995025	5.60178E-05
9	0.995575	4.40364E-05
10	0.996016	3.55025E-05
11	0.996377	2.92136E-05
12	0.996678	2.44483E-05

Table 5.1: Crisp Acceptance Probability for various Sample Size

**5.2 Solution by fuzzy Gamma Distribution**

From the above data we have  $\lambda = 0.048$  ,  $r = 2.056$

Assume that the corresponding triangular fuzzy numbers for the scale and shape parameters are

$$\bar{\lambda} = [0.040, 0.048, 0.054]$$

$$\bar{r} = [2.045, 2.056, 2.070]$$

and the corresponding  $\alpha$  cuts are

$$\bar{\lambda}[\alpha] = [0.040 + 0.008\alpha, 0.054 - .0006\alpha]$$

$$\bar{r}[\alpha] = [2.045 + 0.011\alpha, 2.070 - .014\alpha]$$

Under  $\alpha = 0$

$$\bar{\lambda}[\alpha] = [0.040, 0.054]$$

$$\bar{r}[\alpha] = [2.045, 2.070]$$

Sample Size	P <sub>1</sub> [ $\alpha$ ]	P <sub>2</sub> [ $\alpha$ ]
3	0.000411471	0.000753256
4	0.000229808	0.000422
5	0.000146038	0.000268673
6	0.000100748	0.000185583
7	7.35726E-05	0.000135646
8	5.60178E-05	0.00010335
9	4.40364E-05	8.12871E-05
10	3.55025E-05	6.55618E-05
11	2.92136E-05	5.39668E-05
12	2.44483E-05	4.51768E-05

Table 5.2 Fuzzy Acceptance Probability for various Sample Size

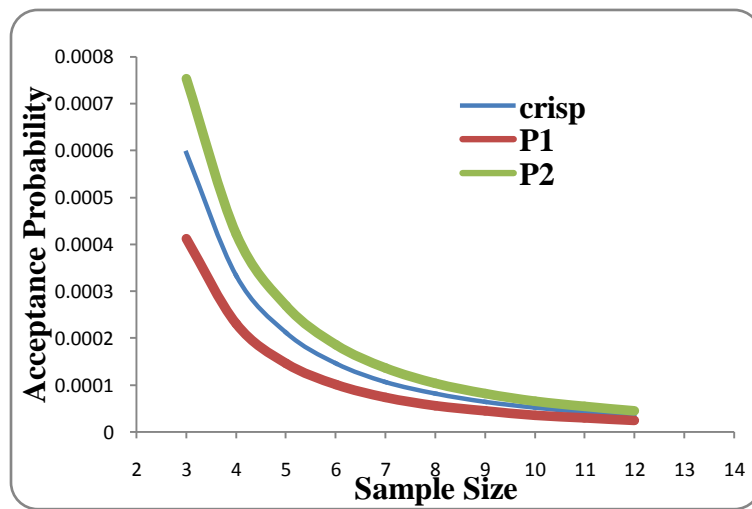


Fig 5.2 Crisp and Fuzzy acceptance probability curves

## 5. CONCLUSION

In this study we compare the acceptance probability of Phosphatidic acid by the influence of TRH in GH3 Pituitary cells by using Gamma distribution with crisp and fuzzy parameter. We showed that the acceptance probability of crisp Gamma distribution lies between the Fuzzy acceptance probability levels.

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