

## ACCEPTANCE SAMPLING MODELS FOR ROLE OF GLUCOSE IN DIABETICS

SANCHAIKUMAR N AND KOMAHAN G

**ABSTRACT.** In the current scenario, it is a known fact that Diabetes, a syndrome of irregular metabolism, is a threat to common people as a lifestyle and genetic disorder. This syndrome happens due to lifestyle disorder and genetic reasons which result in high blood and sugar levels. The reasons of Diabetes are increase in insulin level, growth hormone, and epinephrine, glucagon control blood glucose levels, glucocorticoids, and thyroxine. Hence, this research study analyses the statistical data of the materials of various diabetic patients in terms of Age Group, Marital status, Gender and Social status etc.,

### 1. Introduction

In the contemporary world, Diabetes is considered as epidemic mostly because of lifestyle disorders. This is due to the current working style which was different from our past as hunting societies. Diabetes is classified into two types such as Type 1 (Juvenile Diabetes) and Type 2 (Adult onset diabetes). Out of these two types, Type 1 diabetes occurs as a hereditary syndrome. It happens highly around the age of 14 years among 4-20 % per 100,000 persons. Additionally, this type is an autoimmune syndrome characterizes just 10% of diabetes among people. The normal indications of diabetes in patients are frequent urination, highly thirsty and hungry. These indications have grown swiftly in Type 1 Diabetes within weeks or months. The recurrent urination is the result of low level of water reabsorption in the kidney due to the uneven osmotic level of glucose in the blood. Being highly thirsty is the outcome of dehydration of frequent urination and its weakness. There are other symptoms of diabetes such as slow healing of wounds, weight loss, fatigue and blurred vision because of glucose absorption in the retina in the eyes.

Type 1 diabetes leads to diabetic ketoacidosis in which the smell of the urine is very similar with acetone. Low insulin level of diabetes creates atherosclerosis which causes high threat of heart disease in patients. Over the time of period, diabetes affects the nervous system as well as blood vessels. This enhances the possibility of foot injury and reduces the immunity strength of the body against preventing infection. As a consequence, the patients may undergo amputation if the situation becomes severe.

---

2010 *Mathematics Subject Classification.* 97Mxx, 97R20, 97R30.

*Key words and phrases.* Acceptance sampling model, Testing of Hypothesis, glucose-insulin metabolism.

In order to avoid severe consequences, diabetes should be treated with utmost care and proper medication. For instance, osmotic imbalance in the body results in nerve damage and kidney damage as well as the effect of the damage in the optic nerve may be blindness. Our body gets the energy for its sustenance from the foods which we intake. The raise in the level of glucose in our body is due to the intake of carbohydrates which disseminate into only sugar in the blood. Through this process, our cells can use the energy for the metabolic activity.

Nevertheless, glucose plays a significant role in our body. If the level of glucose is very high, then the pressure also might be high. This increased levels cause harmful effects in the tissues. On the other hand, for normal people without diabetes, the increased glucose concentration makes the  $\beta$ -cells, which are present in the pancreas, carry the insulin to the blood along with various hormones. Hence, in different ways, Insulin has an effect on glucose concentration such as the smooth progress of transporting glucose to various cell membranes specifically in changing glucose to glycogen in the liver and in skeletal muscle. This changing process in the liver supplies enough storage of glucose consumption in the future. So, it is a clear fact that high level of insulin would end up in decreasing the glucose concentration in the blood level. Thus the feedback system facilitates the body strictly to regularize the glucose level in order to the balance.

In regularizing blood glucose, other major hormones than insulin have involved in it. At time of demand of high energy, Epinephrine (adrenalin) disseminates glycogen and increases the production of glucose. This type of hormone operates exactly opposite to the way of insulin to enhance blood glucose. Glucocorticoids help in carbohydrates metabolism specifically in the liver area as well as enhances glucose level. The effects of insulin are blocked by the growth hormone by decreasing the liver consumption of glucose and diminish muscle reaction to insulin. In the process of regulating glucose concentration in the blood, other hormones creates difficult regulatory system which is essential in keeping the blood glucose in terms of supplying energy to every cell in the body.

**Blood glucose level:** Glucose is one of the energy sources for every tissue and organ in the body. It has a significant part in the metabolic activity of all vertebrate. Varieties of hormones such as glucocorticoids and thyroxine, insulin, glucagon, growth hormone and epinephrine are controlled the blood glucose levels in the body. For every individual, blood glucose concentration is in optimal level in which excessive level of it would cause rigorous pathological situations which eventually ends in life threatening risk of diabetes. The level of blood glucose in our body has a tendency to be self-regulatory. Simultaneously, they are vulnerable to some hormones like insulin which reduces the blood glucose level. As per the essentiality in BGRS, this research paper has referred two hormones.

**Insulin** is segregated by  $\beta$ -cells in the pancreas in order to dominate the activity of BGRS as well as reduce the blood glucose level. It assists in the intake of sugar in the process of consumption of glucose in tissues and muscles. The cells of pancreas secreted the Glycogen. The extra glucose has been kept in the liver as Glycogen. If there is a need at the time of low blood sugar, then the glycogen has been converted into the form of glucose. Hence, the major role of glycogen is to change its form to glucose whenever there is a necessity.

To identify a person has diabetes or not, an Oral Glucose Tolerance Test or Fasting Blood Sugar have been used. FBS means a fasting test in which a person should not taken food for 8-10 hours before the blood test for diabetes. In this case, majority of the people prefer to do the test in the morning in an empty stomach. In this test, the normal blood glucose level is 70 mg/dl to 110 mg/dl. If the blood glucose level is 100 mg/dl to 125 mg/dl, then it will be considered as impaired or pre-diabetic condition. If the blood glucose level is more than 125 mg/dl, then it is clearly the symptom of Type 2 diabetes.

## 2. Application

**2.1. Diabetics in India.** Generally, people in India have different perspective and understanding on diabetes as well as various medical health care accessibilities of it. People from upper economic-socio status have better understanding of the risk factors and medication for controlling the disease rather than the lower middle class as per the report given by India in July 2017. Among these communities, the upper class has the comprehend knowledge of preventive measure whereas the lower middle class has taken medication only after they are affected by the disease without knowing the severity of it.

Usually the notion of the diabetic cases in India is that only elderly people have been affected or it is an old age disease. Contrarily, irrespective of age group is affected by the disease because of lifestyle disorders and changes in working hour in their life. It is notable that 2% of women from age group of 15-19 years and 2.6% from 20-25 years are having high level of blood glucose in their body. As per the report from NHFS 2015-2016, similar with the age group mentioned above, Men have 2.9% and 3.7 respectively. According to the registry of Indian Council of Medical Research of youth diabetic, at the present condition, 1:4 persons under the age of 25 years have adult-onset diabetes whereas normally this condition prevails among 40-50 years old age group people. In October 2016, Anoop Misra, chairman, Fortis Centre of Excellence for Diabetes, Metabolic Diseases and Endocrinology, New Delhi, India has opined that, Diabetes strikes Indians a decade earlier than the [rest of the] world. This causes reduced productivity, increased absence in the working population, and gives more time for complications to arise.

Among the death rates of diabetes per 1,00,000 population in Indian states, Tamil Nadu stands highest followed by followed by Punjab and Karnataka . These rates are crossed the national average of 23. These states are not the poorest states but richest in India. At this juncture, we have to notice that diarrhoeal diseases or tuberculosis are not reason for loss of life or disability but cholesterol, high blood pressure and cardiovascular disease.

Even though genetic weakness as a reason is the key factor in the beginning of diabetes with more possibility in South Asian population rather than Europeans, eating habits, diet and environmental characters should be taken into account for the increase of 5% of the disease. As the economic growth has been increasing in India, both urban and rural population have increased the consumption of refined carbohydrates which add extra calories to the body. In 2017, British Journal of Nutrition said in its research paper that the consumption of high glycaemic index white rice had been strongly associated with the risk of Type 2 diabetes among

Indian people. Since 1990 to 2016 in Indian state of Uttar Pradesh, the risk of diabetes has rapidly moved from 37th to 15th position as the primary reason of disability and death. But, simultaneously, tuberculosis and diarrheal diseases has come down the rung of the death and disability ladder. This disparity is due to the less availability of resources in the poorer states which comparably high in richest states. WHO has announced officially that India has the highest number of diabetic patients when compared to the rest of the world. In 2000, India had 31.7 million diabetic patients and was expected to be higher than 100% in 2030 at the rate of massive 79.4 million people. Diabetes Mellitus is the condition in which a person is not able to produce insulin or the body is incapable of using insulin. Currently, diabetes affects over than 62 million people in India which is comparably 7.1% higher than the adult population. The standard age of diabetes is 42.5 years. Every year, the death rate of Indian because of diabetes is approximately one million.

Generally, the cause of diabetes is the higher level of blood sugar over a long period. This extended period of illness leads to develop various health issues like cardiovascular disease in a diabetic person.

### 3. Material and Methods

In general, two forms of diabetes are known as Typel Diabetes, low level production of insulin and Type 2 and gestational diabetes, low level response of the body to insulin. Out of the two forms, Type 2 diabetes (T2D) occurs from the combination two metabolic disorders such as Insulin Resistance and malfunction of insulin-secreting pancreatic -cells. In this context, maximizing insulin secretion is needed to maintain normoglycemia by the insulin resistant. According to the fact, if a person fails to maintain sufficient insulin levels would lead to Type 2 diabetes (T2D). In addition, the glucose concentration level should be in optimal for every individual. If this level is high, then it causes rigorous pathological situations in the body.

In this study, we take data from Diabetics hospital , there are 463 Diabetics patients taking treatment at the clinic. In particular there are 59.6% of male and 40.1% female taking treatment . Here we classify the percentage of different type of age group under treatment. The 8% of patients under treatment age between 18,30 years . The 14% of patients under treatment age between 31,40 years . The 30% of patients under treatment age between 41,50 years . The 38% of patients under treatment age between 51,60 years . The 10% of patients under treatment age between 61,70 years . Here Table -3.1 given different type of Diabetics patients with adherence and Non-adherence values.

Table – 3.1.1 Different type of Diabetics patients with adherence and Non-adherence values.

| Baseline characteristic | Total (n=463) | Medication adherence n (%) | Non-adherence n (%) |
|-------------------------|---------------|----------------------------|---------------------|
| Gender                  |               |                            |                     |
| Male                    | 276           | 203(73.5%)                 | 73(26.5%)           |
| Female                  | 187           | 136(72.7%)                 | 51(27.3%)           |
| Age group               |               |                            |                     |
| 17-30                   | 38            | 34(89.5%)                  | 4(10.5%)            |
| 31-40                   | 67            | 51(76.1%)                  | 16(23.9%)           |
| 41-50                   | 138           | 107(77.5%)                 | 31(22.5%)           |
| 51-60                   | 174           | 120(69.2%)                 | 54(30.8%)           |
| 61-70                   | 46            | 27(58.9%)                  | 19(41.1%)           |
| Level of education      |               |                            |                     |
| Illiterate              | 56            | 31(55.4%)                  | 25(44.6%)           |
| Primary                 | 176           | 122(69.3%)                 | 54(30.7%)           |
| Secondary               | 135           | 103(76.3%)                 | 32(23.7%)           |
| Degree                  | 63            | 54(85.7%)                  | 9(14.3%)            |
| P.G Degree              | 33            | 29(87.9%)                  | 4(12.1%)            |

Table – 3.1.2 Different type of Diabetics patients with adherence and Non-adherence values.

| Baseline characteristic | Total (n=463) | Medication adherence n (%) | Non-adherence n (%) |
|-------------------------|---------------|----------------------------|---------------------|
| Marital status          |               |                            |                     |
| Married                 | 379           | 267(70.5%)                 | 112(29.5%)          |
| Unmarried               | 84            | 72(85.7%)                  | 12(14.3%)           |
| Social habits           |               |                            |                     |
| Smoker                  | 174           | 138(79.3%)                 | 36(20.7%)           |
| Alcoholic               | 102           | 63(61.8%)                  | 39(38.2%)           |
| Tobacco                 | 39            | 28(71.8%)                  | 11(28.2%)           |
| Both                    | 82            | 58(70.7%)                  | 24(29.3%)           |
| None                    | 66            | 52(78.8%)                  | 14(21.2%)           |
| Before Counseling       |               |                            |                     |
| Adults (<45)            | 174           | 145(83.3%)                 | 29(16.7%)           |
| Old Age                 | 289           | 194(67.1%)                 | 95(32.9%)           |
| After Counseling        |               |                            |                     |
| Adults(<45)             | 174           | 172(98.9%)                 | 2(0.1%)             |
| Old Age                 | 289           | 279(96.5%)                 | 10(3.5%)            |

**4. Result and Discussion**

Applying  $\chi^2$  test, we analyze acceptance values

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

**4.1. Result-1. Null Hypothesis ( $H_0$ )**

There is no significant differences between the gender and the adherence report

**Alternate Hypothesis ( $H_1$ )**

There is some significant differences between the gender and the adherence report

Table – 4.1.1  
Gender and adherence Report

| Gender | Medicine Taken | Not Taken | Total  | Gender | Medicine Taken | Not Taken | Total  |
|--------|----------------|-----------|--------|--------|----------------|-----------|--------|
| Male   | 203            | 73        | 276.00 | Male   | 202.08         | 73.92     | 276.00 |
| Female | 136            | 51        | 187.00 | Female | 136.92         | 50.08     | 187.00 |
| Total  | 339.00         | 124.00    | 463.00 | Total  | 339.00         | 124.00    | 463.00 |

Table – 4.1.2  
Gender and adherence Report

| Gender | Medicine Taken | Not Taken | Total |
|--------|----------------|-----------|-------|
| Male   | 0.00           | 0.01      | 0.02  |
| Female | 0.01           | 0.02      | 0.02  |
| Total  | 0.01           | 0.03      | 0.04  |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 1$  is = 0.04

Here,  $0.04 < 3.841$   
 $H_0$  is accepted.

Hence, There is no significant differences between the gender and the adherence report.

**4.2. Result-2. Null Hypothesis ( $H_0$ )**

There is no significant differences between the Age group and the adherence report

**Alternate Hypothesis ( $H_1$ )**

There is some significant differences between the Age group and the adherence report.

Table – 4.2.1  
Age group and adherence Report

| Age Group    | Medicine Taken | Not Taken | Total  | Age Group    | Medicine Taken | Not Taken | Total  |
|--------------|----------------|-----------|--------|--------------|----------------|-----------|--------|
| <b>17-30</b> | 34.00          | 4.00      | 38.00  | <b>17-30</b> | 27.82          | 10.18     | 38.00  |
| <b>31-40</b> | 51.00          | 16.00     | 67.00  | <b>31-40</b> | 49.06          | 17.94     | 67.00  |
| <b>41-50</b> | 107.00         | 31.00     | 138.00 | <b>41-50</b> | 101.04         | 36.96     | 138.00 |
| <b>51-60</b> | 120.00         | 54.00     | 174.00 | <b>51-60</b> | 127.40         | 46.60     | 174.00 |
| <b>61-70</b> | 27.00          | 19.00     | 46.00  | <b>61-70</b> | 33.68          | 12.32     | 46.00  |
| <b>Total</b> | 339.00         | 124.00    | 463.00 | <b>Total</b> | 339.00         | 124.00    | 463.00 |

Table – 4.2.2  
Age group and adherence Report

| Age Group    | Medicine Taken | Not Taken | Total |
|--------------|----------------|-----------|-------|
| <b>17-30</b> | 1.37           | 3.75      | 5.12  |
| <b>31-40</b> | 0.08           | 0.21      | 0.29  |
| <b>41-50</b> | 0.55           | 0.96      | 1.31  |
| <b>51-60</b> | 0.43           | 1.17      | 1.60  |
| <b>61-70</b> | 1.33           | 3.62      | 4.95  |
| <b>Total</b> | 3.55           | 9.72      | 13.27 |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 4 = 9.488$

Here, 13.27 not  $<$  9.488

$H_0$  is not accepted.

Hence, There is some significant differences between the Age group and the adherence report

#### 4.3. Result-3. Null Hypothesis ( $H_0$ )

There is no significant differences between the level of education and the adherence report

#### Alternate Hypothesis ( $H_1$ )

There is some significant differences between the level of education and the adherence report

Table – 4.3.1  
Level of Education and adherence Report

| Education         | Medicine Taken | Not Taken | Total  | Education         | Medicine Taken | Not Taken | Total  |
|-------------------|----------------|-----------|--------|-------------------|----------------|-----------|--------|
| <b>Illiterate</b> | 31.00          | 25.00     | 56.00  | <b>Illiterate</b> | 41.00          | 15.00     | 56.00  |
| <b>Primary</b>    | 122.00         | 54.00     | 176.00 | <b>Primary</b>    | 128.86         | 47.14     | 176.00 |
| <b>Secondary</b>  | 103.00         | 32.00     | 135.00 | <b>Secondary</b>  | 98.84          | 36.16     | 135.00 |
| <b>Degree</b>     | 54.00          | 9.00      | 63.00  | <b>Degree</b>     | 46.13          | 16.87     | 63.00  |
| <b>PG Degree</b>  | 29.00          | 4.00      | 33.00  | <b>PG Degree</b>  | 24.16          | 8.84      | 33.00  |
| <b>Total</b>      | 339.00         | 124.00    | 463.00 | <b>Total</b>      | 339.00         | 124.00    | 463.00 |

Table – 4.3.2  
Level of Education and adherence Report

| Education  | Medicine Taken | Not Taken | Total |
|------------|----------------|-----------|-------|
| Illiterate | 2.44           | 6.67      | 9.11  |
| Primary    | 0.57           | 1.00      | 1.37  |
| Secondary  | 0.17           | 0.48      | 0.65  |
| Degree     | 1.34           | 3.67      | 5.02  |
| PG Degree  | 0.97           | 2.65      | 3.62  |
| Total      | 5.29           | 14.47     | 19.76 |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 4$  is = 9.488

Here, 19.76 not  $<$  9.488  
 $H_0$  is not accepted.

Hence, There is some significant differences between the level of education and the adherence report

**4.4. Result-4. Null Hypothesis ( $H_0$ )**

There is no significant differences between the marital status and the adherence report

**Alternate Hypothesis ( $H_1$ )**

There is some significant differences between the marital status and the adherence report

Table – 4.4.1  
Marital Status and adherence Report

| Marital Status | Medicine Taken | Not Taken | Total  | Marital Status | Medicine Taken | Not Taken | Total  |
|----------------|----------------|-----------|--------|----------------|----------------|-----------|--------|
| Married        | 267.00         | 112.00    | 379.00 | Married        | 277.50         | 101.50    | 379.00 |
| UnMarried      | 72.00          | 12.00     | 84.00  | UnMarried      | 61.50          | 22.50     | 84.00  |
| Total          | 339.00         | 124.00    | 463.00 | Total          | 339.00         | 124.00    | 463.00 |

Table – 4.4.2  
Marital Status and adherence Report

| Marital Status | Medicine Taken | Not Taken | Total |
|----------------|----------------|-----------|-------|
| Married        | 0.40           | 1.09      | 1.48  |
| UnMarried      | 1.79           | 4.90      | 6.69  |
| Total          | 2.19           | 5.98      | 8.17  |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 1$  is = 3.841

Here, 8.17 not  $<$  3.841  
 $H_0$  is not accepted.

Hence, There is some significant differences between the marital status and the adherence report



**4.5. Result-5. Null Hypothesis ( $H_0$ )**

There is no significant differences between the social habits and the adherence report

**Alternate Hypothesis ( $H_1$ )**

There is some significant differences between the social habits and the adherence report

Table -4.5.1  
Social Habits and adherence Report

| Social habits | Medicine Taken | Not Taken | Total  | Social habits | Medicine Taken | Not Taken | Total  |
|---------------|----------------|-----------|--------|---------------|----------------|-----------|--------|
| Smoker        | 138.00         | 36.00     | 174.00 | Smoker        | 127.40         | 46.60     | 174.00 |
| Alcoholic     | 63.00          | 39.00     | 102.00 | Alcoholic     | 74.68          | 27.32     | 102.00 |
| Tobacco       | 28.00          | 11.00     | 39.00  | Tobacco       | 28.56          | 10.44     | 39.00  |
| Both          | 58.00          | 24.00     | 82.00  | Both          | 60.04          | 21.96     | 82.00  |
| None          | 52.00          | 14.00     | 66.00  | None          | 48.32          | 17.68     | 66.00  |
| Total         | 339.00         | 124.00    | 463.00 | Total         | 339.00         | 124.00    | 463.00 |

Table -4.5.2  
Social Habits and adherence Report

| Social habits | Medicine Taken | Not Taken | Total |
|---------------|----------------|-----------|-------|
| Smoker        | 0.88           | 2.41      | 3.29  |
| Alcoholic     | 1.83           | 5.00      | 6.82  |
| Tobacco       | 0.01           | 0.03      | 0.04  |
| Both          | 0.07           | 0.19      | 0.26  |
| None          | 0.28           | 0.76      | 1.04  |
| Total         | 3.07           | 8.39      | 11.46 |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 4$  is  $= 9.488$

Here,  $11.46 < 9.488$

$H_0$  is Rejected.

Hence, There is no significant differences between the social habits and the adherence report

**4.6. Result-6. Null Hypothesis ( $H_0$ )**

There is no significant differences between the Adults and Old age People the adherence report for before counselling taking Medicine

**Alternate Hypothesis ( $H_1$ )**

There is some significant differences between the Adults and Old age People adherence report for before counselling taking Medicine

Table - 4.6.1  
Before counselling Report

| Type    | Medicine Taken | Not Taken | Total  | Type    | Medicine Taken | Not Taken | Total  |
|---------|----------------|-----------|--------|---------|----------------|-----------|--------|
| Adults  | 145.00         | 29.00     | 174.00 | Adults  | 127.40         | 46.60     | 174.00 |
| Old Age | 194.00         | 95.00     | 289.00 | Old Age | 211.60         | 77.40     | 289.00 |
| Total   | 339.00         | 124.00    | 463.00 | Total   | 339.00         | 124.00    | 463.00 |

Table – 4.6.2  
Before counselling Report

| Type    | Medicine Taken | Not Taken | Total |
|---------|----------------|-----------|-------|
| Adults  | 2.43           | 6.65      | 9.08  |
| Old Age | 1.46           | 4.00      | 5.47  |
| Total   | 3.90           | 10.65     | 14.55 |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 1$  is = 3.841

Here, 14.55 not < 3.841  
 $H_0$  is not accepted.

Hence, There is some significant differences between the Adults and Old age People adherence report for before counselling taking Medicine

**4.7. Result-6. Null Hypothesis ( $H_0$ )**

There is no significant differences between the Adults and Old age People the adherence report for After counselling taking Medicine

**Alternate Hypothesis ( $H_1$ )**

There is some significant differences between the Adults and Old age People adherence report for After counselling taking Medicine.

Table – 4.7.1  
After counselling Report

| Type    | Before Counselling | After Counselling | Total  | Type    | Before Counselling | After Counselling | Total  |
|---------|--------------------|-------------------|--------|---------|--------------------|-------------------|--------|
| Adults  | 172.00             | 2.00              | 174.00 | Adults  | 169.49             | 4.51              | 174.00 |
| Old Age | 279.00             | 10.00             | 289.00 | Old Age | 281.51             | 7.49              | 289.00 |
| Total   | 451.00             | 12.00             | 463.00 | Total   | 451.00             | 12.00             | 463.00 |

Table – 4.7.2  
After counselling Report

| Type    | Before Counselling | After Counselling | Total |
|---------|--------------------|-------------------|-------|
| Adults  | 0.04               | 1.40              | 1.43  |
| Old Age | 0.02               | 0.84              | 0.86  |
| Total   | 0.06               | 2.24              | 2.30  |

The degree of freedom at 5% level of significance is  $= (r - 1)(c - 1) = 1$  is = 3.841

Here, 2.30 < 3.841  
 $H_0$  is Accepted

Hence, There is no significant differences between the Adults and Old age People the adherence report for After counselling taking Medicine.

## 5. Conclusion

As the conclusion, this research paper has found out that there is no significant difference between the intake of drugs of both male and female patients. In addition, there is some significant various between for different type of Age group, Level of education, Marital status and Social Habits according to medication regularly and non-regularly. As a result of this research, after counselling, old age and adult diabetic people have taken medication more than before counselling.

## References

1. Ackerman E., Rosevar J.W., Molnar G, Concepts and Models of Biomathematics, F. Heinmets, Marcel Dekker, (1969), 131-153.
2. American Society of Health-System Pharmacists, Insulin Injection, PubMed Health, National Center for Biotechnology Information, U.S. National Library of Medicine, 2012.
3. B. Otieno Kwach., Omolo Ongati., M. Oduor Okoya., Amos Otedo, Mathematical Model for Drug Therapy in Patients with Diabetics Mellitus, International journal of Engineering Science and Mathematics , Volume 2, Issue 1, (2013) ISSN: 2320-0294.
4. Brunilda Nazario M.D., Types of Insulin for Diabetes Treatment, <http://Diabetes.webmd.com/guide/Diabetes-types-insulin>, Accessed on 7 January, 2013.
5. B.Kwach, Mathematical Model for Detecting Diabetics in Blood, Applied Mathematical Sciences, Vol.5, ,No.6, (2011)279-286.
6. Kwach B., Ongati O., Simwa R, Mathematical Model for Detecting Diabetes in the Blood, J. Applied Mathematical Sciences, Vol. 5 (6) (2011), 279-286.
7. Nilam Nilam., Seyed M. Moghadas., Pappur N. Shivakumar, Therapeutic Modelling of Type 1 Diabetes, Type 1 Diabetes Complications, Pathogenesis, and Alternative Treatments, Edted by prof. Chin-Pin Liu (Ed.) InTech, Available from: <http://www.intechopen.com/books/type-1-Diabetescompliction-pathogenesis-and-alternative-treatments/therapeutic-modelling-of-type-1Diabetes>. (2011) ISBN: 978-953-307-756-7
8. Sanchaikumar. N, Swaminathan.B, Muthumani.V and G.Komahan, Mathematical Model For Role Of Glucose In Diabetics, The Journal Of Oriental Research Madras, (2021)ISSN : 0022-3301, 1-9.
9. S. C. Gupta., V.K.Kapoor , Fundamentals of Mathematical Statistics, Sultan Chand & Sons,New Delhi,2014.
10. Venkatesh A, Mohankumar S and Manikandan R, StepStress and Truncated Acceptance Sampling Plan Model for the analysis of Vasopressin, International Journal of Pure and Applied Mathematics, Vol. 117 (6) (2017), 107-114.

SANCHAIKUMAR N: RESEARCH SCHOLAR, DEPT.OF MATHS, A.V.V.M SRI PUSHPAM COLLEGE (AUTONOMOUS), (AFFILIATED TO BHARATHIDASAN UNIVERSITY, TRICHIRAPPALLI), POONDI, THANJAVUR, TAMILNADU, INDIA

*E-mail address:* [sanjaykpt4@gmail.com](mailto:sanjaykpt4@gmail.com)

KOMAHAN G:ASSOCIATE PROF.OF MATHS, RESEARCH ADVISOR, A.V.V.M SRI PUSHPAM COLLEGE (AUTONOMOUS),(AFFILIATED TO BHARATHIDASAN UNIVERSITY, TRICHIRAPPALLI), POONDI, THANJAVUR, TAMILNADU, INDIA

*E-mail address:* [govindarajankomahan@gmail.com](mailto:govindarajankomahan@gmail.com)