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**PREVALENCE OF HEPATITIS B VIRUS SURFACE ANTIGEN AMONG  
PREGNANT WOMEN ATTENDING MATERNITY HOSPITAL IN KRISHNAGIRI  
DISTRICT, TAMIL NADU**

Paranjothi.S<sup>1</sup> & Palanisamy.A\*<sup>2</sup>

<sup>1</sup>Assistant professor, Department of Microbiology, Vysya College, Salem, Tamil Nadu, India

<sup>2</sup>Head, Department of Biological Sciences, Muthayammal College of Arts and Science, Rasipuram, Tamil Nadu, India

**ABSTRACT**

Hepatitis B virus (HBV) infection is an important global health problem. It is estimated that there are 350 million HBV carriers in the world and 2, 50,000 people die annually due to HBV related liver diseases. The prevalence of hepatitis B virus (HBV) carrier and infectivity status among 762 pregnant women in Krishnagiri district, Tamil Nadu, were determined through random testing of volunteer's antenatal clinics through different hospitals with in the krishnagiri district. HBV carriage status was determined by the presence of hepatitis B surface antigen (HBsAg). Samples were confirmed by Enzyme linked immunoabsorbant assay (ELISA). Maternal HBV infectivity status was determined by testing all HBsAg positive samples for the presence of hepatitis Be Ag. Overall 39(5%) pregnant women were identified as positive for HBsAg and 15 of 39 (38%) pregnant women identified as HBV carrier tested for HBeAg. 28 out of 39(72%) pregnant women were identified as reactive for anti-HBe which confirms clinical sign of recovery from infection. The study demonstrates the endemicity of HBV infection by both vertical and horizontal means of transmission. Free screening and immunization of all pregnant women and infants should be incorporated in the antenatal and postnatal programmes in hospital for the eradication of HBV infection among pregnant women.

**Key words:** Hepatitis B virus (HBV) - Hepatitis B surface antigen (HBsAg) - Hepatitis Be antigen (HBeAg) – Hepatitis Be antibody (HBeAb) - Enzyme linked immunoabsorbant assay (ELISA) – Chronic carrier- Antenatal screening.

## INTRODUCTION

Hepatitis B Virus (HBV) is a member of the hepadnaviridae family. It is spherical, partially double stranded, enveloped DNA virus, measures about 40-42 nm in diameter. The virus particle (Virion) consists of an outer lipid envelop, an icosahedral nucleocapsid encloses the viral DNA and DNA polymerase that have reverse transcriptase activity. Blumberg *et al.* (1965) first reported that the protein antigen in the serum of Australian patients known as Australian antigen which was a significant breakthrough in understanding of serum hepatitis. The first finding of hepadnaviruses in naturally infected woodchuck, tree squirrels and pekin ducks has provided animal model along with the availability of human hepatoma cell lines. Some of these viruses were discovered by screening of animals with the test designed for diagnosing hepatitis B in man (Blumberg *et al.*, 1965).

Globally Hepatitis B Virus causes liver diseases in pregnant women. Liver disease is a rare complication during pregnancy and it leads to spread of infection to infant. The morbidity and mortality by hepatitis B is significant especially in developing countries. The viral hepatitis is the commonest cause of jaundice in pregnancy which contributes

the 50-70% of all causes. In India with the estimated prevalence of 2-7% (Onuzulike *et al.*, 2007) and require decisive steps in controlling the diseases.

The studies on the prevalence of HBV shows that 400 million people worldwide are chronic HBV carriers, representing approximately 7% of the total population (Bosch *et al.*, 1999). Among them 78% were in Asia, 16% in Africa, 3% in South America and 3% in Europe, North America and Oceania combined. Epidemiologic studies have demonstrated that there is a consistent and specific association between HBV infection and Hepetocellular carcinoma. In patients with persistent HBV infection, the risk of HCC is 100 times higher than in non-infected individuals.

## MATERIALS AND METHODS

### Collection of sample

Five ml of blood sample was collected by venopuncture and allowed to clot naturally and the serum was separated by centrifugation at 1500 rpm for 15 minutes. The serum collected was tested for HBsAg using one step HBsAg test (Intec products, INC., India). The positive samples were stored at -20<sup>0</sup>C and further confirmed for HBsAg, HBeAg, and HBeAb using commercially available

Enzyme Linked Immunosorbant Assay kit, (Span Diagnostics, India).

### **One step HBsAg test**

One step HBsAg card test was performed to screen the samples positive for HBsAg. 100 µl of test serum sample was added to the card by using sample dropper. The result was observed between 5-10 minutes for 5ng/ml and at 30 minutes for 1ng/ml. Development of purplish red colour in the test strip region shows positive result. The results were observed within 30 minutes.

### **Detection of HBsAg by ELISA**

The prevalence of HBsAg was analyzed by ELISA using Span diagnostic Ltd, Surat, India. The absorbance was performed at 450 and 630nm were taken using ELISA reader (ECIL- MS5608A). The cut-off value was calculated based on the mean absorbance of three negative controls and addition of factor (0.10). Cut-off =  $NCX+0.10$ .

### **Elisa for detection of HBeAg**

The prevalence of HBeAg was analyzed by ELISA using Smart test diagnostics kit. The absorbance was performed at 450 and 630nm were taken using ELISA reader (ECIL- MS5608A). The cut-off value was calculated based on the mean absorbance of three negative controls and addition of factor (0.100). Cut-off (Co) =  $NCX+0.10$ .

### **Elisa for detection of HBeAb**

The prevalence of HBeAb was analyzed by ELISA using Smart test diagnostics kit. The absorbance was recorded by using dichromatic (450-630nm) mode. The cut-off value was calculated based on the mean absorbance of three negative Controls and addition of factor (0.100). Cut-off (Co) =  $(NC+PC) / 3$ .

## **RESULTS**

The present study was carried out to screen the prevalence and genotyping of Hepatitis B virus surface antigen among pregnant women attending maternity hospital in Krishnagiri District, Tamil Nadu.

### **Overall Prevalence of HBsAg/HBeAg and HBeAb**

Seven hundred and sixty two pregnant women participated in this study. Serological analysis by ELISA revealed that 39 (5.0%) pregnant women (Table-1&Fig-1) were positive for Hepatitis B surface antigen (HBsAg). Among the 39 positive cases 15 (38%) pregnant women were identified as HBV carrier (HBsAg +). 28 out of 39(72%) pregnant women were identified as reactive for anti-HBe which confirms clinical sign of recovery from infection.(Table-2& Fig-2)

Table – 1: Prevalence of HBsAg among pregnant women attending maternity hospitals in Krishnagiri district.

Number of samples	Positive	Negative	Prevalence of HBsAg (%)
762	39	723	5.1

Fig: 1. Prevalence of HBsAg among pregnant women attending maternity hospitals in Krishnagiri district.

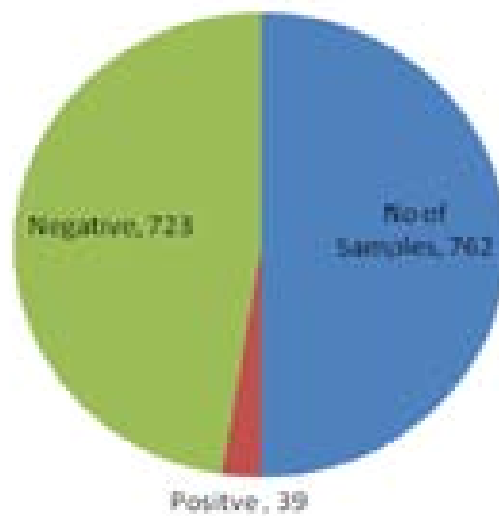
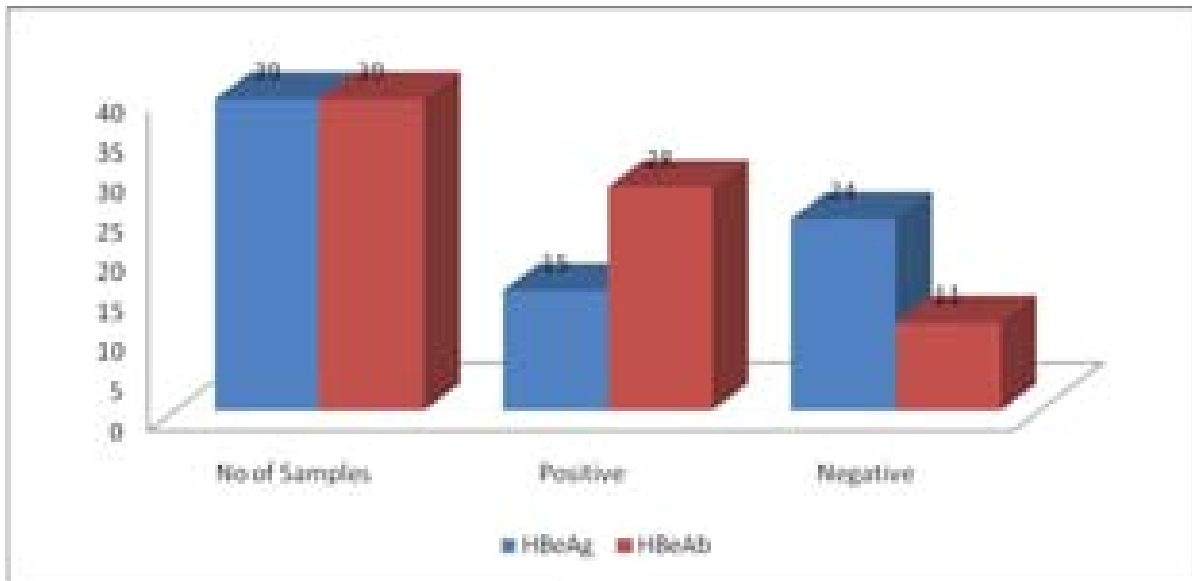


Table -2: Prevalence of HBeAg, and HBeAb, among pregnant women positive for HBsAg.

Number of samples	HBeAg			HBeAb			P-Value <b>P= &lt; 0.05</b>
	+ve	-ve	% of prevalence	+ve	-ve	% of prevalence	
39	15	24	38.0	28	11	72.0	0.003

Fig: 2. Prevalence of HBeAg, and HBeAb, among pregnant women positive for HBsAg.





Different age group from 15 - 45 were participated in this study, the prevalence was high in teen age (15-19) group which recorded HBsAg (9.4%), HBeAg (3.8%) and HBeAb (11.3%). Based on the educational status the prevalence rate was high in among illiterate women's and results are HBsAg 5.5%, HBeAg 2.9% and HBeAb 5.1%. With regard occupational group housewife, student and employees were participated. The results revealed that student community shows high prevalence (7.4%) for HBsAg serological markers. Whereas housewife and employee were infected moderately for the serological markers HBeAg (2.9%) and HBeAb (5.0%).

Prevalence of serological markers HBsAg, HBeAg and HBeAb among

pregnant women with reference to number of pregnancy was studied. Prevalence of HBsAg was high (6.4%) in the first and third pregnancy, whereas in second pregnancy recorded 3.6%. Prevalence of HBsAg in relation to associated risk factors among pregnant women with previous history of immunization status showed 16.6%, blood transfusion (14.2%), jaundice (13.3%), dental therapy (7.1%) and in surgery 7.6%. Among these risk factors those were previously immunized for jaundice shows high prevalence (Table-3).

Table – 3: Prevalence of Hepatitis B surface antigen in relation to associated risk factors

Risk factors	Positivity	Number of samples	No of sample Positive for HBsAg	Prevalence (%)
Jaundice	+ve	15	2	13.3
	-ve	747	37	4.9
Blood transfusion	+ve	7	1	14.2
	-ve	755	38	5.0
Immunization status	+ve	6	1	16.6
	-ve	756	38	5.0
Dental therapy	+ve	14	1	7.1
	-ve	748	38	5.0
Surgery	+ve	26	2	7.6
	-ve	736	37	5.0

**DISCUSSION**

The prevalence of hepatitis B infection varies in different parts of the world. In the present study, the overall prevalence of hepatitis B surface antigen in pregnant women attending hospital in Krishnagiri district, TamilNadu was 5.10%. The study reported an overall prevalence is on intermediate side, as per WHO criteria. The results are in accordance with Fisseha Walle *et al.* (2008), who stated that prevalence rate among pregnant women, were 5.0% in Addish (Ethiopia) 4.0%-6.0% in Jimma, 4.3% -4.6% in Nigeria, 6.5% in Zambia, 4.9% - 6.4% in Korea and 4.2% in Turkey. However, there are reports from other parts of the world showed low prevalence of 0.14% - 0.97% in USA, except Asian American, 1.65% in Mexico and 0.21% in

the North Kerala state in south India. A higher prevalence (15.5%) was found among study population in Mali, 10.0% in Hong Kong, 12.0% in Taiwan, 7.05 in Oman and 18.5% in Brazil. Comparison of present study with other studies from different countries on pregnant women showed a variable result. There is a wide variation in the prevalence of HBsAg in different region of our country and the highest prevalence (9.5%) has been reported by Prakesh *et al.* (2011) in North India, Arunachal Pradesh.

The overall prevalence of HBeAg in this study was 38.0%. Similar observation was reported by Arora *et al.* (2004) and by Tandon *et al.*, (1996) from Madras and Chandigarh with a significant infection of 34.2% and 47.0% respectively. In India, the prevalence rate

of HBsAg in pregnant women varies from 4.8% - 6.87%. In India only a single study has systematically looked at the issue of relative contribution of prenatal and horizontal transmission. A study from Delhi, North India, documented that HBsAg carrier rate in antenatal patients to be 3.7% and HBeAg carrier rate of 7.8% and vertical transmission rate of 18.6% (Nayak *et al.*, 1984). In another study of HBsAg positive antenatal from Chandigarh, North India, prenatal transmission was 30.0% and HBeAg carrier rate among this mother s was 30.0% (Biswas *et al.*, 2007). A recent report from Bangladesh on the Eastern border of India documented 30.05 of antenatal mother to be HBeAg positive, indicating a higher risk for their babies to be persistently infected with HBV (Karim Rumi *et al.*, 1998).

The prevalence rate associated with previous history of immunization revealed that one patient shows positive for HBs Ag among six patient tested this was similar to that of reports from Northern and central European countries (Gay *et al.*, 1999 and Lindh *et al.*, 1993) whereas quite lower prevalence recorded in other Mediterranean countries or region such as France (0.65%) Croatia (0.75%) Italy (1.0%) Sicily (1.1%) and Greece (1.5%) (Llucis Salleras *et al.*, 2009).

Prevalence of HBsAg among the patient with history of blood transfusion revealed that one out 7 (14.2%) have positive, that the history of blood transfusion was not significant with HBsAg seropositivity. Significantly higher prevalence among this group might be due to exposure to unscreened blood or blood products (or) other practices such a tattooing, ear piercings, face marking (Tribalmarkes). This finding is in agreement with several epidemiological studies (Maddawa *et al.*, 2002). In another study conducted in Anyigba, Kogi state by Slue *et al.* (2011) in which pregnant women with history of blood transfusion had significantly higher HBsAg and they reported that blood transfusion is very significant route of HBV transmission. The result in this study are similar with study of Pennap *et al.* (2011) who reported prevalence was 10.46% They demonstrated that the unsafe injection from unqualified medical personnel using HBV contaminated needle and syringe, transfusion of blood and blood products and sociocultural practices such as tribal marks, circumcision and scarification were important routes of HBV transmission.

As regard with previous history of jaundice, the pregnant women in our study 2 out of 15 mothers who had history of

jaundice (13.3%) were HBsAg positive. The history of Jaundice found highest in the risk factor, next to the immunization status. These results are similar to that of Khakhkharvipul *et al.* (2012), and they concluded that screening pregnant women for HBsAg is necessary in order to identify those neonates at risk of transmission. The Study demonstrated history of jaundice was associated with hepatitis B infection. The significant association between HBsAg positivity is comparable with the findings of other studies (Al-waleedi and Khader, 2012).

Risk factors including use of dental therapy and surgery were associated with HBV infection in pregnant women (Awole *et al.*, 2005). Jefferson *et al.* (2000) stated that number of risk factors analyses studies confirmed that HBV infection had statistically significant association with absence of vaccination and other risk factors such as needle stick injury, sharp needles, surgery and blood transfusion

### CONCLUSION

In conclusion, results from this study have shown HBV prevalence in pregnant women is of intermediate endemicity. Out of seven hundred and sixty two samples, 39 samples were positive for HBsAg. Therefore this study helps us to increase awareness of HBV

infection. Pregnant women were potential group reflecting high transmission of hepatitis B virus infection to their neonates, general population and their close contacts. Hence universal immunization against HBV is recommended.

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## **CHANGES OF HAEMATOLOGICAL PARAMETERS IN DENGUE INFECTED PATIENTS, TAMILNADU**

**<sup>1</sup>J. Carolinerose, and<sup>2</sup>A.Palanisamy and <sup>3</sup>H.Vijayarani**

1 Assistant professor, Arignar Anna college, Krishnagiri, India

2 HOD, Biological sciences, Muthayammal College, Rasipuram

3 Assistant professor, Meenakshi College, Madurai, India

### **ABSTRACT**

The study was performed to compare haematological parameter in dengue confirmed patients, suspected dengue patients and other febrile illness with normal healthy persons of same age group. The more common haematological parameters associated with dengue infection are leucopenia, haematocrit, decreased haemoglobin and thrombocytopenia. Serum samples were collected from patients who attended the hospital with symptoms of dengue fever. The samples were confirmed for dengue fever by IgM ELISA. The confirmed samples were used for assay of haematological parameters.

Keywords-Dengue, leucopenia, haematocrit, haemoglobin thrombocytopenia

### **INTRODUCTION**

Dengue fever is caused by four different serotypes of dengue virus (DEN 1, DEN 2, DEN 3, and DEN 4) which are closely related antigenically. Infection with one serotype provides life-long immunity to that virus but not to other serotypes. These viruses are the members of the family Flaviviridae. They have a common morphology and genomic structure and all the members share common antigenic determinants. The present study it was proposed to identify hematological or biochemical markers in serologically confirmed dengue patients

which do not require well sophisticated laboratory as early indicators or predictors of dengue infection. One way to identify these parameters is to estimate the alteration in haematological parameters and to analyse the data to assess whether the incorporation of these laboratory results in addition to the clinical data could suggest the early clinical and laboratory features predictive of dengue infection in disease endemic areas.

The more common haematological parameters associated with dengue infection are leucopenia, haematocrit, decreased haemoglobin and

thrombocytopenia. Leucopenia and thrombocytopenia are felt to relate to bone marrow suppression by dengue virus (La Russa and Innis, 1995). It was stated earlier that the presence of leucopenia in older adults that present with an acute febrile illness should trigger a differential diagnosis of dengue for further laboratory confirmation (Low *et al.*, 2011). According to Sawasdivornet *al.*, (2001), fever in combination with positive Tourniquet test (TT) and leucopenia differentiate dengue fever from other febrile illness. Like leucopenia, laboratory finding of thrombocytopenia also plays a major role in the diagnosis of dengue infection. However, it is a well described feature of DHF rather than DF. Apart from these two major parameters, Erythrocyte Sedimentation Rate (ESR) is also considered as marker of dengue infection. Unaltered ESR is considered as a good indicator of dengue infection. Another haematological parameter namely hemoconcentration is well correlated with DHF and decrease in haemoglobin level is generally considered as non - specific indicator.

### **MATERIAL**

Patients who attended clinics and private hospitals with suspected dengue infection in and around Salem were included for the study. Both out patients and in patients were considered.

Irrespective of age and sex, all the patients with clinically suspected dengue infection were included. Patients were enrolled for the study after obtaining consent from the individual. A detailed history of each patient was collected on a specifically designed performa. Patients with obesity, diabetes mellitus or parenteral history of diabetes mellitus, lipid disorder or any previous exposure to viral infection were excluded from the study. Alcoholic patients were also excluded from the study. The blood and sera collected from all the individuals were examined for haematological and biochemical parameters as per the standard procedures. The haematological parameters assayed were Platelet count, Haemoglobin, ESR, WBC count and Haematocrit. The experiments were performed by standard procedures and analysed. Platelet count was done by the method described by Dacie *et al.*, (2006), Estimation of haemoglobin was done as per the method described by Drabkin and Austin (1932), ESR was performed as per the method described by Westergen's (1957), WBC count was done as per the method described by Drabkin and Austin (1932) and Packed Cell Volume or Haematocrit was done by Wintrob's (1929) method.



## RESULT AND DISCUSSION

The age distribution of the study population is shown in Fig 1. The dengue probable patients age ranged from 1.5 months to 56 years with a mean of  $22.6 \pm 14.7$  years. The representation of The dengue probable patients age ranged from 1.5 months to 56 years with a mean of 22.6

$\pm 14.7$  years. The representation of different age groups were as follows: 0 - 10 years (28.3 %), 11-20 years (18.5 %), 21 – 30 years (18.1 %) and 31 -40 years (22.4 %). The least number of patients (12.9 %) were observed in the age group above 40 years. Only 2 (0.82 %) infants were enrolled in the study.

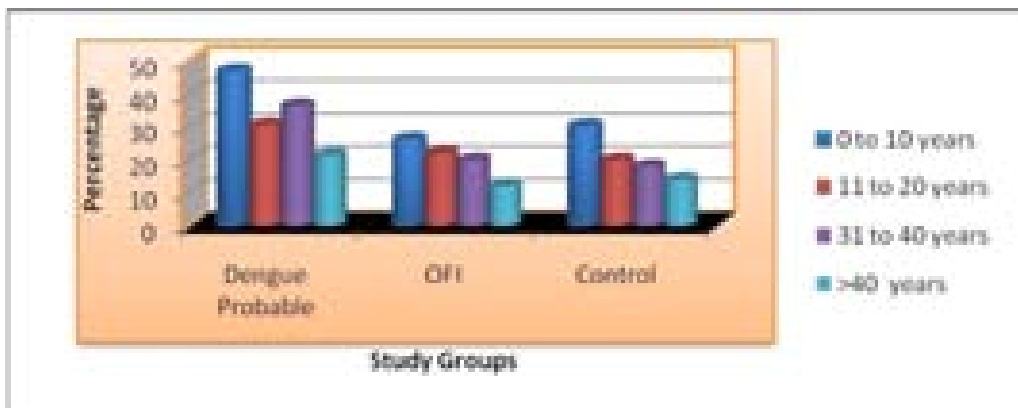


Figure -1 Age distribution of study population

The mean body temperature of the dengue probable patients was  $101.5 \pm 1.4^{\circ}\text{F}$  and it was  $101.2 \pm 1.3^{\circ}\text{F}$  in OFI patients and there was no significant difference in the mean body temperature between these two groups. Other symptoms observed in dengue probable patients were headache (37.4 %), myalgia (22.8 %), arthralgia (25.6 %), nausea (39.8 %), vomiting (52.8 %), abdominal pain (33.5 %), rash (14.2 %), retero orbital pain (22.8 %), diarrhea (18.9 %) and hepatomegaly (22.8 %). All these symptoms, except retero orbital pain were observed in OFI patients. However, the occurrence of rash (2 %) and arthralgia (2 %) was less

The serological confirmation for dengue fever by IgM capture ELISA was done with all the dengue probable patients, 39 % showed positive serology (IgM) to dengue virus by ELISA and thus the primary infection of dengue virus was confirmed in 39 % of dengue probable patients. All these patients were categorized as dengue confirmed patients. Haematological parameters such as platelet count, Hb, ESR, WBC and haematocrit/Packed cell volume (PCV) were studied in all the study groups and the comparison of these parameters between the study groups is depicted in Table 1 and Table 2. The mean platelet

count (count/ $\mu\text{l}$ ) in dengue confirmed, laboratory negative dengue patients and OFI patients were 99859.21, 112052 and 122860 respectively. There was a significant reduction in the platelet count in dengue confirmed patients as compared to control. There was a significant difference in the level of haemoglobin between confirmed dengue cases with laboratory negative dengue patients, OFI and control group. The mean values of haemoglobin (in gm %) in dengue confirmed, laboratory negative dengue patients and OFI patients were  $12.17 \pm 1.15$ ,  $12.84 \pm 1.31$  and  $12.56 \pm 1.03$  respectively. The mean value of ESR (mm/hr) was  $10.9 \pm 2.3$ ,  $10.3 \pm 3.5$  and  $10.1 \pm 2.9$  for dengue confirmed,

laboratory negative dengue patients and OFI patients respectively. The mean value of WBC level ( $\times 10^3/\mu\text{l}$ ) in dengue confirmed, laboratory negative dengue patients and OFI patients were  $5.9 \pm 1.1$ ,  $6.1 \pm 1.4$  and  $6.8 \pm 1.1$  respectively. The mean value of haematocrit (%) was  $47.71 \pm 5.14$ ,  $45.81 \pm 5.8$  and  $45.54 \pm 5.67$  in dengue confirmed, laboratory negative dengue patients and OFI patients respectively. There was a difference in the haematocrit value between the confirmed and laboratory negative dengue patients but the difference was not significant whereas the difference in the mean value between the confirmed and control cases was significantly different.

Table – 1 Percentage of patients with altered Haematological parameters

PARAMETERS	Dengue confirmed patient (%)	Laboratory negative dengue patients (%)	OFI (%)
Platelet	39.4	19.4	18
Haemoglobin	25.3	28.4	44
ESR	11.1	18.1	46
WBC	16.2	25.2	14
PCV	6.1	10.96	12

Table –2 Haematological parameters of the study samples

Parameters	Control	Dengue confirmed patients	Laboratory negative dengue patients	OFI	P-Value
Platelet count / $\mu\text{l}$	194540 $\pm$ 55114	99859.21 $\pm$ 37501	112052 $\pm$ 43414	122860 $\pm$ 42986	< 0.0001***
Haemoglobin (gm %)	13.25 $\pm$ 1.247	12.17 $\pm$ 1.15	12.84 $\pm$ 1.31	12.56 $\pm$ 1.03	< 0.0001***
ESR (mm/hr)	11.3 $\pm$ 1.4	10.9 $\pm$ 2.3	10.3 $\pm$ 3.5	10.1 $\pm$ 2.9	0.0684( <i>ns</i> )
WBC ( $\times 10^3/\mu\text{l}$ )	7.3 $\pm$ 1.4	5.9 $\pm$ 1.1	6.1 $\pm$ 1.4	6.8 $\pm$ 1.1	< 0.0001***
PCV (%)	43.7 $\pm$ 5.11	47.71 $\pm$ 5.14	45.81 $\pm$ 5.8	45.54 $\pm$ 5.67	0.0004***

ns - Not significant, \*\*\* -Extremely Significant

The percentage of patients with decrease in platelet count in dengue confirmed, laboratory negative dengue patients and OFI patients were 39.4, 19.4 and 18 respectively. The percentage of dengue confirmed patients with decrease in haemoglobin content was 25.3, laboratory negative dengue patients was 28.4 and OFI patients was 44%. Altered level in ESR was seen in 11.1 % of dengue confirmed patients, 18.1 % of laboratory negative dengue patients and 46 % of OFI patients. The percentage of patients with decrease in WBC in dengue confirmed, laboratory negative dengue and OFI patients were 16.2, 25.2 and 14 respectively. The percentage of dengue confirmed, laboratory negative dengue and OFI patients with altered haematocrit are 6.1, 10.96 and 12 respectively. The results of haematological investigation carried in the study population showed that thrombocytopenia (39 %) was more

common in dengue confirmed patients. Leucopenia was found in 16.2 % of dengue Jainet *al.*, (2011) also revealed the same, Chadwick *et al.*, (2006) in Singapore who found a positive correlation between thrombocytopenia and IgM positive serology and the same is observed in the present study.

The mean count of WBC less than 1000/ $\mu\text{l}$  in dengue confirmed patients was 5.9  $\pm$  1.1 which was significantly lower than OFI and the control group. Similar result was obtained by Rongrungruar and Leelarasamee (2001) in DF patients in Thailand. Whichmannet *al.*, (2006) found leucopenia in 53.2 % of patients with acute phase of illness. ESR was altered in 11.1 % of dengue confirmed patients. Supporting evidence was also given by Kalayanarooj and Nimmanitya (1989). Anaemia (6-9 g/dl) was observed in 25.3 % of the dengue confirmed patients. The haematological features of the dengue

patients in the present study revealed that thrombocytopenia and leucopenia are the two important parameters in the early diagnosis of dengue infection and other parameters such as haematocrit and anaemia do not play any role in the diagnosis of dengue infection at an early stage.

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## Preliminary phytochemical screening of leaf extract of *Euphorbia geniculata*

\* G. Kanchana and T. Kalaivani

\* Muthayammal College of Arts and Science, Rasipuram, Tamil Nadu, India.

Email Id: *kanchanamoorthi@gmail.com*.

### ABSTRACT

Plant and plant-based medicaments are the basis of many of the modern pharmaceuticals we use today for our various ailments. The present paper shows the therapeutic importance of *Euphorbia geniculata* leaves and features its medicinal character. The leaves of *Euphorbia geniculata* were collected, shadow dried and extracted with petroleum ether, chloroform, methanol, ethanol and water. Phytochemical analysis of *Euphorbia geniculata* was carried out according to the standard procedures. The preliminary phytochemical screening revealed the presence of alkaloids, flavonoids, phenols, tannins and phytosterols in various extract of *Euphorbia geniculata*. The presence of these phytochemicals can be correlated with the medicinal potential of this plant.

**Keywords:** Phytochemical, *Euphorbia geniculata*, Alkaloids, Flavonoids.

### INTRODUCTION

Plant materials remain an important resource to combat serious diseases in the world. The traditional medicinal methods, especially the use of medicinal plants, still play a vital role to cover the basic health needs in the developing countries. The medicinal value of these plants lies in some chemical active substances that produce a definite physiological action on the human body. The most important of these bioactive constituents of plants are alkaloids, tannin, flavonoid and phenolic compounds (Edeogal *et al.*, 2005).

Medicinal plants have curative properties due to the presence of various complex chemical substances of different composition, which are found as secondary plant metabolites in one or more part of the plants. The plants metabolites, according to their composition, are grouped as alkaloids, glycosides, corticosteroids, essential oil, etc. Now a days, these medicinal valuable compounds obtained from the medicinal plants are called “biomedicine” (John Mitchell *et al.*, 2002).

In India, medicinal plants are widely used by all section of people either

directly as remedies or in different indigenous medicinal practices. Our country represents a store house of genetic diversity of plants. India has high wealth of medicinal plants. Siddha system has its root in Dravidian civilization and Saiva Siddhantha (Antindehou *et al.*, 2002).

The *Euphorbia geniculata* is an erect, branched, smooth, half-woody herb or shrubby plant, 0.5 to 1.5 meters high. Leaves are alternate and extremely variable in shape, most often oblong-ovate, 3 to 10 centimeters long, the lower ones usually entire, the upper ones variously lobed, sinuate, dentate, or subentire, and the uppermost ones blotched with red at the base, similar to the bracts. Bracts are leaflike, much smaller than the leaves; the lower part is red and the upper, green. Involucres are clustered at the ends of the branches, about 3 millimeters long, green, with one sinus bearing an unappendaged gland. Capsules are nodding, about 5 millimeters wide.

*Euphorbia geniculata* is used for constipation, bronchitis and asthma and hay fever. Latex is used for insect bites and also used as purgative. Leaves and roots are used for traumatic injury. The present study was designed to evaluate the photochemical constituents of *Euphorbia geniculata*.

## MATERIALS AND METHODS

### Plant collection

The fresh leaves of *Euphorbia geniculata* was collected from the Gardens of Kumarapalayam. The leaves were washed thoroughly 2-3 times with running tap water. Leaf material was then air dried under shade. The plant material was grinded and powders were kept in small plastic bags.

### Preparation of plant extracts

The grinded leaf powder of 25g/250ml was taken in a conical flask and it was immersed by the organic solvent (Petroleum ether, Chloroform, methanol, ethanol and water). The flask was then plugged with cotton wool and kept at room temperature for 48 hrs. After two days, the supernatant was collected and the solvent was evaporated to make the final volume one-fourth of the original volume and stored at 4°C in air tight bottles.

### Preliminary phytochemical screening

The various extract of *Euphorbia geniculata* leaves were subjected to preliminary phytochemical screening (Trease and Evans, 2002).

#### Alkaloids:

**Mayer's Test:** A small quantity of the extract was treated with few drops of dilute hydrochloric acid and filtered. The filtrate was tested with alkaloid Mayer's reagent. Formation of cream precipitate

indicated the presence of alkaloids.

**Dragendroff's Test:** To 2-3ml of the extract added few drops of Dragendroff's reagent. Formation of orange red (or) reddish brown precipitate indicated the presence of alkaloids.

**Wagner's Test:** To 2-3 ml of the extract added few drops of Wagner's reagent. Formation of reddish brown precipitate indicated the presence of alkaloids.

#### **Flavonoids:**

**Sodium hydroxide Test:** To 2-3 ml of the extract, few drops of sodium hydroxide solution was added in a test tube. Formation of intense yellow colour that became colourless on addition of few drops of dilute hydrochloric acid indicated the presence of flavonoids.

#### **Phytosterols:**

**Salkowski Test:** To 2 ml of extract, added 2ml chloroform and 2 ml concentrated sulphuric acid and shaken well. Appearance of red chloroform layer and greenish yellow fluorescence acid layer indicated the presence of sterols.

#### **Phenols:**

0.5 ml of ferric chloride solution was added to 2 ml of the test solution. Formation of blue-green or red colour indicated the presence of phenols.

#### **Tannins:**

Small quantity of extract was boiled in 20 ml of water in a test tube and then filtered. A few drop of 0.1% ferric

chloride was added and observed for brownish green or blue-black coloration which indicated the presence of tannins.

#### **Carbohydrates:**

**Benedict's test:** The extract was treated with Benedict's reagent and heated for few minutes. Formation of brick red precipitate shows the presence of reducing sugar.

#### **Fixed oils and fats (spot test):**

Press a small quantity of powder between two filter papers. Oil strains on the filter paper indicated the presence of fixed oils.

## **RESULTS AND DISCUSSION**

The present study carried out on the plant samples revealed the presence of medicinally active constituents. The phytochemical screening of the leaves of *Euphorbia geniculata* is presented in Table-1. The petroleum ether extract showed the presence of alkaloids, flavonoids, phytosterols, tannin and fixed oil and fat. The chloroform extract showed the presence of alkaloids, phenols and tannins. The methanol extract showed the presence of alkaloids, flavonoids, phenols and tannins. The ethanol extract showed the presence of alkaloids, phytosterols, phenols and fixed oil and fat. The aqueous extract showed the presence of alkaloids, flavonoids, phenols, tannins, phytosterols and fixed oil and fat. The results of phytochemical analysis comprehensively



validate the presence of therapeutically important and valuable secondary metabolites (Alkaloids, Flavonoids, Phenols, Tannins and phytosterols) in the leaves of *Euphorbia geniculata*.

Plants produce a diverse range of bioactive molecules making them rich source of different types of medicine (Chhetri *et al.*, 2008). The phytochemical screening of *Euphorbia geniculata* showed that the leaves were rich in alkaloids, flavonoids, tannins and saponins. They were known to show medicinal activity as

well as exhibiting physiological activity (Sofowara, 1993). Phytochemical constituents such as alkaloids, flavonoids, tannins, phenols, saponins, and several other aromatic compounds are secondary metabolites of plants that serve a defense mechanism against predation by many microorganisms, insects and other herbivores (Bonjar *et al.*, 2004). Tannins bind to proline rich proteins and interfere with the protein synthesis (Shimada *et al.*, 2006).

**Table 1- Phytochemical screening of the leaf extract of *Euphorbia geniculata***

<b>Solvent→ Phytochemical↓</b>	<b>Petroleum ether</b>	<b>Chloroform</b>	<b>Methanol</b>	<b>Ethanol</b>	<b>Water</b>
<b>Alkaloids</b>	+	+	+	+	+
<b>Flavonoids</b>	+	-	+	-	+
<b>Tannins</b>	+	-	+	-	+
<b>Phenol</b>	-	+	+	+	+
<b>Carbohydrate</b>	-	-	-	-	-
<b>Phytosteroids</b>	+	-	-	+	+
<b>Fixed oil &amp; fat</b>	+	-	-	+	+

+ Presence of constituent, - Absence of constituent

## CONCLUSION

The phytochemical screening of *Euphorbia geniculata* revealed the presence of alkaloids, flavonoids, tannins, phenolic compounds, phytosterols, fat and oil respectively. It could be suggested that

*Euphorbia geniculata* are not only interesting source of medicinal activities but also potential source of phytochemicals. The present investigation suggests that *Euphorbia geniculata* is potentially a good source of traditional

medicine and therapeutics. Further studies are essential to isolate the bioactive components so that it can be used further in designing specific drugs.

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# Evaluation of antibacterial activity on different solvent extracts of *Punica granatum* against few pathogens

\* **Selvamaleeswaran P**

\* Muthayammal College of Arts and Science, Rasipuram - 637 408, Namakkal, TN.

E.mail: *maleeswaran83@gmail.com*.

## ABSTRACT

The present study was carried out to investigate the antimicrobial activity of *Punica granatum* against the few pathogen viz., *Escherichia coli* (*E.coli*), *Bacillus subtilis* (*B.subtilis*), *Staphylococcus aureus* (*S. aureus*) and *Proteus mirabilis* (*P. mirabilis*). The extracts of *Punica granatum* was tested against *E.coli*, *B.subtilis*, *S. aureus* and *P. mirabilis* by the agar disc diffusion method. Different extracts of *P. granatum* showed inhibitory effects against *E.coli*, *B.subtilis*, *S. aureus* and *P. mirabilis* ethanol extracts of *P. granatum* showed maximum of zone of inhibition against *E.coli* (21 mm), *B.subtilis* (16 mm), *S. aureus* (18 mm) *P. mirabilis*(17) next to that petroleum ether of *P. granatum* showed *E.coli* (18 mm), *B.subtilis* (00 mm), *S. aureus* (12 mm) *P. mirabilis*(11mm) followed by isopropanol *E.coli* (14 mm), *B.subtilis* (11 mm), *S. aureus* (12 mm) *P. mirabilis*(11mm) and acetone extracts *E.coli* (20 mm), *B.subtilis* (19 mm), *S. aureus* (18 mm) *P. mirabilis*(18mm). The antimicrobial activity of all the four plant extracts are comparable and their potential as alternative in the treatment of infectious by these microorganisms. Susceptibility testing is conducted on isolates using drugs selected on the basis of their importance to human medicine.

## INTRODUCTION

Medicinal plants are gifts of god, to cure infinite number of diseases among the human beings and other living organism (Bushra Beegum et al., 2003). India throughout its long history has accumulated a rich body of experiential facts of the use of medicinal plants for the treatment of various diseases. Chemical studies of Indian medicinal plants offer a

valuable materials base for the discovery and development of new drugs of natural origin. Systematic screening of them may result in the discovery of novel effective compounds (Tomoko et al., 2002).

Pomegranate or *P. granatum* is a small tree or shrub, belonging to Punicaceae family. The tree is found to grow wild in Persia, Arabia, Afghanistan and parts of western Pakistan. The tree is

much valued for its fruit and its various parts are reputed for their medicinal properties. Leaf juice is considered to be astringent, while bark and rind of the fruits are valuable in chronic diarrhea and early stages of dysentery (Nadkarani, 1976). From the literature *survey* it has been observed that most of the work has been carried out on the constituents of leaves, bark, stem and roots. Active constituents isolated from the plant are the alkaloids pellentrine, isopellentrine, pseudopellinterine and methyl isopellentrine. These compounds are known to possess anthelmintic properties (Wibaut 1957).  $\beta$ -Sitoslerol, friedelin, estrogens and D-mannitol have also been reported to be present in stem, roots and leaves (Fayez, Negam and Sharaf, 1963). In view of its reputed healing properties and reported isolation of estrogens we have also initiated a study of the isolation of bioactive constituents from the seeds of *P. granatum*.

## **MATERIALS AND METHODS**

### **Collection of plant materials**

*P. granatum* collected from Kolli Hills, Namakkal, Tamil Nadu. India.

### **Preparation of crude extract**

Leaf samples of *P. granatum* were air and shade dried for two weeks and pulverized to powder using mortar. The dried and powdered leaves materials (50 g)

were extracted successively with 200 ml of petroleum ether, Acetone, Isopropanol, and Ethanol by using Soxhlet extractor for 48 h at a temperature not exceeding the boiling point of the solvent. The extracts were filtered using Whattmann filter paper (No.1) and then concentrated in vacuum at 40°C using Rotary evaporator. The residues obtained were stored in a freezer -70°C until further tests.(Abdul et al., 2010). These extracts were dissolved in dimethyl sulphoxide (100 mg/ml) to make the final concentrations.

### **Evaluation of antibacterial activities**

The crude extracts were used for bioassay against both gram positive and gram negative bacteria. Inoculum was prepared from the 24 hours old culture of bacterial isolates in nutrient broth. Nutrient agar plates were prepared and the inocula were seeded by spread plate method. The disc diffusion method was used for the antibacterial evaluations. Disc of 10mm diameter were placed into the sterile medium with the test organisms and filled with 10, 20, 30, 40 and 50 $\mu$ l of plant extracts. The plates were incubated at 37°C for 18-24 h. Antibacterial activity was evaluated by measuring the inhibition zone in millimeter in diameter and tabulated. All the samples were done in triplicate. Both positive and negative controls were determined, for negative control the four solvents were also used to determine their

effect on test organisms. While two common antibiotics viz... Amphotericin and Tetracycline discs were also used to compare the effectiveness of the plants extracts with that of the antibiotics.

**RESULT**

Total of four extracts viz., Petroleum Ether; Acetone, Isopropanol and Ethanol were examined against the pathogens. The antibacterial activity of the leaf extracts of *P. granatum* were illustrated in Table 1. The present study results showed that ethanol extracts of *P. granatum* showed maximum of zone of inhibition against *E.coli* (21 mm), *B.subtilis* (16 mm) , *S. aureus* (18 mm) *P. mirabilis*(17) next to that petroleum ether

of *P. granatum* showed *E.Coli* (18 mm), *B.subtilis* (00 mm) , *S. aureus* (12 mm) *P. mirabilis*(11mm) followed by Isopropanol *E.Coli* (14 mm), *B.subtilis* (11 mm) , *S. aureus* (12 mm) *P. mirabilis*(11mm) and acetone extracts *E.Coli* (20 mm), *B.subtilis* (19 mm) , *S. aureus* (18 mm) *P. mirabilis*(18mm).The petroleum ether extract of *P. granatum* also showed the low percent of inhibition against *E.Coli*.

The diameters of the zone produced by Petroleum Ether; Ethanol, Isopropanol and Acetone extracts of pomegranate against *E. coli*, *B. subtilis*,*S. aureus* and *P. mirabilis* are given in Table 1 and Fig 1 to 4.

**Table 1**

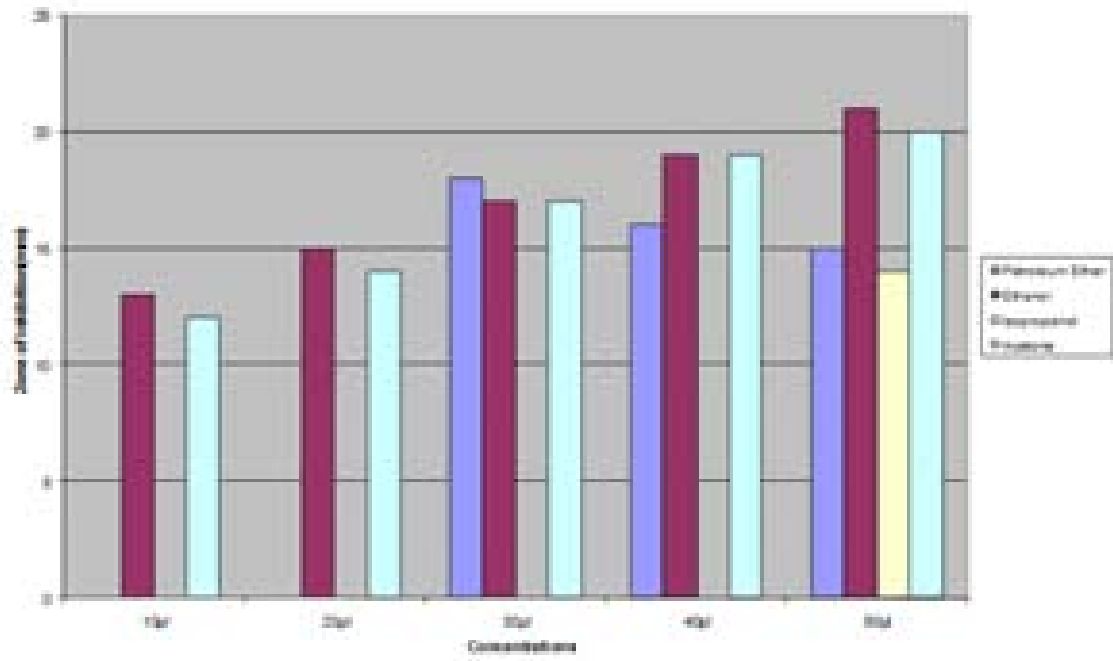
**Antimicrobial activity of leaves extracts *Punica granatum* against the few pathogens (mm)**

**Zone of inhibition in diameter (mm)**

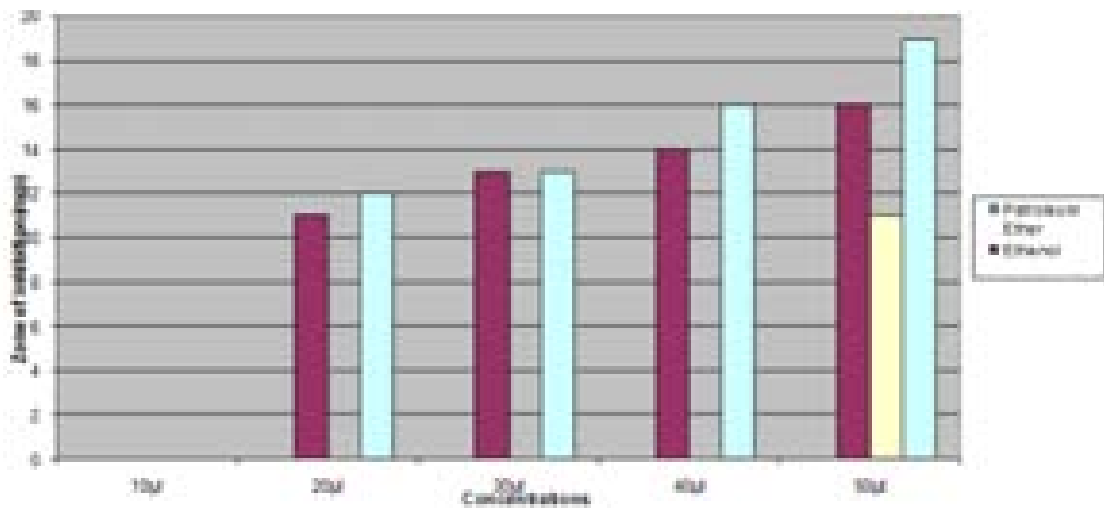
S. No	Petroleum Ether extract (µL)**					Ethanol extract (µL)**					Isopropanol extract (µL)**					Ethanol extract (µL)**				
	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
1	00	00	15	16	18	13	15	17	19	21	00	00	00	00	14	12	14	17	19	20
2	00	00	00	00	00	00	11	13	14	16	00	00	00	00	11	00	12	13	16	19
3	00	00	00	00	12	12	13	15	17	18	00	00	00	11	12	00	13	15	16	18
4	00	00	00	00	11	13	14	16	17	17	00	00	00	00	11	12	13	15	16	18

\*1: *E.Coli*, 2: *B.subtilis*, 3: *S. aureus*, 4: *P. mirabilis*\*\* Control (solvents alone) is failed to show the zone of inhibition. µL of extract samples (100mg/ml).

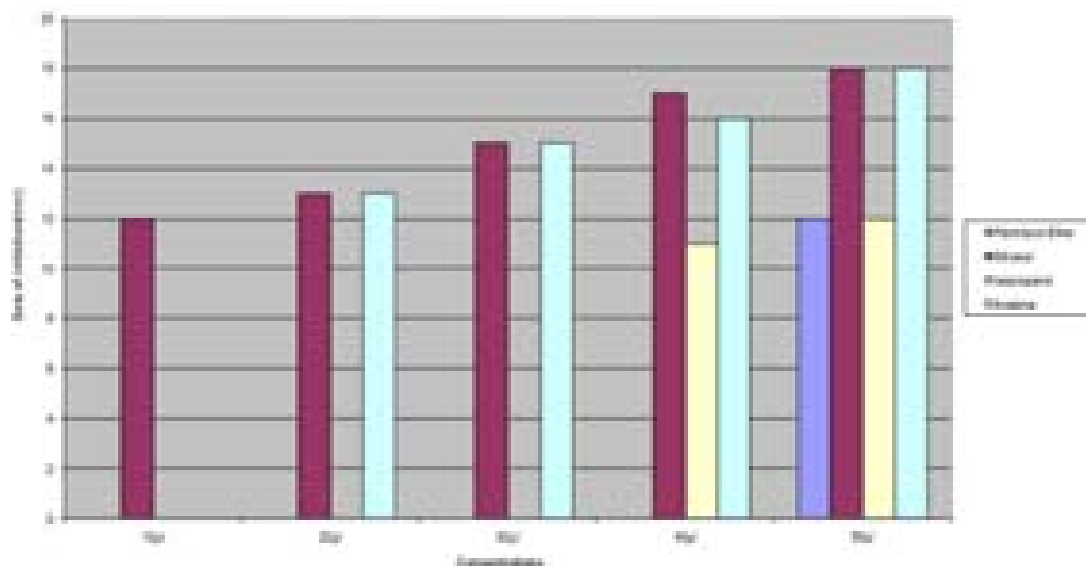
**Fig 1: Antibacterial activity of various Extracts of *Punica granatum* against *E.Coli***



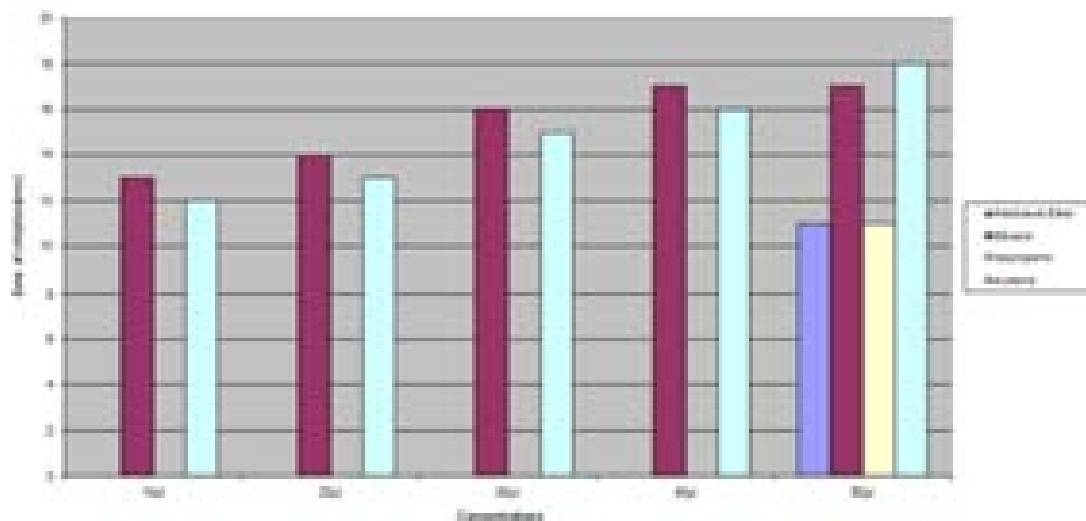
**Fig 2: Antibacterial activity of various Extracts of *Punica granatum* against *Bascillus Subtilis***



**Fig 3: Antibacterial activity of various Extracts of *Punica granatum* against *Stephylococcus Aureus***



**Fig 4: Antibacterial activity of various Extracts of *Punica granatum* against *Proteus mirabilis***



**DISCUSSION**

The result of antimicrobial screening of different extracts of *P. granatum* leaves have been tabulated in

table 1. The zone of inhibition formed was proportional to the concentration. Ethanol extract found to be more effective and showed highest growth inhibition of *E. coli*, *B. subtilis*, *S.aureus* and *P. mirabilis*

as compared to the tetracycline.

The petroleum ether and Acetone extract was observed to be effective against *E.Coli*, *Bacillus subtilis*, *S.aureus* and *proteus mirabilis*. The result of present study proves the traditional use of *P. granatum* leaf in various ineffective diseases as mentioned earlier.

Current strategies to overcome the global problem of antimicrobial resistance include research in finding new and innovative antimicrobials from plants. This study was carried out to determine the antibacterial activity of plant extracts of *Olea africana* stem-bark, *Psidium guajava* leaves, *Vernonia amygdalina* leaves, *Lantana camara* leaves and *Mangifera indica* leaves which are used in folklore medicine to treat infections of microbial origin in Longisa region of Bomet District, Kenya (Cheruiyot *et al.*, 2009).

Medicinal plants are the wealthy source of antibacterial agents and curatives. *Tecoma stans*, *Coleus forskohlii* and *Pogostemon patchouli*. *In vitro* antibacterial activity of crude leaf extracts of these three plants was tested by disc diffusion method against five human pathogenic bacteria *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Salmonella typhi*, *Klebsiella pneumonia* and *Vibrio parahemolyticus*. Gram-negative bacterial strains were more susceptible to the crude extracts as

compare to gram-positive. However, this study revealed maximum growth inhibition and effectiveness was remarkably observed in the extracts of *Coleus forskohlii*, *Pogostemon patchouli* and then in *Tecoma stans*. These results indicate that leaves have a potential broad spectrum antibacterial activity (Senthil kumar *et al.*, 2010).

The susceptibility of various microbial agents to different extract of *P. granatum* indicates that plant is the potential source for antimicrobial compound. So further work on the profile in order to determine the nature of bioactive principles present in the plant and their mode of action.

## ACKNOWLEDGEMENTS

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**Preventive effect of leaves of *Justicia Tranquebariensis* on isoproterenol induced myocardial infarction in albino Wistar rats**

**P. Ganapathy\*, M. Shabana Begum\***

\* Muthayammal College of Arts & Science, Rasipuram - 637 408, Tamil Nadu, India.

E.mail: bcmsm@muthayammal.in.

**ABSTRACT**

Myocardial infarction (MI) is the interruption of blood supply to part of the heart, causing heart cells to die, commonly due to occlusion (blockage) of a coronary artery. The present study evaluate investigate the preventive effect of *Justicia Tranquebariensis* ethanol leaf extract on serum cardiac marker enzymes and lipids in isoproterenol (ISO) induced myocardial infarction in albino Wistar rats. Rats subcutaneously injected with ISO (85 mg/kg) at an interval of 24 hours for 2 days showed a significant increase in the activities of cardiac marker enzymes such as creatine kinase (CK), lactate dehydrogenase (LDH), aspartate transaminase (AST) and alanine transaminase (ALT) and lipid profile levels such as total cholesterol (TC), triglycerides (TG). Pretreated with ethanol leaf extract of *Justicia tranquebariensis*, the levels in low density lipoprotein (LDL) significantly decrease in ISO-induced rats. *Justicia Tranquebariensis* ethanol leaf extracts showed a significant effect and maintained the marker enzyme and levels of lipids in serum.

**Key Words:** *Justicia tranquebariensis*, Isoproterenol, Lipids, Marker Enzymes

**INTRODUCTION**

Myocardial infarction is the common presentation of the ischemic heart disease. It occurs when myocardial ischemia surpasses the critical threshold level for an extended time resulting in irreversible myocardial cell damage. Although clinical care is improved, public awareness is raised and health innovations are widely used, myocardial infarction still remains the leading cause of death worldwide (Aronow, 2006). According to the World Health Organization it will be the major cause of death in the world by

the year 2020 (Lopez and Murrau, 1998). Myocardial infarction is the acute condition of myocardial necrosis that occurs as a result of imbalance between coronary blood supply and myocardial demand. Although clinical care has been improved, public awareness is raised and health innovations are widely used, myocardial infarction remains the leading cause of death world wide (Aronow, 2006).

Isoproterenol [1-(3,4-dihydroxyphenyl)-2-isopropylaminoethanol hydrochloride] is a

synthetic catecholamine and  $\beta$ -adrenergic agonist, which has been documented to produce severe stress in the myocardium resulting in the myocardial infarction, if administered in supramaximal doses (Rona, 1985; Rona *et al.*, 1959). It produces myocardial necrosis which caused cardiac dysfunction, increased lipid peroxidation along with an increase in the level of myocardial lipids, altered activities of the cardiac enzymes and antioxidants (Karthikeyan *et al.*, 2007; Rajadurai and Prince, 2006). It has been suggested that the oxidative products of catecholamines are responsible for changes in the myocardium (Yates *et al.*, 1981). These free radicals stimulate lipid peroxidation and cause irreversible damage to the myocardial membrane. Isoproterenol-induced myocardial necrosis showed alterations in membrane permeability, leading to the loss of function and integrity of myocardial membranes (Todd *et al.*, 1980). It is the acute condition of necrosis of the myocardium which is accompanied by increased release of cardiac marker enzymes, accumulated lipid peroxides, and damaged cardiac function (Rajadurai and Prince, 2007b; Rajadurai and Stanely Mainzen Prince, 2006, 2007).

*Justicia Tranquebariensis* is a small shrub, which is widely distributed in the southern parts of India. Some species

of the genus *Justicia* have been used in the traditional system of medicine for the treatment of fever, pain, inflammation, diabetes, diarrhea and liver diseases. They also possess anti tumoral, anti viral, analgesic and anti-inflammatory activities. In this genus about 20 species have been chemically investigated and the major secondary metabolites isolated were lignans, flavonoids, steroids and triterpenes (Ghosal *et al.*, 1981). The juice of small of small and somewhat fleshy leaves of this species of *Justicia* is considered by the natives of India as cooling and aperients, and is prescribed for the children in the smallpox, in the doses of a table-spoonful or two, twice daily; bruised leaves are also applied to blows and other external injuries.

The present study has been designed to evaluate the cardioprotective activity of *Justicia Tranquebariensis* ethanol leaf extract in isoproterenol-induced myocardial damage in rats. This noninvasive myocardial infarction rat model was used. Our research also attempted to demonstrate the molecular mechanism of its therapeutic effect by studying the correlate functional parameters, biochemical markers

## MATERIALS AND METHODS

### Experimental Animals

All the experiments were done with female albino Wistar rats weighing 140-160 g, obtained from the Venkateswara Enterprises, Bangalore were used in this study. They were housed in polypropylene cages (47×34×20 cm) lined with husk, renewed every 24 hours under a 12:12 h light/dark cycle at around 22°C and had free access to tap water and food. The rats were fed on a standard pellet diet Pranav Agro Industries Ltd., Maharashtra, India. The pellet diet consisted of 22.02% crude protein, 4.25% crude oil, 3.02% crude fiber, 7.5% ash, 1.38% sand silica, 0.8% calcium, 0.6% phosphorus, 2.46% glucose, 1.8% vitamins, and 56.17% carbohydrates. It provided a metabolizable energy of 3600 kcal. The experiment was carried out in accordance with the guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), New Delhi, India.

### Drugs and chemicals

Isoproterenol hydrochloride, rutin and EA were purchased from Sigma chemicals, St. Louis, MO, USA. Adenosine triphosphate (ATP), triethanolamine (TEA), copper nitrate and diphenyl carbazide were obtained from Himedia laboratory, Mumbai, India. Triglycerides (TG), HDL cholesterol, glucose, protein and uric acid kits were

purchased from Agappe Diagnostics, Kerala, India. All other chemical used in this study were of analytical grade.

### Preparation of plant extract

*Justicia Tranquebariensis* leaves were collected at Rasipuram, Namakkal Dt, Tamilnadu, India. The leaves of the plant were shade dried and powdered. Dried powder (200g) was taken and extracted using Soxhlet apparatus. The extract obtained was concentrated to dry residue under reduced pressure at room temperature.

### Induction of Experimental Myocardial Infarction

Isoproterenol (85 mg/kg) was dissolved in normal saline and injected subcutaneously to rats at an interval of 24 h for two days (Rajadurai and Prince, 2006).

### Experimental Design

A total of 24 rats were divided into 4 groups of 6 rats in each group and used in this study.

- Group 1: Normal control rats
- Group 2: *Justicia tranquebariensis* (300 mg/kg)
- Group 3: ISO control rats (85 mg/kg)
- Group 4: *Justicia tranquebariensis* (300 mg/kg) + ISO

*Justicia tranquebariensis* was dissolved in double distilled water and administered to rats orally using an intragastric tube daily for a period of 21 days. At the end of treatment period all the rats were injected with ISO (85 mg/kg) at

an interval of 24 hours for 2 days. All the rats were anesthetized with pentobarbital sodium (35 mg/kg) and sacrificed by cervical decapitation. Blood was collected; serum were separated by centrifugation was used for the estimation of various biochemical parameters.

### Biochemical estimation

Lipids were extracted from serum by the method of Folch *et al.*, using chloroform: methanol mixture (2:1 v/v). Total cholesterol (TC) was estimated by the method of Zlatkis *et al.*, Free fatty acids (FFA) levels were estimated by the method of Falholt *et al.* HDL levels were estimated by Assmann, method and triglycerides (TG) levels were estimated by Schettler and Nussel, method using a commercial kit from Agappe Diagnostics.

Cholesterol in the lipoprotein fractions was also determined by the method of Zlatkis *et al.* [19] as described earlier. HDL-cholesterol was estimated in the supernatant obtained after precipitation with phosphotungstic acid/Mg<sup>2+</sup>. LDL-cholesterol and VLDL-cholesterol were calculated as follows:

$$\text{VLDL-C} = \text{TGs}/5$$

$$\text{LDL-C} = \text{Total cholesterol} - (\text{HDL-C} + \text{VLDL-C})$$

### Statistical analysis

Statistical analysis was performed by one way analysis of variance (ANOVA) followed by Duncan's multiple

range test (DMRT) using Statistical Package for the Social Sciences (SPSS) software package version 9.05. *P* values <0.05 were considered significant.

### RESULTS

Figure 2-3 represent the effect of *Justicia Tranquebariensis* leaf extract on the activities of serum CK, LDH, AST and ALT in normal and ISO-induced rats. Rats induced with ISO, showed a significant increase in the activities of these cardiac enzymes in serum when compared to normal control rats. Pretreatment with leaf extract of *Justicia Tranquebariensis* (300 mg/kg) daily for a period of 21 days significantly minimized the alterations in the activities of these enzymes in ISO-induced rats when compared to ISO-alone induced rats.

Total cholesterol, triglycerides, HDL and LDL levels in serum in normal and ISO-induced rats are shown in figure 4-6. Rats treated with ISO showed a significant increase in TC, TG and LDL levels, but there was a significant decrease in HDL levels. Rats pretreated with leaf extract of *Justicia Tranquebariensis* (300 mg/kg) for 21 days significantly decreased the levels of TC, TG and LDL with subsequent increase in the level of HDL cholesterol to ISO-induced rats.

## DISCUSSION

Isoproterenol is well known cardiotoxic agent due to its ability to destruct myocardial cells. In this study, significant decline was shown in the activities of cardiac markers such as creatine kinase (CK), lactate dehydrogenase (LDH), aspartate transaminase (AST) and alanine transaminase (ALT) in serum of ISO-treated rats. When myocardial cells, containing LDH, CK, AST, and ALT are damaged or destroyed due to decrease oxygen supply or glucose, the cell membrane become permeable or may rupture, which result in the leakage of these enzymes. This account for the increased activities of LDH, CK, AST, and ALT in serum of ISO- induced rats (Ahmed *et al.*, 2004). Pre-treatment with aqueous leaf extract of *Justicia Tranquebariensis* (300 mg/kg) for a period of 21 days, significantly prevented the ISO-induced elevation in the activities of diagnostic marker enzymes in serum. This could be due to the free radical scavenging property of the extract in the presence of antioxidative phytochemicals such as flavonoids, alkaloids, sterols, tannins and phlobatannins and flavonoid glycosides (Das *et al.*, 1964).

Lipids play an important role in the pathogenesis of myocardial infarction. Isoproterenol treated cardio toxicity is

associated with increased levels of circulatory lipids. Hypercholesterolemia and hypertriglyceridemia are the risk factors for the development of myocardial infarction. Increased levels of blood cholesterol and its accumulation in the heart are well associated with myocardial damage (Salter and White, 1996). It has been reported that the increase in the myocardial cholesterol content in isoproterenol treated rats is due to increased uptake of LDL-cholesterol from the blood by myocardial membranes (Anandan *et al.*, 2007). The mechanism of observed increase in triglycerides after myocardial infarction may be due to elevated flux of fatty acids from the plasma. Oral pretreatment with aqueous leaf extract of *Justicia Tranquebariensis* decreased the levels of TC, TG and LDL and increased the levels of HDL in the serum.

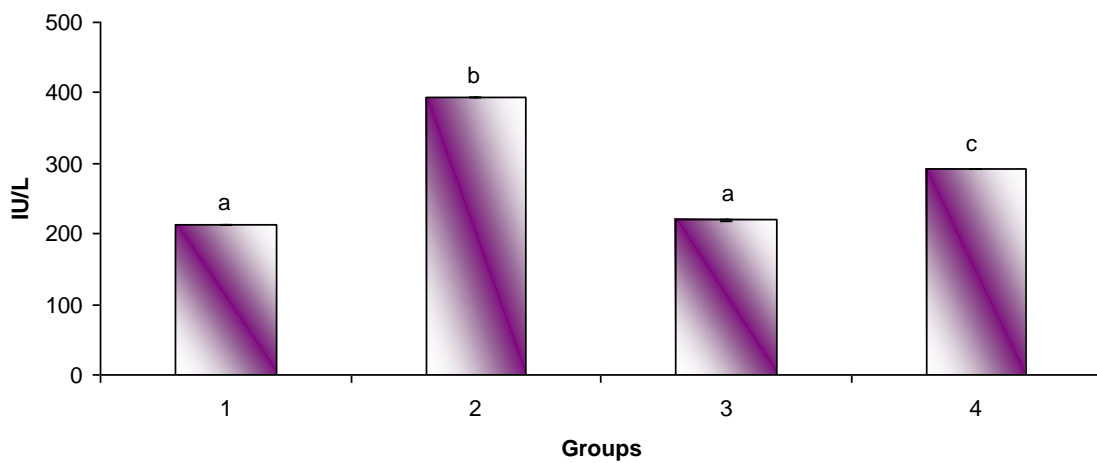
## CONCLUSION

The present study provided experimental evidence that *Justicia Tranquebariensis* maintained the cardiac marker enzyme activities and lipid profile and improved cardiac performance in ISO-induced rats. This finding might be rational to understand the beneficial effects of *Justicia Tranquebariensis* on cardio protection against myocardial injury, in which oxidative stress was long known to contribute to the pathogenesis.

**Fig 1.** *Justicia tranquebariensis*



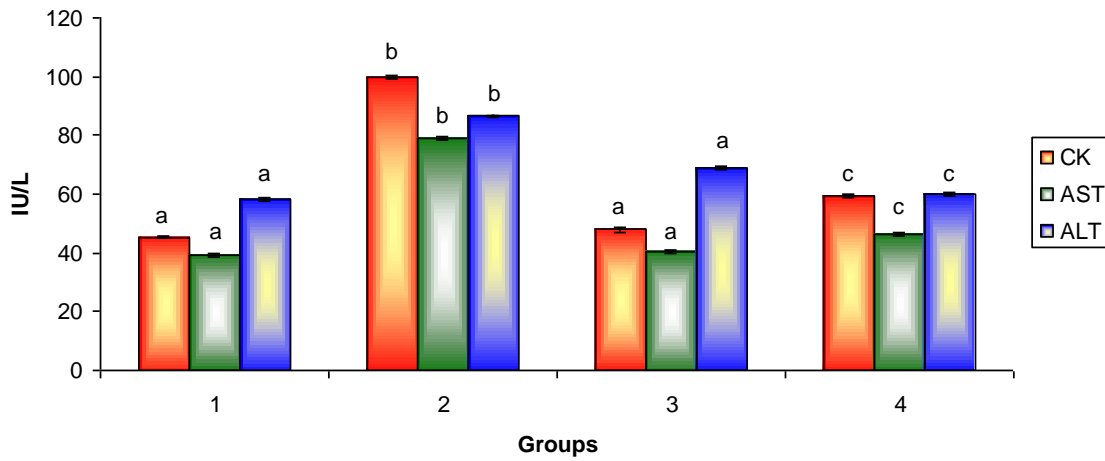
**Fig. 2.** Effect of *Justicia Tranquebariensis* on the activities of LDH in normal and ISO-induced MI in rats.



Each value is mean  $\pm$  S.D. for 6 rats in each group.

Columns not sharing a common superscript (a-c) differ significantly with each other ( $P < 0.05$ , DMRT).

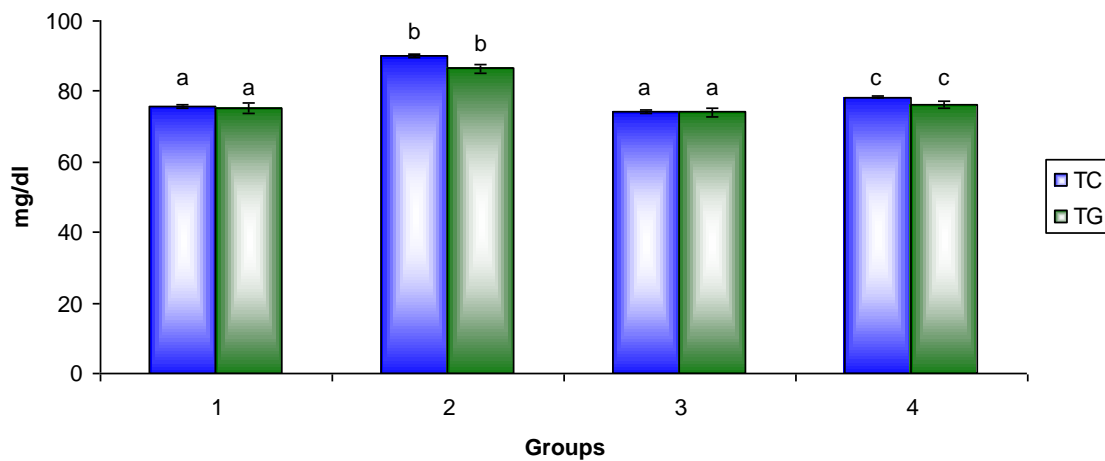
**Fig. 3.** Effect of *Justicia Tranquebariensis* on the activities of CK, AST and ALT in normal and ISO-induced MI in rats.



Each value is mean ± S.D. for 6 rats in each group.

Values not sharing a common superscript (a-c) differ significantly with each other ( $P < 0.05$ , DMRT).

**Fig. 4.** Effect of *Justicia Tranquebariensis* on the levels of TC and TG in normal and ISO-induced MI in rats.

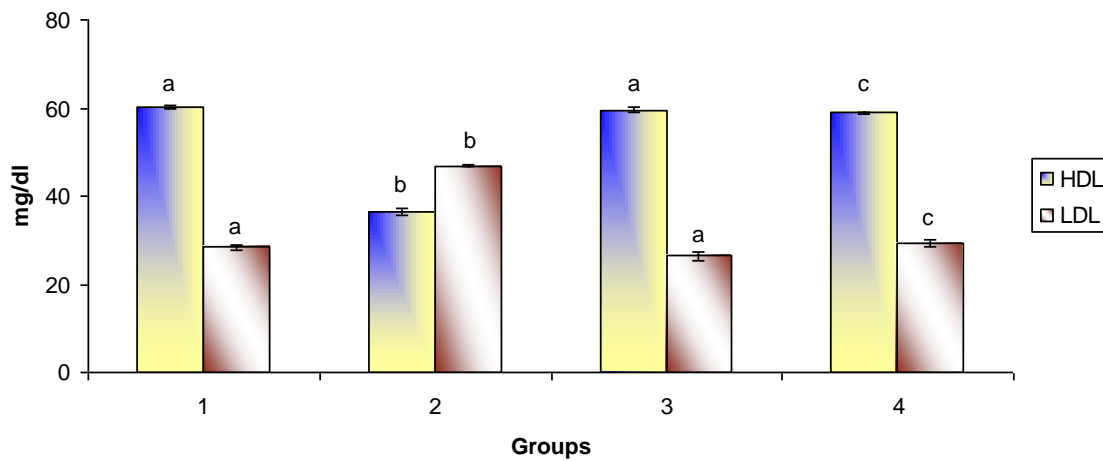


Each value is mean ± S.D. for 6 rats in each group.

Values not sharing a common superscript (a-c) differ significantly with each other ( $P < 0.05$ , DMRT).



**Fig. 5.** Effect of *Justicia Tranquebariensis* on the levels of HDL and LDL in normal and ISO-induced MI in rats.



Each value is mean  $\pm$  S.D. for 6 rats in each group.

Values not sharing a common superscript (a-c) differ significantly with each other ( $P < 0.05$ , DMRT).

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# Chemico-biological interaction of Coumarin dervative with Bovine Serum Albumin: Modulation of the interaction by $\beta$ -cyclodextrin

Premalatha D and Sudha N\*

Department of Chemistry, Muthayammal College of Arts and Science,  
Rasipuram, 637 408, Tamil Nadu, India.

## ABSTRACT

We report in this paper the association of 6-methyl-3-[(4-ethylphenyl)imino]methyl-4H-chromen-4-one (MEPIMC) with  $\beta$ -Cyclodextrin ( $\beta$ -CD) and the influence of cyclodextrin on MEPIMC's binding with bovine serum albumin. The stoichiometry and the binding constant of the MEPIMC- $\beta$ -CD inclusion complex are reported based on UV-Visible absorption and fluorescence spectroscopic studies. The binding titrations of MEPIMC with BSA in water and in the presence of aqueous  $\beta$ -CD are carried out. The Stern–Volmer constants and the binding constants for the MEPIMC–BSA binding in the presence and absence of  $\beta$ -CD are reported. The differences in the magnitude of the binding strengths are discussed. Molecular modeling is used to optimize the sites and mode of binding of MEPIMC with BSA. Förster Resonance Energy Transfer (FRET) studies are carried out and the proximity of the interacting molecules is reported in the presence and absence of  $\beta$ -CD.

*Key words:*  $\beta$ -Cyclodextrin; Bovine Serum Albumin; FRET; MEPIMC; fluorescence

## INTRODUCTION

Serum albumins, which are abundant blood plasma proteins, act as carriers for numerous exogenous and endogenous compounds (Ehteshami et al., 2013; Kaboudin et al., 2013; Bi et al., 2009). Popular studied albumins are bovine serum albumin (BSA) and human serum albumin (HSA). Both BSA and HSA have very high conformational adaptability to a great variety of ligands (Kragh-Hansen, 1981). Ligand–protein binding studies intend to comprehend the binding mechanism using absorption, fluorescence, circular dichroism etc (Kumar & Buranaprapuk,

1999; Jaiswal et al., 2002; Filipe et al., 2002; Jacobsen & Brodersen, 1983; Reed, 1977). Based on such studies, information on the binding process of many drugs, decrease of their toxicity, and the increase in their solubility has been gained at the molecular level [Moreno et al., 1999; Feng et al., 1998; Gelamo et al., 2000; Pal et al., 2000; Panjehshahin et al 1989; Vorum et al., 1994). In general, albumins are of low tryptophan and high cystine contents whereas BSA differs in its tryptophan content. BSA has tryptophan groups at 134 and 212 positions. Primarily, three domains and six principal binding sites

have been identified for several important biomolecules (Kragh-Hansen, 1981; Panjehshahin et al., 1989; Vorum et al., 1994; Kragh-Hansen, 1985; Mishra et al., 2005). BSA has conformational adaptability and thus binds to several compounds with high binding strengths. Binding of drugs with serum albumins is different from that with other proteins such as enzymes or antibodies. Thus, it is greatly important to know the number and the nature of the binding sites of albumin with small molecules. This paper deals with the binding of a synthesized flavonoid derivative, 6-methyl-3-[(4-ethylphenyl)imino]methyl-4H-chromen-4-one (abbreviated as MEPIMC) to BSA and the effect of complexation by  $\beta$ -cyclodextrin on the binding with BSA.

Cyclodextrins (CDs) are cyclic oligosaccharides composed of  $\alpha$ -D-glucopyranose units. The most common naturally occurring CDs are composed of 6, 7 and 8 ( $\alpha$ -,  $\beta$ - and  $\gamma$ -CD) D-glucopyranose.  $\beta$ -CD is the most studied among these three (He and Carter, 1992). Cyclodextrins form inclusion complexes with various guest molecules with suitable polarity and dimension owing to their special molecular structure of hydrophobic internal cavity and hydrophilic exterior (Enoch et al., 2010; Enoch & Swaminathan, 2007).

The host-guest inclusion complexes can be stabilized through several types of intermolecular interactions such as

hydrogen bonds, Van der Waals forces, strain energy of the macrocyclic ring, and hydrophobic or dipolar interactions (Sameena et al., 2014). Studies on the topical drug availability of cyclodextrins show that they can either increase or decrease drug permeability through biological barriers. Hydrophilic cyclodextrins, and their drug complexes, are only able to permeate into biological membranes with considerable difficulty. Cyclodextrins do enhance drug permeability without causing physicochemical changes within the barrier (Sameena & Enoch, 2012; Valero et al., 2007; Vyas et al., 2008). Although cyclodextrins are known for their drug carrying ability, the binding of drugs with serum albumins in CD-encapsulated form is very rarely found in the literature (Laza-Knoerr et al., 2010). In order to understand the ability of these container molecules in transporting drugs and in protecting the drugs from decay and to comprehend the percentage availability of drugs at the disease site investigation must be done on binding of small molecules in CD-encapsulated form with proteins (Sudha & Enoch, 2011). This paper reports the binding of a derivative of coumarin, MEPIMC with  $\beta$ -cyclodextrin and the comparison of the binding, based on spectral analysis and molecular modeling, with free form of the small molecule.

## Experimental Design

### Chemicals and Solvents

6-methyl-3-formylchromone and 4-ethylaniline were purchased from Sigma–Aldrich, Bangalore, India.  $\beta$ -Cyclodextrin from Hi Media and used as received. Crystalline bovine serum albumin and HEPES buffer were purchased from Hi Media. All the solvents used from Merck were of spectral grade which were used as received.

### Synthesis and characterization of MEPIMC

Synthesis scheme of MEPIMC, as per the reported procedure [33], is given in Fig. 1. An equimolar (0.1 mM) amount of 6-methyl-3-formylchromone (0.2 g) and 4-ethylaniline (0.71 g) were stirred with 50 ml of methanol. The mixture was heated to 60° C for 0.5 hours and cooled to room temperature. Yellow crystals were separated out. The completion of the reaction was monitored by TLC and purified by column chromatography using Hexane : Ethylacetate mixture (80:20).

### Preparation of test solutions

Test solutions were prepared by appropriate dilution of a stock solution of MEPIMC. The stock solution of MEPIMC was made in methanol due to its less solubility of in water. The test solutions were having the concentration of methanol as 1 %. HEPES buffer (0.1 M) is used to prepare stock solution of BSA of concentration  $3.0 \times 10^{-5}$  M. Triply distilled water was used throughout the

experiments. All experiments were carried out at ambient temperature of  $25 \pm 2^\circ$  C. The test solutions were homogeneous after the addition of all additives. The absorption and the fluorescence spectra were recorded against appropriate blank solutions.

### Instrumentation

A double beam UV–Visible spectrophotometer, Jasco–V 630 is used for absorption measurements using 1cm path length cells. Perkin-Elmer LS55 spectrofluorometer equipped with a 120 W Xenon lamp for excitation served the measurement of fluorescence. Both the excitation and the emission band widths were set up at 2.5 nm. Ultra-sonicator PCI 9L 250H, India was used for sonication.

## Results and discussion

### Complexation of MEPIMC with $\beta$ -CD

Fig. 2 (a) shows the absorption spectra of MEPIMC in water and at various amounts of  $\beta$ -CD. The concentration of MEPIMC is fixed with increasing concentration of  $\beta$ -CD, the absorbances at the two bands (307 nm and 395 nm) show hyperchromic shift up to the maximum concentration of  $\beta$ -CD. The two bands are shifted strongly (by 10 nm) towards the blue. The change is more pronounced in the fluorescence spectrum of MEPIMC [Fig. 2 (b)]. There is a prominent emission band at 411 nm. The 411nm band shows an 8 nm blue shift at the addition of  $\beta$ -CD. The intensity of fluorescence is enhanced at each addition of  $\beta$ -CD in increasing

concentration. This fluorescence enhancement is a result of inclusion complexation of MEPIMC with  $\beta$ -CD. The  $\beta$ -CD cavity offers a vibrational restriction to the MEPIMC molecule as it is

encapsulated by CD. The absorption and fluorescence spectral data for the complexation of MEPIMC with  $\beta$ -CD are given in Table 1.

Table 1

Absorption and fluorescence spectral data of MEPIMC in various concentrations of  $\beta$ -CD

Conc. of $\beta$ -CD, mol dm <sup>-3</sup>	Absorption maxima, nm	Absorbance, a.u.	Fluorescence maxima, nm
0	307	0.023	411
	395	0.008	
$1.0 \times 10^{-4}$	306	0.027	-
	392	0.009	
$2.0 \times 10^{-4}$	306	0.029	-
	390	0.009	
$4.0 \times 10^{-4}$	304	0.030	411
	391	0.009	
$8.0 \times 10^{-4}$	303	0.033	410
	390	0.011	
$1.0 \times 10^{-3}$	303	0.036	409
	387	0.013	
$2.0 \times 10^{-3}$	299	0.040	409
	388	0.018	
$4.0 \times 10^{-3}$	299	0.044	408
	387	0.019	
$8.0 \times 10^{-3}$	297	0.048	403
	386	0.016	
$1.0 \times 10^{-2}$	297	0.050	403
	385	0.019	

The Benesi–Hildebrand plot of  $1/I-I_0$  vs.  $1/[\beta\text{-CD}]$ , following the equation (1), shows a linearity [Fig. 2 (c)] which in turn suggests that the inclusion complexation is of the stoichiometry 1:1 [MEPIMC: $\beta\text{-CD}$ ].

$$\frac{1}{I-I_0} = \frac{1}{I'-I_0} + \frac{1}{(I'-I_0)K[\beta\text{-CD}]^2} \tag{1}$$

where  $I$  refers to the variable intensity of fluorescence of MEPIMC with various concentrations of  $\beta\text{-CD}$ ,  $I'$  is the intensity of fluorescence at the highest concentration of  $\beta\text{-CD}$ ,  $I_0$  is the intensity in water, and  $K$  is the binding constant.

**Binding of MEPIMC with BSA**

The absorption spectrum of BSA shows a hyperchromic shift continuously at each addition of MEPIMC in increasing concentration. This is shown in Fig. 3 (a). The absorption band at 278 nm shifts to

277 nm at the maximal concentration of MEPIMC. Fig. 3 (b) shows the fluorescence spectra of BSA at various added amounts of MEPIMC. The BSA molecule has an intrinsic fluorophore, tryptophan, which mainly contributes to its fluorescence. Addition of small molecules causes usually quenching of tryptophan fluorescence. Without binding to MEPIMC, BSA has a strong fluorescence emission band at 348 nm when the excitation was done at 280 nm. The fluorescence emission intensity of BSA decreased with increased MEPIMC addition. A very small blue shift of maximum occurs at the addition of MEPIMC. The absorption and fluorescence spectral data of MEPIMC with BSA were given in Table 2.

**Table 2 Absorption and fluorescence spectral data of MEPIMC with BSA**

Conc. of MEPIMC, mol dm <sup>-3</sup>	Absorption maxima, nm	Absorbance, a.u.	Fluorescence maxima, nm
0	278	0.249	348
2.5 x 10 <sup>-6</sup>	278	0.408	348
5.0 x 10 <sup>-6</sup>	278	0.422	348
1.0 x 10 <sup>-5</sup>	278	0.450	347
1.5 x 10 <sup>-5</sup>	278	0.488	347
2.0 x 10 <sup>-5</sup>	278	0.535	347
2.5 x 10 <sup>-5</sup>	277 312	0.604	348
3.0 x 10 <sup>-5</sup>	277 313	0.652	348



Interaction between MEPIMC and BSA occurs which alters the hydrophobic environment of tryptophan. Fluorescence quenching is well known to be classified in to dynamic and static types. The quenching mechanism between MEPIMC and BSA was analyzed using the titration data applying the Stern–Volmer equation (Equation 2)

$$\frac{F_0}{F} = 1 + K_q \tau_0 [Q] = 1 + K_{sv} [Q]$$

(2)

where  $F_0$  and  $F$  are the fluorescence intensities of BSA in the absence and presence of the quencher respectively.  $K_q$  is the biomolecular quenching rate constant and  $\tau_0$  is the lifetime of the BSA in the absence of quencher.  $[Q]$  is the concentration of the quencher and  $K_{sv}$  is the Stern–Volmer quenching constant. The Stern – Volmer plot for MEPIMC–BSA system is shown in Fig. 3 (c). The calculated  $K_{sv}$  for the binding of MEPIMC with BSA in aqueous medium is  $7.4 \times 10^4 \text{ mol}^{-1}\text{dm}^3$ . The apparent binding constant  $K_A$  and binding sites  $n$  for a small molecule binding independently to a set of equivalent sites on BSA can be obtained from the following equation,

$$\log \frac{F_0 - F}{F} = n \log K_A - n \log \left( \frac{1}{[D_t] - (F_0 - F)([P_t]/F_0)} \right)$$

(3)

where  $F_0$  and  $F$  are the fluorescence intensities of BSA in the absence and presence of the quencher respectively.  $[D_t]$

and  $[P_t]$  are the total quencher concentration and the total BSA concentration respectively. The linear plot of  $\log (F_0 - F)/F$  vs.  $\log (1/[D_t] - (F_0 - F)/[P_t][F_0])$  is shown in Fig. 3 (d). The calculated binding constant is  $7.73 \times 10^4 \text{ mol}^{-1}\text{dm}^3$ . The number of binding sites is  $\approx 1$ . This indicates that only a single binding site exists in BSA for MEPIMC molecule.

A reliable method for studying protein–ligand interactions and determination of the distance between the ligand and the tryptophan residues of BSA is Förster resonance energy transfer (FRET). The FRET efficiency  $E$  is given by Equation 4. In this equation  $r_0$  is the distance between the ligand and the tryptophan residue of the protein,  $R_0$  is the Förster distance at which 50% of the excitation energy is transferred to the acceptor.  $R_0$  is calculated from the donor emission and the acceptor absorption spectra using the Equation 5.

$$E = 1 - F/F_0 = R_0^6/R_0^6 + r_0^6$$

(4)

$$R_0^6 = 8.79 \times 10^{-25} K^2 N^4 \Phi J$$

(5)

$$J = \frac{\int_0^\infty F_D(\lambda) \epsilon_A(\lambda) \lambda^4 d\lambda}{\int_0^\infty F_D(\lambda) d\lambda}$$

(6)

In Equation (8),  $K^2 = 2/3$ , which denotes the orientation factor related to the geometry of the donor and acceptor of the randomly oriented dipoles in fluid

medium.  $N$  is the average refractive index of the medium in the wavelength range where there is spectral overlap.  $\Phi$  is the fluorescence quantum yield of the donor.  $J$  represents the spectral overlap between the fluorescence spectrum of the donor and the absorption spectrum of the acceptor.  $J$  can be calculated using Equation (9) where  $F(\lambda)$  is the corrected fluorescence intensity of the donor in the wavelength range of  $\lambda$  to  $\lambda + \Delta\lambda$  and  $\varepsilon(\lambda)$  represents the extinction coefficient of the acceptor at  $\lambda$ . Fig. 9 shows the spectral overlap between the UV–Visible absorption of MEPIMC and the fluorescence spectrum of free BSA.

The calculated values of  $N$ ,  $\Phi$ ,  $J$ ,  $E$ ,  $R_0$ , and  $r$  are 1.33, 0.15,  $1.1943 \times 10^{-20} \text{ cm}^3 \text{ L mol}^{-1}$ , 0.1181, 2.6365 nm and 3.686 nm, respectively. The average distances between the donor and the acceptor is less than 8 nm. Hence energy transfer occurs

between BSA and MEPIMC. Since  $r$  is higher than  $R_0$ , it implies that MEPIMC quenches the intrinsic fluorescence of BSA by static quenching. This occurs through a non–radiative energy transfer.

### **Binding of MEPIMC- $\beta$ -CD complex with BSA**

The absorption spectra of the titration MEPIMC- $\beta$ -CD complex vs. BSA are shown in Fig. 4 (a). The absorption bands are shifted to shorter wavelength 1 nm on complexation, along with a hyperchromic shift. The tryptophan fluorescence of BSA shows a more pronounced change of intensity and 4 nm red shift of maximum on addition of the MEPIMC- $\beta$ -CD complex in fluorescence than in absorption. The absorption and fluorescence spectral data of MEPIMC- $\beta$ -CD complex with BSA were given in Table 3.

**Table 3 Absorption and fluorescence spectral data of MEPIMC- $\beta$ -CD complex with BSA**

<b>Conc. of MEPIMC, mol dm<sup>-3</sup></b>	<b>Absorption maxima, nm</b>	<b>Absorbance, a.u.</b>	<b>Fluorescence maxima, nm</b>
0	278	0.302	343
$2.5 \times 10^{-6}$	278	0.423	343
$5.0 \times 10^{-6}$	278	0.443	343
$1.0 \times 10^{-5}$	278	0.447	344
$1.5 \times 10^{-5}$	278	0.486	345
$2.0 \times 10^{-5}$	278	0.556	346
$2.5 \times 10^{-5}$	277	0.564	347
$3.0 \times 10^{-5}$	277	0.653	347

There is quenching of tryptophan fluorescence [as shown in Fig. 4 (b)] continuously at each addition of MEPIMC- $\beta$ -CD. The Stern-Volmer plot for this interaction between MEPIMC- $\beta$ -CD and BSA is shown in Fig. 4 (c). The calculated  $K_{sv}$  is  $5.42 \times 10^4 \text{ mol}^{-1} \text{ dm}^3$ . Fig. 4 (d) shows the plot of  $\log (F_0 - F)/F$  vs.  $\log (1/ [Dt] - (F_0 - F)[Pt]/F_0)$  for the binding interaction of the  $\beta$ -CD complexed MEPIMC with BSA. The binding constant is  $7.2 \times 10^4 \text{ mol}^{-1} \text{ dm}^3$ . This is significantly lesser than the binding constant of the binding of free MEPIMC molecule with BSA (in the absence of  $\beta$ -CD). Hence the immediate observation is that the tryptophan units in the binding pockets of BSA are less accessible for MEPIMC when in  $\beta$ -CD encapsulated form.

The distance between the MEPIMC- $\beta$ -CD complex and the tryptophan residues of BSA is calculated from the FRET method as discussed earlier. The calculated values of  $N$ ,  $\Phi$ ,  $J$ ,  $E$ ,  $R_0$ , and  $r$  for the MEPIMC-BSA in the presence of  $\beta$ -CD are found to as 1.33, 0.15,  $2.9614 \times 10^{-20} \text{ cm}^3 \text{ L mol}^{-1}$ , 0.1598, 3.0673 nm and 4.0447 nm, respectively. Fig. 4 (e) shows the spectral overlap between the UV-Visible absorption of MEPIMC- $\beta$ -CD and the fluorescence spectrum of free BSA. The distance between the donor and the acceptor is altered by the presence of  $\beta$ -CD.

Molecular docking technique is used to extend further insight into the mode of

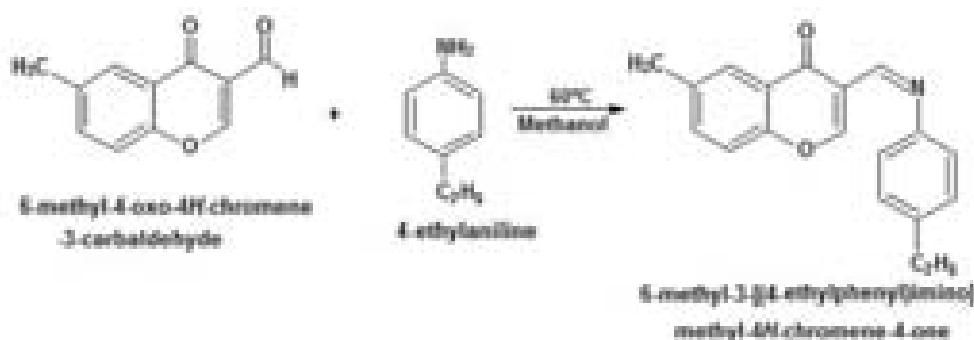
MEPIMC-BSA binding. The docking pose of MEPIMC with BSA is given in Fig. 6. The structures of the molecules were refined by assigning the bonds, bond orders, charge and hybridization, creating explicit hydrogen and this was repeated. BSA consists of three homologous domains (I, II, and III): I (residues 1-183), II (184-376), III (377-583), each containing two sub-domains (A and B) that assemble to make it a heart shaped molecule. There is a large hydrophobic cavity in sub-domain IIA to accommodate the drug molecule, which plays an important role in the transportation of drugs in BSA. The best energy ranked results [Fig. 5] reveal that MEPIMC is located within the sub-domain III hydrophobic cavity in close proximity to the residues, such as Val-551, Phe-550, Met-547, Lys-524, Phe-506, and Tyr-400 suggesting the existence of hydrophobic interaction between them. Moreover, clearly hydrogen bonding interactions are revealed at these sites. Hence, this finding provides a good structural basis to explain the efficient quenching of fluorescence of BSA by MEPIMC. Furthermore, there are also a number of hydrophobic interactions, because several apolar residues in the proximity of the ligand play an important role in stabilizing the molecule via phobic interactions. As shown in the figure the hydrogen bonding occurs, due to the presence of the hydroxyls of the MEPIMC molecule, with the Val-551, Phe-550, Met-

547, Lys-524, Phe-508, and Tyr-400 residues of BSA. These hydrogen bonds increase the stability of the MEPIMC–BSA bound system. Therefore, the interaction between the MEPIMC and BSA is dominated by hydrogen bonds along with hydrophobic interaction. Since  $\beta$ -CD blocks some of the possible hydrogen bond formation between MEPIMC and BSA, the binding strength is relatively low compared to that in water.

### Conclusion

In this work, we studied the interaction of 6-methyl-3-[(4-ethylphenyl)imino]methyl-4H-chromen-4-one (MEPIMC) in free form and  $\beta$ -CD-bound form with bovine serum albumin (BSA) by fluorescence spectroscopy and UV–visible absorption spectroscopy. The stoichiometry of the inclusion complex of MEPIMC with  $\beta$ -CD is 1:1 and encapsulation by  $\beta$ -CD offers restriction for the access of MEPIMC by protons. The structure of the inclusion complex is

### Figure and Figure Captions

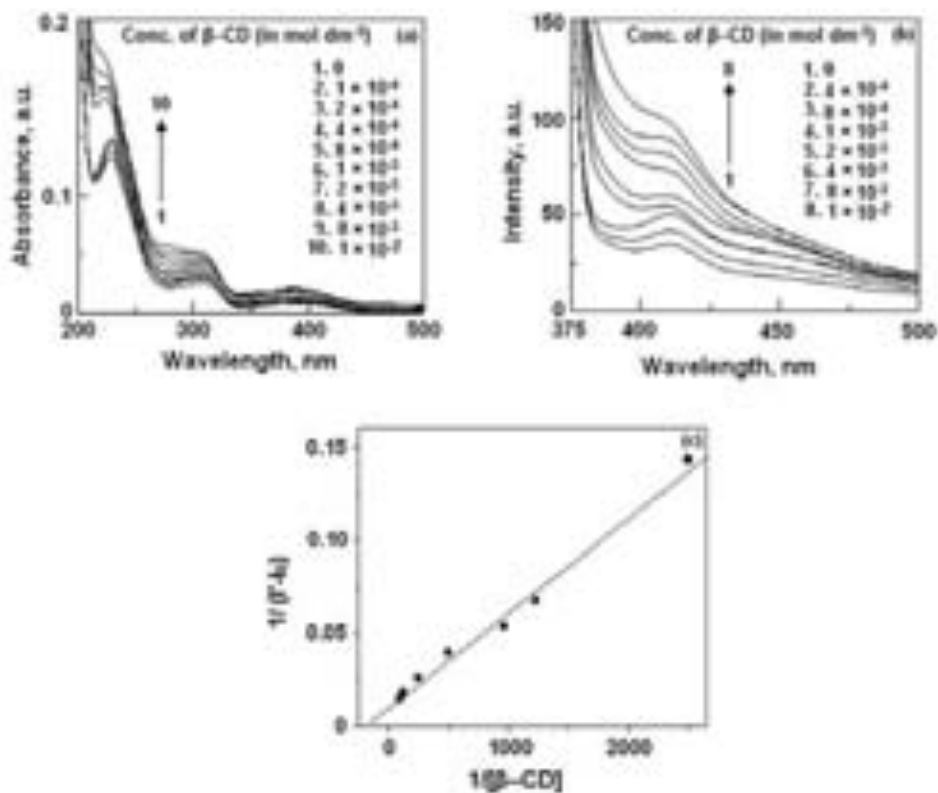


**Fig. 1.** The reaction scheme for the synthesis of MEPIMC

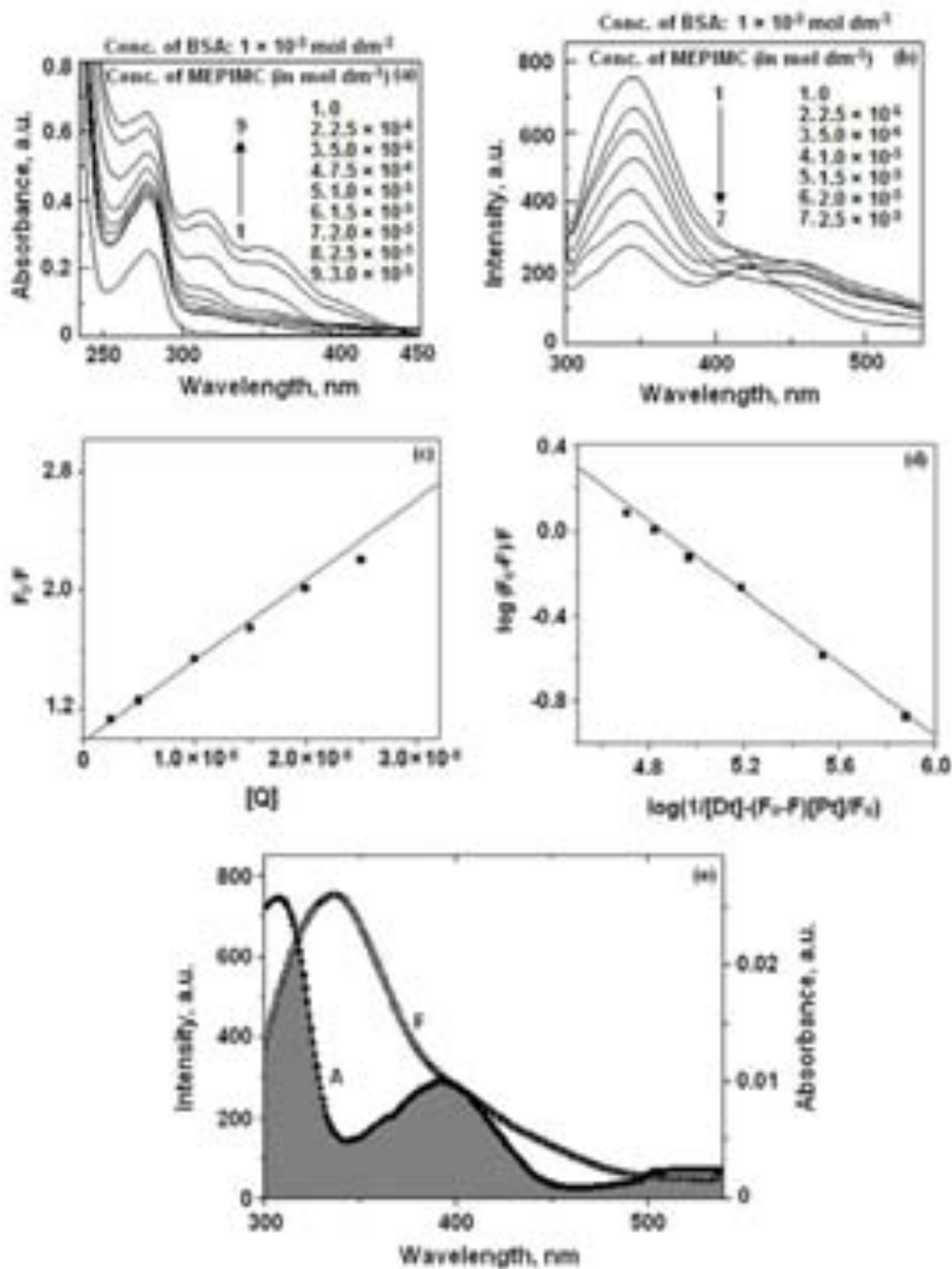
proposed using the results from absorption and fluorescence spectroscopic results. Quenching of BSA fluorescence by MEPIMC occurs as a result of the formation of BSA–MEPIMC complex. Molecular docking studies confirm the interaction between the MEPIMC and BSA. In the presence of  $\beta$ -CD the  $K_{SV}$  and the binding constant values of the quenching due to the binding of MEPIMC with BSA is decreased which suggests the blocking of the hydrogen bonding and phobic interaction of MEPIMC with BSA. The Förster distance between the donor and the acceptor are altered in the presence of  $\beta$ -CD and  $\beta$ -CD clearly modulates the binding of MEPIMC with BSA.

### Acknowledgements

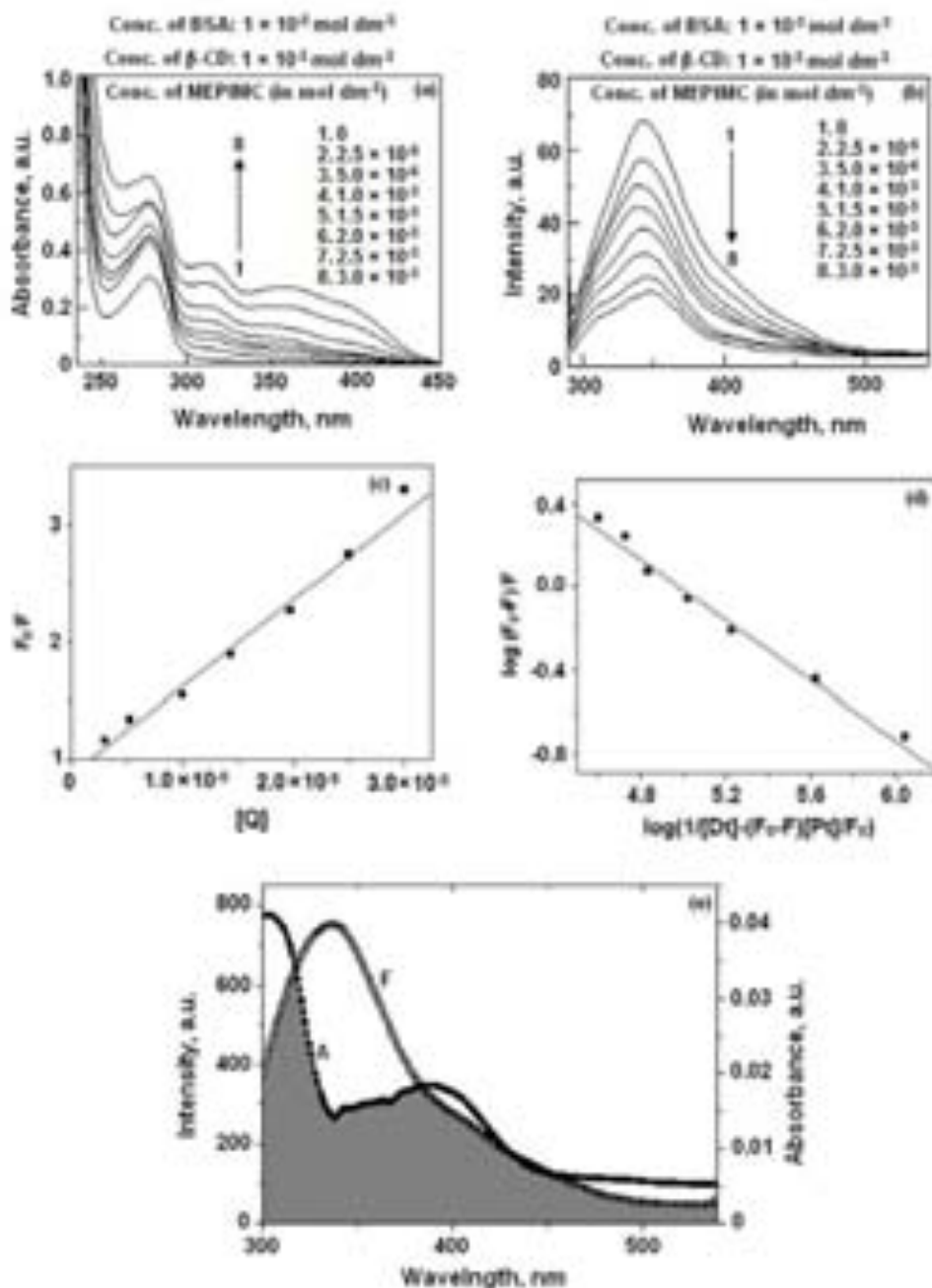
We express our sense of gratitude to Secretary and Principal of Muthayammal College of Arts and Science and Department of Chemistry, Karunya University for spectroscopic and docking studies.



**Fig. 2.** (a) Absorption spectra of MEPIMC in the presence of various concentrations of  $\beta$ -CD. (b) Fluorescence spectra of MEPIMC in the presence of various concentrations of  $\beta$ -CD. (c) The plot of  $1/I - I_0$  against  $1/[\beta\text{-CD}]$  for the interaction of MEPIMC in the presence of various concentrations of  $\beta$ -CD.



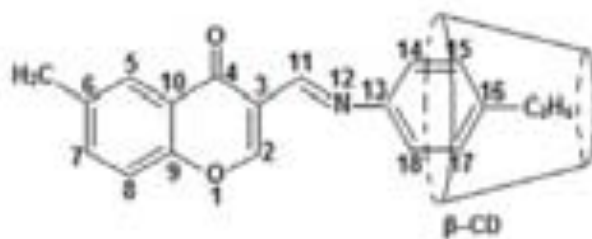
**Fig. 3.** (a) Absorption spectra of BSA in the presence of various concentrations of MEPIMC. (b) Fluorescence spectra of BSA in the presence of various concentrations of MEPIMC. (c) The plot of  $F_0/F$  against  $[MEPIMC]$  for the interaction of BSA in the presence of various concentrations of MEPIMC. (d) The plot of  $\log [F_0-F]/F$  against  $\log (1/[Dt] - (F_0-F)/[Pt][F_0])$  for the interaction of BSA with various concentrations of MEPIMC. (e) Spectral overlapping between the UV absorption spectrum of MEPIMC and the fluorescence spectrum of BSA.



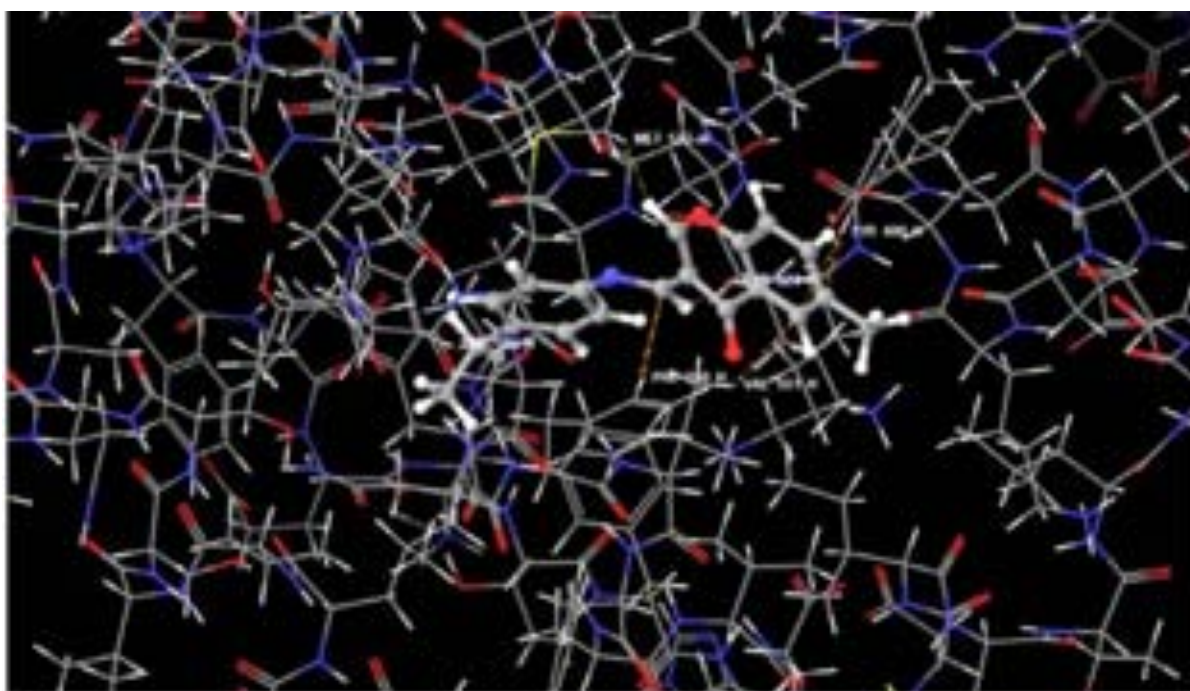
**Fig. 4. (a)**

Absorption spectra of BSA in the presence of various concentrations of MEPIMC-β-CD. (b) Fluorescence spectra of BSA in the presence of various concentrations of MEPIMC-β-CD. (c) The plot of  $F_0/F$  against [MEPIMC] for the interaction of BSA in the presence of various concentrations of MEPIMC-β-CD. (d)

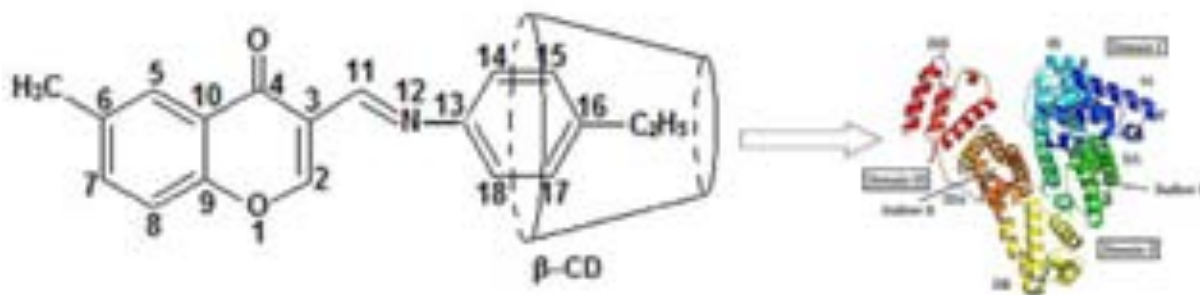
The plot of  $\log [F_0-F]/F$  against  $\log (1/[Dt] - (F_0-F)/[Pt][F_0])$  for the interaction of BSA with various concentrations of MEPIMC-β-CD. (e) Spectral overlapping between the UV absorption spectrum of MEPIMC-β-CD and the fluorescence spectrum of BSA.



**Fig. 5.** Inclusion of MEPIMC with  $\beta$ -CD.



**Fig. 6.** (b) Docking poses of MEPIMC–BSA binding.



**Fig. 7.** Graphical abstract for the interaction of MEPIMC– $\beta$ -CD complex with BSA.



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# Domain Driven Data Mining Approach for Web Personalization

V.Vijayadeepa

Head/Academy of Computer Science

Muthayammal College of Arts and Science, Rasipuram, Namakkal-637408

E-Mail: [hodacs@muthayammal.in](mailto:hodacs@muthayammal.in),

## ABSTRACT

Now a days, user personalization in the web becomes very important due to the increase in web search engine users. This paper has an unified model to provide user personalization for efficient web search. Search topics are categorized by semantic concepts. Implicit feedback from the users was collected by tracking their behavior on the web page based on their actions on the web page. Actions like save, copy, bookmark, time spent and logging into data base were tracked, which will be used to build unified model. In this work, the related users can mine the information collaboratively with little amount of time. Based on the feed back from the users we categorize the users and the search query is categorized using semantic concepts, so that the topic identification and the user interest could be identified in a short time to reduce the search time. The unified model is built based on the categorized information, using which we provide personalized results to the user during web search. This methodology minimizes the search time and provides more amount of relevant information.

**Index terms** - Feature extraction, similarity measure, SQ categorization and page classification, semantic web search.

where customizing the user's search based on domain driven data mining approach.

## Background

Ioannis Anagnostopoulos and Ilias Maglogiannis in their work proposed, Adapting user's browsing and web evolution features for effective search in Medical portals are an intelligent meta-search algorithm exclusively for health-related web search.

## INTRODUCTION

Web is a dynamic environment as the data and the user change frequently. In such a dynamic environment, the task of finding desired information quickly and exactly becomes crucial and tracking user search behavior is also difficult. This motivated to personalization of web search

Practical algorithms and lower massive bounds for similarity search in massive graphs, proposed by (Daniel

Fogares & Balazs Racz., 2007). is scalable to graphs with billions of vertices on a distributed architecture. The similarities of multi step neighborhoods of vertices are numerically evaluated by similarity functions using SimRank and PSimRank similarity functions for the application of fingerprint verification. An Evaluation of Personalized Web Search for Individual User, supports user to searches by learning about user preferences and by observing responses to prior search experiences aided by User Conceptual Index (UCI) to improve user search in the World Wide Web by (Sendhilkumar & Geetha 2007). Work developed with two systems to support the visual exploration of web search results The same kind of dual window projection but in web graphical format is made in the proposed system (Orland Hoerber & Xue Dong Yang., 2006).

Query Sensitive Self Adaptable Web Page Ranking Algorithm analyses HITS and PageRank, ranking algorithms given by (Wenxue Tao, & Wanli Zuo., 2003) and points out their limitations in capturing both global and local importance scopes.

## METHODOLOGY

The user interface is a tabbed web browser, which is a part of the system. Through this browser the user provide short-term query simultaneously in

multiple tabs for his information need. The user interacts with the system to give search query, to view the ranked results and to view the re ranked results. While re-ranking we collect all the resultant url's, and we identify the topic about which the particular page is talking about. Then we identify the semantic meaning of the particular web page. The relevancy score will be assigned to the particular page according to the relevancy of the page with the semantic concept and relevancy with the search query. The re ranking is done based on the past search behavior of the user with the system and also with the relevancy score of the particular web page. The browser also supports for providing actions like *SAVE, COPY, PRINT AND E-MAIL*, which depicts the importance of the web page for his need. The browser also projects the re-ranked results in an interactive graph like structure rather than list based representations.

Each user-visited web page is represented by a set of index words that comes under top list. The usage time of each search query and usage-time of each visited page is calculated transparently without disturbing the user.

Based on the search query, index word and usage-times, the User Conceptual Index (UCI) is calculated. The UCI can be represented mathematically as a function of weights of above parameters.

The usage time directly indicates whether previous search results were relevant or irrelevant to the user's information need.

The search queries that have similar or related meaning are categorized to a group using word-dictionary in-order to avoid inconsistencies that arise in above strategies.

The visited-pages that have similar or related index words are also categorized to recommend the pages for a novice user. The users with similar search behavior are categorized to a group to improve the efficiency of personalization mechanisms.

The pages are re-ranked by analyzing individual's behavior and are projected to them in dual window.

**Feature Extraction**

**Algorithm: Feature Extraction**

{

*Given:* User visiting page  $P_i$

*Procedure:*

step1: The de- tagged and stop words eliminated page  $P_i$  can be represented as

$IW = \{IW_1, IW_2, IW_3, IW_n\}$  and  $F = \{F_1, F_2, F_3 \dots F_n\}$  where  $IW$  is the index word set and  $F$  is the Frequency set corresponding to  $IW$  and  $n$  is the number of index words in the page.

step2: Select top 'k' frequency words

$F_{topk} = \{F_1, F_2 \dots F_t\}$  which corresponds to  $IW_{topk} = \{IW_1, IW_2 \dots IW_t\}$

Where  $k \leq t \leq n$ .

step3: Compute the mean for the above set

$$\mu (F_{topk}) = [F_1 + F_2 + \dots + F_t] / t$$

step4: The keywords in  $IW_{top}$  that have frequency above  $\mu (F_{topk})$  form the feature of the page.

step5: Now represent the feature of the page as

$$\text{Feature } (P_i) = \{F_1, F_2 \dots F_m\}$$

Where  $1 \leq m \leq k$ .

Step6: Identify the semantic concept of Search query.

Step7: Compute the relevancy score with search query and the semantic meaning of the web page.

$$\text{SRS} = (N_k / T_k) * 100$$

$N_k$ -No of key words appeared under the semantic concept.

$T_k$ -Total no of keywords in the semantic concept.

step6: End

}

**Measurement of Similarity users with User Association Analysis**

The user association is analyzed to find the similarity of search among different users.

**Algorithm: Similarity measure**

{

*Given:* User behavior graph

*Procedure:*

step1: Indexing

for  $i := 1$  to  $N$  do

```

        for every vertex j of the
        web graph do
        Behavior [i] [j] []: =reversed path
        of length l starting from j.
    End
End
    step2: User Sim(i,j)
    Sim: =0
    For i: =1 to N do
        For j:=1 to N do
            Let k be the smallest offset with
            Behavior[i][u][k]=Behavior[j][u][k]
        If such k exists then
            Sim=Sim+ck
        End
    End
    Return Sim/N
Step 3: End
}

```

The above algorithm is used to identify the similarity behavior between two users. Whenever the search behavior is common, then it is certain that the users might come from same source point. Thus, higher the length l in the above algorithm, greater is the similarity.

### Search Query Categorization

The query categorization is necessary to reduce the limitations in key word based search.

### Algorithm: SQ Categorization

```

{
Given: Search Queries given by the user in
a due course of time
Procedure:
    Step1: Collect all the search
queries given by the user in a due course
of time.
    Step2: Find the alternate meaning
of the search query using a word
dictionary.
    Step3: Compute relevancy score
between identified semantic concept of
search query and alternate meanings of
search query.
    Step 4: Select the search query as
relevant one according to the relevancy
score.
    Step 5: If such commonalities
exist, update the TF matrix and ST matrix.
}

```

### Visited Page Categorization

Higher the similarity ranks between two users, greater the commonalities of search between them.

### Algorithm: Page Classification

```

{
Given: The index terms of all the visited
pages by the user in a due course of time
Procedure:

```

Step1: Collect all the index terms of all the visited pages by the user in a due course of time.

Step2: Find the alternate meaning of the index terms using a word dictionary.

Step3: Compute relevancy score between identified semantic concept of index term and alternate meanings of index term.

Step 4: Select the index term as relevant one according to the relevancy score.

Step 5: If such commonalities exist, update the SFmatrix

}

### Results and Analysis

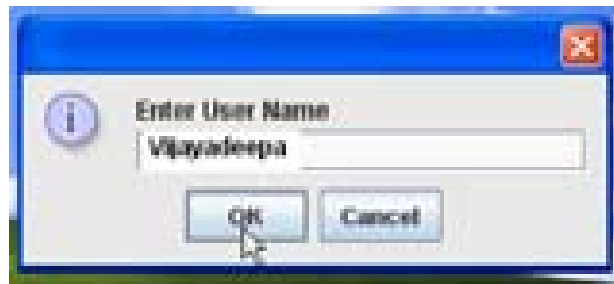


Fig1. Shows the name of user

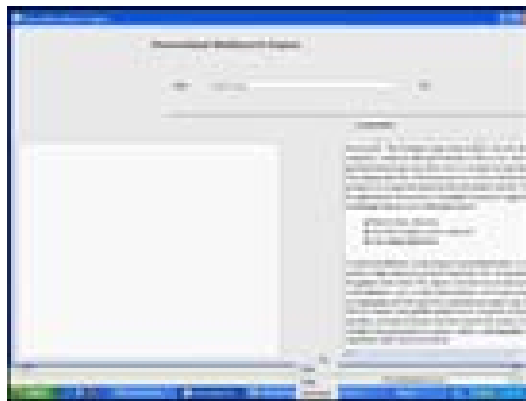


Fig 2. Shows the result for query Data mining

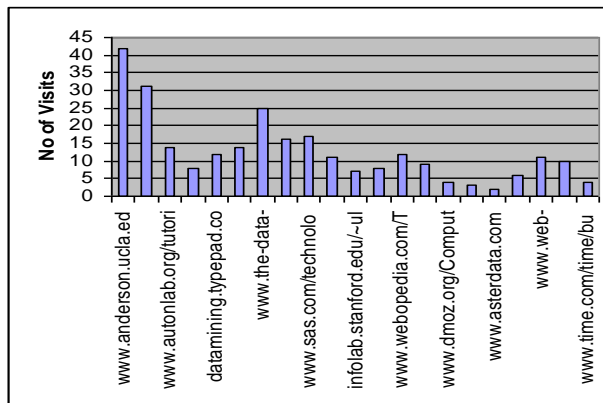




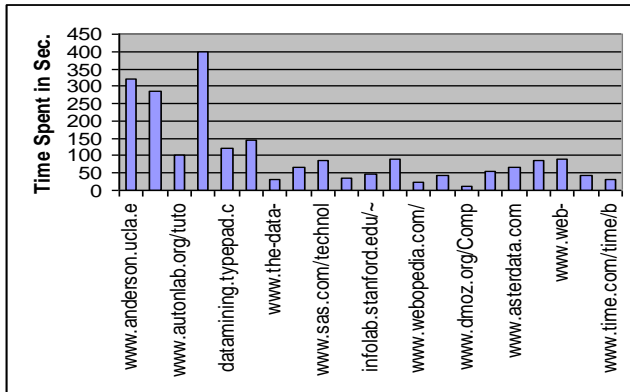
**Fig 3. Shows the page source of URL clicked**



**Fig 4 displays the result of action performed.**

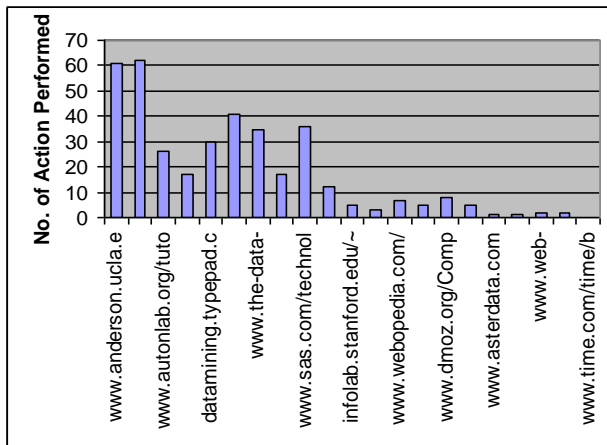


Graph 1- displays the no of visits of each urls visited. Each url is visited by various users at various times, for many times. According to the total number of visits by all users, the urls are plotted to the graph.



**Graph 2- displays the urls versus time spent.**

The user may spent different amount of time at each time he or other user visits the web page. We have collected all those data's and calculated total amount of time spent in the particular web page and constructed the data.



**Graph 3- displays the no of action performed on each urls.**

This displays the results according to the number of action performed. The user may performed various number of actions at various web pages. We have collected the total number of actions performed on each web pages and displayed in the graph.



**Fig 5 displays the proposed results.**

The results displayed above shows , the recommended results from our framework according to the interest of the users.

**CONCLUSION**

With the semi-structure of information on the Internet and the arbitrariness of releasing the enormous amount of web pages, turns finding desired information quickly and exactly to be a crucial task. Search engine is playing an increasing important role in information retrieval on the Internet. The search results given by search engines are generally sorted on descendent importance of its usage. Humans think in terms of concepts but the concept may be differing from one another. Hence the importance of a page is gained from users with different concepts. Thus this contradictory importance does not be feasible in future. Hence user centric personalization is the only solution to solve the problem. We further investigate this framework to increase the relevancy of the web links to the search query.

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# Multi-dimensional alert correlation for collaborative filtering against DDoS attack in MANET

Devi.L<sup>1</sup> AnushaPriya.A<sup>2</sup>

Assistant professor, Department of PG Computer Science

Muthayammal College of Arts & Science, Rasipuram, Namakkal(Dt) 637408

E-Mail ID: [devi33kaveen@gmail.com](mailto:devi33kaveen@gmail.com)

## ABSTRACT

The growth in coordinated network attacks such as scans, worms and distributed denial of service (DDoS) attacks is a profound threat to the security of the Internet. Collaborative intrusion detection systems (CIDSs) have the potential to detect these attacks, by enabling all the participating intrusion detection systems (IDSs) to share suspicious intelligence with each other to form a global view of the current security threats. Current correlation algorithms in CIDSs are either too simple to capture the important characteristics of attacks, or too computational expensive to detect attacks in a timely manner. We propose a decentralized, multi-dimensional alert correlation algorithm for CIDSs to address these challenges. A multi-dimensional alert clustering algorithm is used to extract the significant intrusion patterns from raw intrusion alerts. A two-stage correlation algorithm is used, which first clusters alerts locally at each IDS, before reporting significant alert patterns to a global correlation stage. We introduce a probabilistic approach to decide when a pattern at the local stage is sufficiently significant to warrant correlation at the global stage. We then implement the proposed two-stage correlation algorithm in a fully distributed CIDS. Our experiments on a large real-world intrusion dataset show that our approach can achieve a significant reduction in the number of alert messages generated by the local correlation stage with negligible false negatives compared to a centralized scheme. The proposed probabilistic threshold approach gains a significant improvement in detection accuracy in a stealthy attack scenario, compared to a naive scheme that uses the same threshold at the local and global stages. A large scale experiment on Planet Lab shows that our decentralized architecture is significantly more efficient than a centralized approach in terms of the time required to correlate alerts.

**Keywords:** IDS, CIDS, DDos, Alert correlation algorithm, correlate-and filter approach, AODV.

## INTRODUCTION

A major threat to the reliability of Internet services is the growth in stealthy and coordinated attacks, such as scans, worms and distributed denial-of-service (DDoS) attacks. While intrusion detection systems (IDSs) provide the ability to detect a wide variety of attacks, traditional IDSs focus on monitoring a single sub network. This limits their ability to detect coordinated attacks in a scalable and accurate manner, since they lack the ability to correlate evidence from multiple sub networks , (Axelsson,, 1999). An important challenge for intrusion detection research is how to efficiently correlate evidence from multiple sub networks. Collaborative intrusion detection systems (CIDSs) aim to address this research challenge. A CIDS consists of a set of individual IDSs coming from different network administrative domains or organizations, which cooperate to detect coordinated attacks. Each IDS reports any alerts of suspicious behavior that it has collected from its local monitored network, then the CIDS correlates these alerts to identify coordinated attacks that affect multiple sub networks. A key component of a CIDS is the *alert correlation* algorithm, which clusters similar incidents observed by different IDSs, prioritises these incidents, and

identifies false alerts generated by individual IDSs. The problem of alert correlation (also known as event correlation) is an active area of research. A key issue is how to improve the scalability of alert correlation while still maintaining the expressiveness of the patterns that can be found. *Single dimensional* correlation schemes have been widely studied due to their simplicity, but they lack the expressiveness to characterize many types of attack behaviors. For example, such schemes can correlate alerts pertaining to the same source addresses, but cannot discriminate between different types of behavior. More sophisticated schemes use *multi-dimensional* correlation to identify patterns in events. For example, the Auto Focus system uses a form of frequent item set mining, which finds combinations of attribute values that appear in event records with a minimum frequency, known as their *support* threshold. A common problem with frequent item set approaches is that many slight variations of a frequent pattern can also be frequent, *e.g.*, if a particular source address and destination port combination are identified as a frequent pattern, then the source address on its own will also be reported as a frequent pattern. It is thus important to compress frequent patterns by filtering out redundant patterns of alerts that can be explained by more specific patterns. Auto

Focus is an example of such a system that combines this “correlate-and filter” approach.

While *multi-dimensional* correlation techniques have a clear advantage in terms of their expressiveness, their computational complexity limits their use in collaborative IDSs. As the number of participants in a CIDS increases, we need to find a way of managing the complexity of correlating the increased number of alerts that are collected. The key research question that we address in this paper is how to constrain the search space for alert correlation, in order to improve the scalability of a CIDS without sacrificing the expressiveness and accuracy of the system. We address the problem of improving the scalability of alert correlation in a CIDS through three complementary directions of research. Our first contribution to the problem is to constrain the search space for multi-dimensional alert patterns by using knowledge of the types of attack categories of interest to limit the search to certain predefined combinations of dimensions or features. We refer to each possible combination of features as a *pattern*. Given a set of features that are used to describe network traffic flows, such as source address, destination port and protocol, we define a set of generic patterns that correspond to specific

categories of attacks. For example, the features “source address” and “destination port” form a pattern that corresponds to a particular class of DDoS attacks, (Hu *et al* 2006).. Rather than searching for frequent instances of all possible patterns, we focus on a predefined set of patterns corresponding to known categories of attacks. We can organize this set of patterns into a lattice, with the most general patterns at the top of the lattice, and the most specific patterns at the bottom of the lattice. This lattice structure provides a bias to constrain the search space of the correlate and-filter algorithm for finding frequent, non-redundant patterns of alerts in our CIDS. Our second contribution to the scalability problem addresses the challenge of how to cope with the huge volume of raw alerts that can be generated by each participating IDS in the system. If a centralized server is used to run the correlate-and-filter algorithm, then this server can become a bottleneck in terms of the bandwidth required to download all raw alerts, as well as the computational load involved in correlating all these alerts. We address this challenge by using a hierarchical approach to distribute the computation using a two-stage scheme. In our two-stage scheme, each participant IDS first applies the correlate-and-filter algorithm to its own raw alerts locally. Any pattern instances

that are found locally are then reported to a central server. The central server then runs the correlate-and-filter algorithm on the pre-processed pattern instances from the entire participant IDSs, which results in a set of globally significant pattern instances. This approach has the potential to reduce the bandwidth and computational load at the centralized server, but risks increasing the false negative rate of the CIDS due to alerts being prematurely filtered by the local IDSs. In particular, consider a stealthy attack where the evidence is uniformly distributed across a set of sub networks. A stealthy attack that is *globally* significant might not be *locally* significant at every affected IDS. If the same minimum support is used at both the local and global stages, then some globally significant pattern instances will be unnoticed. In order to address this problem, we introduce a probabilistic model to estimate the support threshold for local correlation in our scheme. Our empirical evaluation shows that our two-stage scheme can achieve substantial reductions in the bandwidth and processing load at the centralized server, with negligible reduction in detection accuracy.

## Background work

A major threat to the reliability of Internet services is the growth in stealthy

and coordinated attacks, such as scans, worms and distributed denial-of-service (DDoS) attacks. While intrusion detection systems (IDSs) provide the ability to detect a wide variety of attacks, traditional IDSs focus on monitoring a single subnet work. This limits their ability to detect coordinated attacks in a scalable and accurate manner, since they lack the ability to correlate evidence from multiple subnet works. An important challenge for intrusion detection research is how to efficiently correlate evidence from multiple subnet works.

Collaborative intrusion detection systems (CIDSs) aim to address this research challenge. A CIDS consists of a set of individual IDSs coming from different network administrative domains or organizations, which cooperate to detect coordinated attacks. Each IDS reports any alerts of suspicious behavior that it has collected from its local monitored network, then the CIDS correlates these alerts to identify coordinated attacks that affect multiple subnet works (Karger, *et al* 1997). A key component of a CIDS is the *alert correlation* algorithm, which clusters similar incidents observed by different IDSs, priorities these incidents, and identifies false alerts generated by individual IDSs.

DDoS attack is the main problem in all ad hoc scenario i.e. in MANET and



as well as in wireless sensor networks. An intrusion detection system in wireless sensor network which uses the anomaly intrusion detection system in which IDS uses two intrusion detection parameters, packet reception rate (PRR) and inter arrival time (IAT). But only these two parameters are not completely sufficient for intrusion detection in wireless sensor network and as well as in MANET, (Zhou.,.,*et al* 2007).. If we also add other parameters into it to make it works more accurately. So in our proposal we use different intrusion detection parameters in mobile Ad hoc networks. We assume that a mobile ad hoc network contains two or more than two mobile devices that are communicate from each other through intermediate nodes, each node contain routing table , in our proposal we use AODV routing protocol in all normal module attack module and IDS (intrusion detection system) for prevention through attack. In this paper we simulate the three different condition results normal time, Attack time and IDS module time through NS-2 simulator.

## Method

In this section, we evaluate both the two-stage correlate-and filter algorithm and the underlying decentralized CIDS architecture. We first conduct a study of the feasibility of using the proposed two-

stage correlate-and-filter algorithm by comparing it against a fully centralized scheme. We compare these two schemes in terms of their *detection accuracy* and *message exchange rate* using a simulation based on a real-world intrusion dataset. We then evaluate the fully decentralized CIDS architecture by conducting a large scale experiment on Planet Lab using a real-world worm outbreak dataset , (Katti, *et al* 2005). In this section, we first introduce the real-world intrusion dataset used in the experiments. Then we report on the simulation results of the proposed two stage correlate-and-filter algorithm for non-stealthy attack scenarios using the naive threshold selection scheme and in stealthy attack scenarios using the probabilistic threshold selection scheme respectively.

## Algorithm

Detection system  $d_i$ :

**for** each time interval **do**

collect raw alerts  $r_i$  locally

$LA_i$  = local alert report on  $d_i$

$LA_i$  ( correlate-and-filter  $r_i$

**for** each  $p_{ij} = LA_i$  **do**

look up the destination node for  $p_{ij}$

$dt = \text{lookup}(\text{srcIP of } p_{ij})$

subscribe( $p_{ij}$  ,  $n_{ij}$  ,  $d_i$ ) on  $d_t$

**end for**

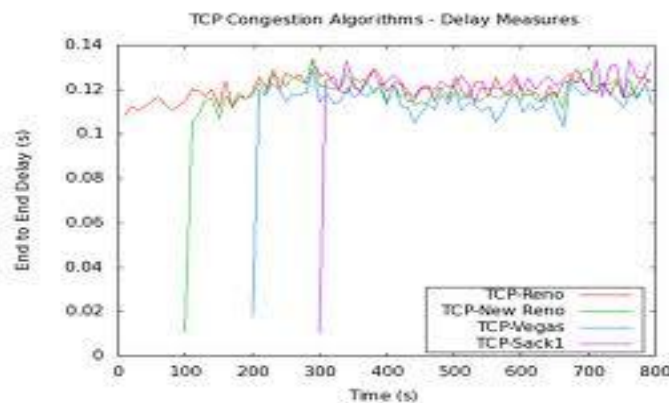
**end**

Our simulation program is written in Java and run on a Sun T-2000 server, which contains an 8-core 1 GHz Ultra SPARC CPU, 16 GB of RAM, and the Solaris 10 operating system. The *dataset* is stored in a *mysql* relational database.

We simulate 2n participating IDSs by varying n from 3 to 7. Each simulated IDS is assigned a unique *provider-id* which is a field of the alert table in the database. Each IDS periodically queries the database using this *provider-id* and a specified time interval. Then these raw alerts will be processed by two different simulated processes: the two-stage correlate and filter process and the centralized correlate-and-filter process. In this simulation, we consider the alert patterns and messages generated by the

**Result Analysis**

centralized process as our *gold standard* for calculating the *detection accuracy* and *message exchange rate*. According to performance analysis in normal case, in attack case and in IDS case we observe that DDOS attack definitely affected the network and our scheme is successfully defense the network and also provides the protection against them. In case of attack we observe that the routing load is very high because attacker node are continuously transmit the routing packets to their neighbored and every node in network are reply to attacker node by that heavy congestion is occur. Packet delivery fraction and end to end delay are also goes low, which shows that packets are not deliver accurately and number of dropped data is goes high approximately twice to the normal condition.



**End-to-End delays in various TCP congestion algorithms**

**Conclusion**

The proposed mechanism eliminates the need for a centralized

trusted authority which is not practical in ADHOC network due to their self organizing nature. The results demonstrate that the presence of a DDOS increases the packet loss in the network considerably.

The proposed mechanism protects the network through a self organized, fully distributed and localized procedure. The additional certificate publishing happens only for a short duration of time during which almost all nodes in the network get certified by their neighbors. After a period of time each node has a directory of certificates and hence the routing load incurred in this process is reasonable with a good network performance in terms of security as compare with attack case. We believe that this is an acceptable performance, given that the attack prevented has a much larger impact on the performance of the protocol. We introduce a probabilistic approach to estimate the optimal threshold for local correlation in stealthy attack scenarios by (Bhattacharyya & Johnson, 1977). In comparison to a centralized correlate-and-filter algorithm, our evaluation using a real-world intrusion dataset shows that our decentralized approach reduces alert messages significantly with little degradation in detection accuracy in most attack scenarios. The proposed probabilistic scheme achieves a significant improvement in detection accuracy compared to a naive threshold selection scheme that uses the same local and global threshold. For future work, we will consider how to optimize the load distribution in the fully decentralized

CIDS architecture, and how to make the support threshold adaptive to different types of attack scenarios.

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# A Comparative Study on EOQ for a Problem of with and without Shortage of Inventory Model

S. Mohan Prabhu, Department of Statistics,  
Muthayammal College of Arts and Science, Rasipuram, Namakkal - 637408.

## ABSTRACT

In this paper deals with comparative an inventory model when the different types of cost shortages models are used. And also find the value of Economic Order Quantity, No. of order and Total Cost Value after that compare the both model, which is with and without shortage of Inventory Model.

**Key Words:** Economic order Quantity, Time, Total Cost, No. of Order, Shortage.

### Introduction

The ambiguous term Operations Research (O.R.) was coined during World War - II, when the British military management called upon a group of scientists together to apply a scientific approach in the study of military operations to win the battle. The main objective was to allocate scarce resources in an effective manner to various military operations and to the activities within each operation. The effectiveness of operations research in military spread interest in it to other government departments and industry.

Due to the availability of faster and flexible computing facilities and the number of qualified O.R. professionals, it is now widely used in military, business, industry, transportation, public health, crime investigation, etc.

It is concerned with coordinating and controlling the operations or activities

within an organization. O.R. can be regarded as use of mathematical and quantitative techniques to substantiate the decisions being taken. O.R takes tools from subjects like mathematics, statistics, engineering, economics, psychology, etc. and utilizes them in order to know the consequences of possible alternative actions.

Numerous synonyms for operations research are in common use. The British like operational research and the Americans like management science, but a preferable term to describe this subject is decision analysis. Inventory is simply a stock of physical goods (assets) having certain economic values, which can be in any one of the following forms namely material, money or labour. It may be regarded as those goods which are produced, stored and used for a day- to-day functioning of the organization.

In the recent past, inventories were also viewed as reassures of the wealth and power of an individual of a country based on the account of wheat, sold etc. stored in its ware houses. During this period managing the inventories was an easy affair.

Inventories are recently viewed as a high degree of potential risk rather than a measure of wealth owing to the speedy developments and changes in product life. The latest concept of inventories have compelled to make fullest use of scientific techniques in the management inventories, known as inventory control. Inventory control is the technique of maintaining stock- items at desired levels.

The actual objective of any inventory model is to answer two questions, namely.

1. How much to order / produce?
2. When to order / Start?

The answer to the first question is the optimum amount that should be ordered / produced by time. Likewise, the answer for the second question is depending on the system that it may be based on periodic review type (receive a new order at equal unit time) or (continuous review type when the level of inventory reaches the recorder point, place a new order)

#### **Assumptions**

1. Demand is known and uniform

#### **DEFINITIONS**

- ❖ O.R. is the art of winning wars without actually fighting. - *Aurther Clarke*
- ❖ O.R. is the art of giving bad answers to problems which otherwise have worse answers. - *T.L. Saaty*
- ❖ O.R. is the application of the theories of Probability, Statistics, Queuing, Games, Linear Programming, etc. to the problems of war, govt. and industry.
- ❖ O.R. is the use of scientific methods to provide criteria for decisions regarding man machine systems involving repetitive operations.

Inventory is the term used to refer the stock of good or other materials, which is not kept for immediate use, but for future demand and distribution. Inventory control is the process, which involves the proper handling and maintaining of the materials kept in the inventory.

In this paper we consider the application of the inventory model to a problem of EOQ involving different varieties of problem. In this model is very basic model of EOQ, we are compare them with and without shortage model. The following assumptions and notations layout the structure of the model under consideration.

2. D - Denote the total no. of units purchased or produced.

3. Q - Denote the lot size in each production run.
4. Shortages are not permitted/are permitted.
5. Lead time is zero.

**Notations**

1.  $Q^*$  (or) EOQ : Minimum total inventory cost.
2.  $t^*$  : Optimum length of time in orders.
3.  $n^*$  : Optimum no. of orders placed per year.
4.  $T^*$  : Time difference between receipt of orders.
5.  $Q_1^*$  : Optimum Stock/Maximum level of Inventory.
6.  $TC^*$  : Optimum cost of inventory.

**Deterministic Inventory Model**

The word inventory refers to any kind of resource having economic value and is maintained to fulfill the present and

future needs of an organization. Fred Hansman, defined inventory as: an idle resource of any kind provided such a resource has economic value. Such resource may be classified into three categories.

1. Physical resources such as raw materials, semi – finished goods, furnished goods, spare parts etc.
2. Human resource such as unused labour (Man Power).
3. Financial resource such as working capital etc.

The following are a few examples of the type of inventory held by various organizations. Since the final product (Output) of a service organization such as bank, hospital, etc., cannot be stored for use in the near future, the concept of inventory control for them is associated with the various forms of productive capacity.

Type of Organization	Type of Inventories Held
<b>1. Manufacturer</b>	<b>Raw Materials Spare Parts, Semi – Finished Goods, Furnished Goods.</b>
<b>2. Hospital</b>	<b>No. of Beds, Stock of Drugs, Specialized Personnel.</b>
<b>3. Bank</b>	<b>Cash Reserves, Tellers.</b>
<b>4. Airline Company</b>	<b>Seating Capacity, Spare Parts, Specialized Maintenance Screw.</b>

**Meaning of Inventory Control**

Inventory control is the activity concerned with the Management of

inventory situations. There are two basic functions of inventory control.

1. Maintaining an accounting record to handle the inventory transactions concerning each inventory item.

For handling inventory transactions, a record keeping system called kardex file is maintained for each inventory item. All inventory transactions concerning an item are recorded on the item's card.

2. Deciding inventory replenishment decisions. There are two basic replenishment decisions.

- a. When is it necessary to place an order (or produce) to replenish inventory?

The answer to the question depends upon the organization's forecast or requirement for an item. If the demand of an item is independent of that of other items, and then the recorder point technique can be used to know the time of replenishment.

- b. How much is to be ordered (or produced) in each replenishment?

The decision of number of units to order (or produce) for replenishment depends upon several types of inventory costs.

### **General Notation used in the Inventory Model**

D-Total Demand

Q -Size of the lot / run.

$C_1$ -Holding cost / Unit / Unit of time

$C_2$ -Shortage cost / Unit / Unit of time

$C_s$ -Setup cost or ordering cost / run / Ordering.

r-Demand rate

K-Production rate.

C-Average total cost per unit time.

t-Time interval between two consecutive replenishment.

Z-Stock / order level.

L-Lead time.

$Q^*$ ,  $t^*$ ,  $Z^*$ ,  $C^*$  - optimum level of Q, t, Z & C respectively.

### **Reasons for Maintaining Inventories**

The need of the Management to make decisions regarding the inventory arises because of the various alternative course of action available with the enterprise. It is essential for an enterprise to have inventory due to the following reasons.

1. It helps in smooth and efficient running of the business.
2. It provides adequate service to the customers.
3. It helps in minimizing the loss due to the deterioration, obsolescence, damage etc.
4. It acts as a buffer stock when raw materials are received late and shop rejections are too many.

### **Merits of Inventory**

1. Very much useful for the Smooth and efficient running of the business.



2. The economics of production with large run sizes.
3. Helps in reducing the transportation cost.
4. The advantages of price discounts by bulk purchasing.

### **Demerits of Inventory**

1. Storage space rent
2. Interest on investment
3. Physical handling of the inventory items.
4. Accounting
5. Depreciation and deterioration.

### **Uses of inventory Control**

The Inventory Control application captures information needed to provide analysis of inventory as it pertains to turnover ratios, accuracy, excess and obsolescence and transaction activity for inventory investment. The Inventory Control application also provides the ability to monitor inventory transactions, analyze inventory levels, classify (ABC) inventory for positive control and maintain a history of inventory use as a guide for better planning. Specific features of the Inventory Control application include:

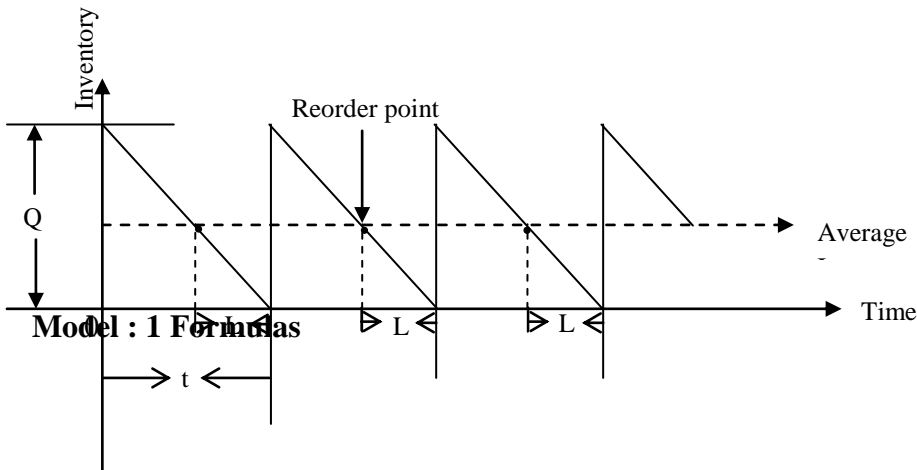
- ❖ ABC analysis and report
- ❖ Inventory gross usage maintenance

- ❖ Two-step cycle counting
- ❖ Inventory reorder quantity maintenance including reorder quantities, reorder points, and safety stock
- ❖ Economic order quantity processing
- ❖ Inventory display (by part number)
- ❖ Material analysis
- ❖ Inventory analysis
- ❖ Inventory history display and report
- ❖ Stock status report most of the physical goods deteriorate over time .Various authors have developed an EOQ models

### **Applications of Inventory**

- ❖ Inventory system also manages in and outwards material of hardware.
- ❖ Real-time inventory control systems use wireless, mobile terminals to record inventory transactions at the moment they occur. A Wireless LAN transmits the transaction information to a central database.

**Model : 1 Deterministic Inventory with No Shortages**



$$1) Q^* = EOQ = \sqrt{\frac{2DC_1}{C_s}} \quad 2) t^* = \sqrt{\frac{2C_s}{DC_1}} \quad 3) n^* = \sqrt{\frac{DC_1}{2C_s}} \quad 4) = \frac{1}{2} Q^* C_1 + DC_s / Q^*$$

Example for Model: 1

Assume, Demand D = 5000 units per year; Setup cost  $C_s$  = Rs.20 per order  
 Unit cost C = Rs.50; Holding cost  $C_1$  = Rs.117.5

Calculate  $Q^*$ ,  $t^*$  and  $n^*$ :

$$1. Q^* = EOQ = \sqrt{\frac{2DC_1}{C_s}} = \sqrt{\frac{2 \times 5000 \times 117.5}{20}} = \sqrt{\frac{1175000}{20}} = \text{Rs.}242.3840$$

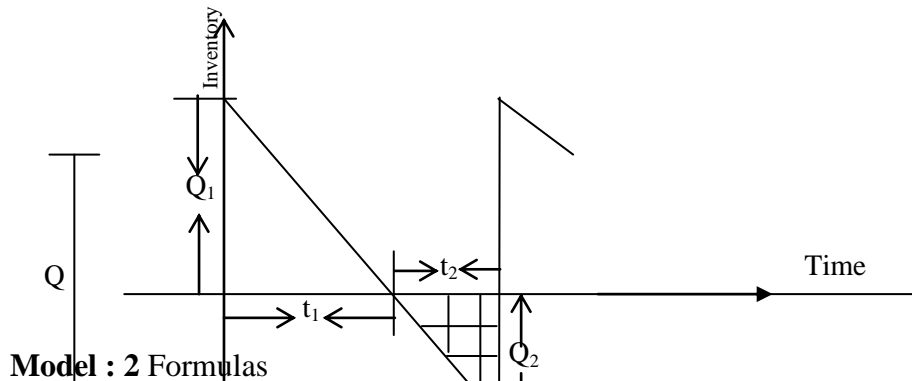
$$2. t^* = \sqrt{\frac{2C_s}{DC_1}} = \sqrt{\frac{2 \times 20}{5000 \times 117.5}} = \sqrt{\frac{40}{587500}} = 0.00825137/\text{yr}$$

$$3. n^* = \sqrt{\frac{DC_1}{2C_s}} = \sqrt{\frac{5000 \times 117.5}{2 \times 20}} = \sqrt{\frac{587500}{40}} = 121.19 \text{ order/yr}$$

$$4. TC = \frac{1}{2} Q^* C_1 + DC_s / Q^* = \frac{1}{2} (242.38) (117.5) + \frac{5000 \times 20}{242.38}$$

$$= 14239.825 + 472.5753 = \text{Rs.}14652.4003$$

**Model : 2 Deterministic Inventory with Shortages**



**Model : 2 Formulas**

$$1) T^* = \sqrt{\frac{2C_s}{DC_1} \cdot \frac{C_1 + C_2}{C_2}} \quad 2) Q_1^* = \sqrt{\frac{2DC_s}{C_1} \cdot \frac{C_1 + C_2}{C_1}} \quad 3) TC^* = \sqrt{\frac{C_2}{C_1 + C_2}}$$

**Example for Model : 2**

Assume, Demand = 5000 units per year,  $C_s = \text{Rs.}12 / \text{order}$   
 $C_1 = 20\% \text{ of Rs.}24, C_2 = 25\% \text{ of Rs.}24$

$$1. T^* = \sqrt{\frac{2C_s}{DC_1} \times \frac{C_1 + C_2}{C_2}} = \sqrt{\frac{2 \times 20}{5000 \times 4.8} \times \frac{4.8 + 6}{6}}$$

$$= \sqrt{\frac{40}{24000} \times \frac{10.8}{6}} = \sqrt{0.003} = 0.05477/\text{yr}$$

$$2. Q_1^* = \sqrt{\frac{2DC_s}{C_1} \times \frac{C_1 + C_2}{C_1}} = \sqrt{\frac{2 \times 5000 \times 20}{4.8} \times \frac{4.8 + 6}{4.8}}$$

$$= \sqrt{\frac{200000}{4.8} \times \frac{10.8}{4.8}}$$

$$= \sqrt{41667 \times 2.25}$$

$$= \sqrt{93750}$$

$$= 306.19$$

$$3. TC^* = \sqrt{2DC_s C_1} \times \sqrt{\frac{C_2}{C_1 + C_2}}$$

$$= \sqrt{2 \times 5000 \times 20 \times 4.8} \times \sqrt{\frac{6}{4.8 + 6}}$$

$$= 979.80 \times 0.745356$$

$$= 730.30$$

## Summary

From the above numerical examples, it is found in with shortage case is not more than that of the without shortage case of total cost. And we have comparatively example – 1 and example - 2 deterministic inventory model for with shortage and without shortage cases. The deterministic demand rate is fixed to be a both model. The total cost of example – 1 and example - 2 is very differ and time equally nearing. Whenever shortage are allowed and they are completely backlogged and EOQ. We can make a good comparative study between the results of the with-shortage case and without shortage case.

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# **A Study on Policyholders' Opinion on Policies and Premium of Selected Life Insurance Companies**

\* **V. Ranganathan** and \*\* **M. N. Periyasamy**

\* Hindusthan College of Arts & Science, Coimbatore - 28.

Email: *veluranganathan@yahoo.com*.

\*\* Muthayammal College of Arts & Science, Rasipuram, Namakkal (Dt) - 637 408.

Email: *mnp.samy@gmail.com*

## **ABSTRACT**

The main challenges before the insurance industry are innovating new products, changing customer behavior, Government intervention, competition, technology distribution network, automation, technological advancement and quality client relationship. Apart from these the benefits of the products of the life insurance companies must equate the premium amount charged by them. Now a days, so many means and mode of payment facilities are available to pay the premium amount, but there is a doubt whether these facilities are more convenient to them or not. After the liberalization of the insurance industry, the researcher believes that there is a necessity to intensively study and extensively analyse opinions of the customers on the policies introduced and amount spent on premium. Hence, the researcher has undertaken this research work. This study throws a flood of light on policies, amount of premium charged and mode of payment of premium of life insurance companies. The study is descriptive and analytical in nature. It is based on primary data. Non probability sampling method has been pursued to collect the primary data. The total sample size of the study is 480. The study suggested that the life insurance companies may introduce innovative policies which are the best in all fibres and the policyholders should be made to understand the advantages of paying the premium on online. The study concludes that irrespective of the repercussion, the life insurance companies, whether private or public, will have to concentrate on fixing affordable price for their products, adopting easy channel of payment of premium and introducing innovative policies.

## **Introduction**

‘Insurance – A little Price - for a Priceless Security and Precious Service’ – An LIC Hoarding “A protection against the loss of income that would result if the insured passed away. The named

beneficiary receives the proceeds and is thereby safeguarded from the financial impact of the death of the insured. Insurance and assurance are the two sides of the same coin” – Selected Risk managers perceive insurance as an

economic model for reducing and eliminating risk by a process of bringing together an adequate number of homogenous groups so that the loss arising out of the risk becomes predictable for the group. In practice, each member of the group substitutes a small part of the certain cost to meet any uncertain financial loss that would exist but for the contract of insurance. It being so on one side, due to passage of time, many life insurance companies have come into existence, thereupon many metamorphoses have taken place on the mosaic floor of life insurance industry. Insurance that guarantees a specific sum of money to a designated beneficiary upon the death of the insured or to the insured if he or she lives beyond a certain age. The most important factor in insurance industry is the security of amount insured and customer satisfaction. The pivotal elements have its reflection on customer retention, customer loyalty thereby winning the hearts of new customers. This ensures insurance companies to accomplish its corporate goal of maximum profit and increment in market share. Thus customer satisfaction is the end result of customer's expectations and perception of the services offered by the life insurance companies.

## **Statement of the problem**

Understanding the question is as important as answering the question. Similarly, understanding the problem is as important as finding out the solution for the problem. Most of the insurance policies offered by insurance companies focus on providing the customers with an opportunity for investment and the customers are aware of the products through advertisement. The main challenges before the insurance industry are innovating new products, changing customer behavior, Government intervention, competition, technology distribution network, automation, technological advancement and quality client relationship. Apart from these the benefits of the products of the life insurance companies must equate the premium amount charged by them. Now a days, so many means and mode of payment facilities are available to pay the premium amount, but there is a doubt whether these facilities are more convenient to them or not. After the liberalization of the insurance industry, the researcher believes that there is a necessity to intensively study and extensively analyse opinions of the customers on the policies introduced and amount spent on premium. Hence, the researcher has undertaken this research work.

**Scope of the Study**

The beauty of a garland lies in its fragrance. Likewise, the essentiality of a research work lies in its scope of study. In this millennium, insurance industry is likely to play an important role in changing the economic landscape of the country. However, the success of the insurance industry will primarily depend upon meeting the rising expectations of the consumers and fixing the price for the products who will be the real kings in the liberalized insurance market in future. This study throws a flood of light on policies, amount of premium charged and mode of payment of premium of life insurance companies.

**Objectives of the present study**

1. To analyze the policyholders’ opinion on policies, amount of premium and mode of payment of premium of Life Insurance Companies.
2. To offer suggestions based on findings of the study.

**Methodology and research design**

The study is descriptive and analytical in nature. It is based on primary data. Non probability sampling method has been pursued to collect the primary data. The total sample size of the study is 480. The distribution of sample policyholders of LIC of India and private life insurance companies is shown in Table 1, given below.

**Table -1**

**Sample distribution of policyholders of life insurance companies**

S. No.	Life Insurance Companies	No. of Respondent	Percentage
1	LIC of India	240	50
2	Private Life Insurance Companies	240	50
Total		480	100

*Source: Primary data*

In order to select the sample respondents, three levels have been adopted. At the first level, LIC of India (Public Sector) and four private life insurance companies (21 private players functioning in our country during the period of collection of primary data) were selected. The four private life insurance

companies were selected, based on their highest market share in terms of collection of total and new business premium. At the second level, snow ball sampling technique has been adopted to select twelve agents/advisors from LIC of India and twelve agents/advisors of private life insurance companies (3 agents each from 4 private life insurance companies).



**Table - 2****Sample distribution of policyholders of private life insurance companies**

S. No.	Private Life Insurance Companies	No. of Respondents	Percentage
1.	Bajaj Allianz Life Insurance Co.	60	25
2.	HDFC Standard Life Insurance Co.	60	25
3	SBI Life Insurance Co.	60	25
4	ICICI Prudential Life Insurance Co.	60	25
Total		240	100

*Source: Primary data*

At the third level, twenty policyholders coming under each of the twelve agents/advisors of LIC of India and twelve agents/advisors of private life insurance companies were selected on the basis of convenience sampling technique. The selection of policyholders was made after active consultation with the agents/advisors so as to represent all categories such as the rich, the poor, male, female, the educated and respondents having no formal education as well as to cover all the areas in Coimbatore city. The distribution of 240 sample policyholders of private life insurance companies is exhibited in Table-2.

### **Collection of Data**

In order to collect the primary data, structurally, separately well-formulated interview schedules were designed for the policyholders of life insurance companies.

They did contain similar questions so as to suit the policyholders of different insurance companies in such a way. The fieldwork was carried from May 2011 to November 2012. The interview schedules were pre-tested and necessary modifications therein were made to ensure the clarity in sense and contents. A pilot study was conducted by the researcher with the 30 policyholders.

### **Frame Work of Analysis**

Conventional tools like descriptive tables and percentages were used for the purpose of analysis. Further, the following specific tools like Mean Scores, t-test and ANOVA were used.

**Analysis and Interpretation**

**Table-3**  
**Personal profile of the respondents**

		<b>No. of Respondents</b>	<b>Percentage</b>
Age	Up to 30 years	110	23
	31-40 years	161	34
	41-50 years	132	27
	Above 50 years	77	16
Total		480	100
Gender	Male	375	78
	Female	105	22
Total		480	100
Educational Qualifications	No formal Education	38	8
	School level Education	148	31
	Collegiate level Education	211	44
	Professional level Education	83	17
Total		480	100
Occupational Status	Employee	227	47.3
	Professionals	83	17.3
	Business men	75	15.6
	Agriculturists	48	10
	Others	47	9.8
Total		480	100
Family Monthly Income	Below Rs.10,000	140	29
	Rs.10,000-Rs.20,000	169	35
	Rs.20,001-Rs.30,000	68	14
	Rs.30,001-Rs.40,000	44	9
	Rs.40,001-Rs.50,000	35	8
	Above Rs.50,000	24	5
Total		480	100
Marital Status	Married	396	83
	Unmarried	84	17
Total		480	100
No. of Members in the Family	3 and below	180	38
	4 to 5	263	55
	5 and above	37	7
Total		480	100

*Source: Primary data*

The table 3 explains the personal profile of the respondents. Regarding age group of the respondents, 34 percent of the respondents are in the age group of 31 – 40 years, 27 percent of the respondents are in the age group of 41 – 50 years, 23 percent of the respondents are in the age group under 30 years and 16 percent of the respondents are in the age group of above 50 years. Majority of the respondents are in the age group between 31 and 40 years.

With regards to gender, 78 percent of the respondents are male and the remaining 22 percent of the respondents' female. Majority of the respondents are male.

In relation with educational qualifications, 44 percent of the respondents are having collegiate education, 31 percent of the respondents are having school level education, 17 percent of the respondents are having professional education and 8 percent of the respondents are not having even the formal education. Majority of the respondents have collegiate education.

Regarding the Occupational status, 47.3 percent of the respondents are employees, 17.3 percent of the respondents are professionals, 15.6 percent of the respondents are business man, 10 percent of the respondents are agriculturists and

9.8 percent of the respondents are in other categories which include students, home-makers and pensioners. Majority of the respondents are employees.

Information regarding family monthly income of the respondents clear that 35 percent of the respondents are in the income group of Rs.10,000 to Rs.20,000, 29 percent less than Rs.10,000, 14 percent between Rs.20,001 and Rs.30,000, 9 percent between Rs.30,001 and Rs.40,000, 7 percent between Rs.40,001 and Rs.50,000 and 5 percent above Rs.50,000. Majority of the respondents are in the income group of Rs.10000 to Rs.20000.

From the table it is also known that 83 percent of the respondents are married and remaining 17 percent of the respondents are unmarried. Majority of the respondents are married.

The data relating to number of earning members in the family shows that 55 percent of the respondents have 4 to 5 members in their families, 38 percent less than 3 members and 7 percent more than 5 members. Majority of the respondents have 4 to 5 members in their families.

**Table - 4**  
**Opinion about the policies**

S. No.	Opinion	No. of Respondents	Percentage
1	Very much innovative	76	15.8
2	Innovative	203	42.3
3	Normal	182	37.9
4	Not at all innovative	19	4.0
Total		480	100.0

Source: Primary data

The Table-4 indicates the opinion of the respondents about the policies introduced by the Life Insurance Companies. 42.3 percent of the respondents are opine that the policies are ‘Innovative’, 37.9 percent of the respondents feel that the policies are

‘normal’, 15.8 percent of the respondents state that the policies are ‘very much innovative’ and 4 percent of the respondents think that the policies are ‘not at all innovative’.

Majority of the respondents opine that the policies introduced by the life insurance companies are “Innovative”

**Table - 5**  
**Policies-voluntary purchase or upon influence**

S. No.	Particulars	No. of Respondents	Percentage
1	Voluntarily	240	50.0
2	Upon Influence	240	50.0
Total		480	100.0

Source: Primary data

The table-5 contemplates that 50 percent of the respondents have purchased

the policies voluntarily and the remaining 50 percent of the respondents have purchased the policies on influence.

**Table -6**  
**Total sum insured by the respondents**

S. No.	Total sum insured	No. of Respondents	Percentage
1	Below Rs.1,00,000	143	29.8
2	Rs.1,00,000 to Rs.3,00,000	220	45.8
3	Rs.3,00,001 to Rs.5,00,000	35	7.3
4	Above Rs.5,00,000	82	17.1
Total		480	100.0

*Source: Primary data*

From the table-6, it is understood that 45.8 percent of the respondents' amount of sum insured is between Rs.1,00,000 and Rs.3,00,000, 29.8 percent of the respondents' sum insured is below Rs.1,00,000, 17.1 percent of the

respondents' sum insured is above Rs.5,00,000 and 7.3 percent of the respondents' sum insured is between Rs.3,00,001 and Rs.5,00,000.

Majority of the respondents' amount of sum insured is between Rs.1,00,000 and Rs.3,00,000.

**Table - 7**  
**Amount of annual premium**

S. No.	Annual premium	No. of Respondents	Percentage
1	Less than Rs.1,000	87	18.1
2	Rs.1,000-Rs.5,000	157	32.7
3	Rs.5,001-Rs.10,000	112	23.3
4	Above Rs.10,000	124	25.8
Total		480	100.0

*Source: Primary data*

From the table-7, it is understood that 32.7 percent of the respondents' annual premium varies between Rs.1,000 to Rs.5,000, 25.8 percent respondents' annual premium is above Rs.10,000, 23.3 percent of the respondents annual premium Rs.5,000.

varies between Rs.5,001 and Rs.10,000 and 18.1 percent of the respondents annual premium is less than Rs.1,000.

Majority of the respondents' annual premium amount varies between Rs.1,000 and

**Table - 8**  
**Opinion of policyholders on premium amount**

S. No.	Opinion on premium	No. of Respondents	Percentage
1	Very high	22	4.6
2	High	101	21.0
3	Moderate	331	69.0
4	Low	22	4.6
5	Very low	4	0.8
Total		480	100.0

*Source: Primary data*

From the table-8, it is understood that 69 percent of the respondents are of opinion that the premium amount is 'moderate', 21% percent of the respondents believe that the premium amount is 'high', 4.6 percent of the respondents feel that the premium amount is 'low', another 4.6 percent of the respondents think that the premium amount is 'very high' and 0.8 percent of the respondents say the premium amount is 'very low'.

Majority of the respondents are of opinion that the premium amount is 'moderate'.

**CHI-SQUARE TEST AS REGARDS OPINION ON PREMIUM AMOUNT**

**Table - 9**

**Opinion on premium amount charged by different life insurance companies**

		Opinion on premium amount										TOTAL	
		Very high		High		Moderate		Low		Very low		No.	%
		No.	%	No.	%	No.	%	No.	%	No.	%		
<b>Life Insurance Companies</b>	LIC	4	1.7	27	11.3	196	81.7	10	4.2	3	1.3	240	100.0
	Bajaj Allianz	5	8.3	17	28.3	32	53.3	6	10.0			60	100.0
	HDFC Standard	5	8.3	22	36.7	33	55.0					60	100.0
	SBI Life	3	5.0	13	21.7	37	61.7	6	10.0	1	1.7	60	100.0
	ICICI Prudential	5	8.3	22	36.7	33	55.0					60	100.0
<b>TOTAL</b>		<b>22</b>	<b>4.6</b>	<b>101</b>	<b>21.0</b>	<b>331</b>	<b>69.0</b>	<b>22</b>	<b>4.6</b>	<b>4</b>	<b>0.8</b>	<b>480</b>	<b>100.0</b>

Source: Primary data

The above table indicates the opinion of the respondents relating to the premium amount collected by the Life Insurance Companies. 81.7 percent of the respondents LIC of India have opined that the premium amount is ‘moderate’, 53.3 percent of the respondents of Bajaj Allianz have felt that the premium amount is ‘moderate’, 55 percent of the respondents HDFC Standard are of opinion that the premium amount is ‘moderate’, 61.7 percent of the respondents of SBI Life Insurance Co. have thought that the premium amount is ‘moderate’ and 55 percent of the respondents of ICICI Prudential have stated that the premium

amount is ‘moderate’.

Majority of the respondents have opined that the premium amount charged by the life insurance companies is ‘moderate’.

In order to find out whether there is any significant association among the respondents of different Life Insurance Companies regarding their opinion on premium amount charged, the following hypothesis has been formulated and tested by applying Chi-square.

**Hypothesis:** There is no significant association among the respondents of different Life Insurance Companies regarding their opinion on premium amount charged by different life insurance

companies.

**Table - 10**  
**Chi square test-opinion on premium amount**

	Value	Df	Sig.	Table Value
<b>Chi-Square</b>	82.022	16	**	32.000

\*\* Significant at 1% level

Since the calculated Chi-square value (82.022) is greater than the table value (32.000), the hypothesis is rejected. Hence it is inferred that there is significant association among the respondents of different Life Insurance Companies regarding their opinion on premium amount charged by different Life Insurance Companies.

The two-way table is presented to analyse the opinion of the respondents on premium amount among the respondents of different policy values insured. Chi-square test was also conducted to find out whether there is any significant association regarding opinion on premium amount among the respondents having different policy values insured.

**Table - 11**  
**Total sum insured and opinion on premium amount**

		Opinion on premium amount										TOTAL	
		Very high		High		Moderate		Low		Very low		No.	%
		No.	%	No.	%	No.	%	No.	%	No.	%		
<b>Total sum insured</b>	Below Rs.100000	8	5.6	29	20.3	100	69.9	4	2.8	2	1.4	143	100.0
	Rs.100000-300000	11	5.0	55	25.0	148	67.3	5	2.3	1	0.5	220	100.0
	Rs.300001-500000	1	2.9	5	14.3	25	71.4	3	8.6	1	2.9	35	100.0
	Above Rs.500000	2	2.4	19	23.2	51	62.2	10	12.2			82	100.0



TOTAL	22	4.6	108	22.5	324	67.5	22	4.6	4	0.8	480	100.0
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Source: Primary data

Among the respondents who have insured to the value of Rs.3,00,001 to Rs.5,00,000, 71.4 percent of the respondents opined that the premium amount is ‘moderate’. Among the respondents who have insured to the value of below Rs.1,00,000 69.9 percent of the respondents felt that the premium amount is ‘moderate’. Among the respondents who have insured to the value of Rs.1,00,000 to Rs.3,00,000, 67.3 percent of the respondents opined that the premium amount is ‘moderate’. Among the respondents who have insured to the value of above Rs.5,00,000, 62.2 percent of the respondents stated that the premium amount is ‘moderate’

Among the respondents who have opted for different values of policies, majority (67.5%) of the respondents have stated that the premium charges are ‘moderate’.

In order to find out whether there is any significant association regarding opinion on premium amount among the respondents of different policy values, the following hypothesis has been formulated and tested by applying Chi-square.

**Hypothesis:** There is no significant association regarding opinion on premium amount among the respondents of different policy values.

**Table - 12**

**Chi-square test-sum insured and opinion on premium amount**

	Value	d. f.	Sig.	Table Value
<b>Chi-Square</b>	22.461	12	*	21.026

\* Significant at 5% level

Since the calculated Chi-square value (22.461) is greater than the table value (21.026), the hypothesis is rejected.

So it can be concluded that there is significant association regarding opinion on premium amount among the respondents of different policy value.

**Table - 13**  
**Period of premium payment**  
**(Multiple response)**

S. No.	Period of premium	No. of Respondents	Percentage
1	Monthly	142	29.6
2	Quarterly	186	38.8
3	Half yearly	115	24.0
4	Yearly	125	26.0
5	Single premium	32	6.7

*Source: Primary data* 'monthly', 26 percent 'yearly', 24 percent 'half yearly' and 6.7 percent 'single premium'. Majority of the respondents pay their premium 'quarterly', 29.6 percent their premium 'quarterly'.

**Table - 14**  
**Mode of premium payment**

S. No.	Payment of Premium	No. of Respondents	Percentage
1	(By) Self	233	49
2	Through agents	173	36
3	By self/ through agents	26	5
4	Through employer	24	5
5	Through Bank (Standing instruction)	24	5
	Total	480	100

*Source: Primary data* Majority of the respondents prefer to pay the premium amount by selves.

From the above table it is understood that 49 percent of the respondents pay the premium amount by selves, 36 percent through agents, 5 percent by selves and through agents, 5 percent through employer and another 5 percent of through bank (standing instruction).

**Table - 15**  
**Payment of premium on online**

S. No.	Online Payment	No. of Respondents	Percentage
1	Yes	68	14
2	No	412	86
	Total	480	100

*Source: Primary data*

From the above table it is understood that 86 percent of the respondents do not pay their premium amount on online and 14

percent of the respondents pay their premium on online.

Majority of the respondents do not pay their premium amount on online.

**Table - 16**

**Opinion about online premium**

S. No.	Opinion	No. of Respondents	Percentage
1	Convenient	64	94
2	Not Convenient	4	6
	Total	68	100

*Source: Primary data*

From the above table it is noticed that among the 68 respondents 94 percent of the respondents feel that the online premium payment is convenient and 6 percent of the respondents do think that the online premium payment is not convenient.

Majority of the respondents have opined that the online premium payment is convenient to pay the premium amount.

**Key Findings of the Study**

➤ Most (34%) of the respondents are in the age group between 31 and 40 years.

➤ Majority, that is 78 percent of the respondents are male and the remaining 22 percent of the respondents' female.

➤ Majority (44%) of the respondents have collegiate education.

➤ Regarding the Occupational status, majority (47.3%) of the respondents are employees.

➤ Data regarding family monthly income of the respondents clear that majority (35%) of the respondents are in the income group of Rs.10000 to Rs.20000.

➤ Majority that is, 83 percent of the

respondents are married and remaining 17 percent of the respondents are unmarried.

- The data relating to number of earning members in the family shows that majority (55%) of the respondents have 4 to 5 members in their families.
- Most (42.3%) of the respondents opine that the policies introduced by the life insurance companies are “Innovative”
- The study also contemplates that 50 percent of the respondents have purchased the policies voluntarily and the remaining 50 percent of the respondents have purchased the policies on influence.
- Most (45.8%) of the respondents’ amount of sum insured is between Rs.1,00,000 and Rs.3,00,000.
- Most (32.7%) of the respondents’ annual premium amount varies between Rs.1,000 and Rs.5,000.
- Majority (69%) of the respondents are of opinion that the premium amount is ‘moderate’.
- Majority of the respondents have opined that the premium amount charged by the life insurance companies is ‘moderate’.
- The result of chi-square shows that there is significant association among the respondents of different Life Insurance Companies regarding their opinion on premium amount charged

by different Life Insurance Companies.

- Among the respondents who have opted for different values of policies, majority (67.5%) of the respondents have stated that the premium charges are ‘moderate’.
- The Chi-square result of opinion on premium amount reveals that there is significant association regarding opinion on premium amount among the respondents of different policy value.
- Most (38.8%) of the respondents prefer to pay their premium ‘quarterly’ basis.
- Majority (49%) of the respondents prefer to pay the premium amount by selves.
- Majority, that is 86 percent of the respondents do not pay their premium amount on online and only 14 percent of the respondents pay their premium on online.
- Among the 68 respondents, 94 percent of the respondents feel that the online premium payment is convenient and 6 percent of the respondents do think that the online premium payment is not convenient.

## **Suggestions**

### **Introducing Innovative Policies**

Most of respondents do think that the policies introduced by the life insurance companies are innovative in

nature. Nevertheless, a considerable number of the respondents feel them as normal. In order to satisfy all the people in general, the policyholders in particular, the life insurance companies may introduce innovative policies which are the best in all fibres.

### **Suggestibility of Paying Premium on Online**

Out of the respondents studied, only twelve percent of them pay the premium on online. Among the respondents, ninety four percent of them feel the payment of premium on online as convenient. In this computer world, in order to save the time of the policyholders as well as that of the insurance personnel, and to reduce their laboriousness of monetary transactions from end to end, the policyholders should be made to understand the advantages of paying the premium on online. Such understanding can be effected by insurance agents/advisors through demonstration of online payment.

### **CONCLUSION**

The Indian insurance industry is as old as it is in any other part of the world. It has become revolutionarily grown and remarkably developed by virtue of the ingress of the private life insurance companies. Irrespective of the

repercussion, the life insurance companies, whether private or public, will have to concentrate on fixing affordable price for their products, adopting easy channel of payment of premium and introducing innovative policies. Only those life insurance companies, which can make a niche in the heart of the customers, will be able to survive and thrive on the open wide horizon of life insurance industry. Hence, they will have to navigate the ship of their companies in right direction with better affordabilities. Thereby, the Indian Insurance Industry will have a rosy path for their further retention and progression with certainty.

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## **CHALLENGING PATTERN OF DISINVESTMENT IN INDIA**

**A.Karthigai Selvam, Asst Prof in Economics**

**Muthayammal College of Arts & Science- Rasipuram**

**E-Mail I.D - Karthi\_ecofin@yahoo.com**

### **ABSTRACT**

The present paper has mainly revealed that the purpose of disinvestment policy involved in sick PSU, target, realization, and its future challenges to be faced by the govt. In order to improve the financial performance of the sick PSU may offer a part of sale to the public as per the Law. The Disinvestment Policy has to ensure the transparency, accountability, and obvious phase of sale of sick PSU. Transparency is a pre-requisite for a successful disinvestment programme. This will alone bring the creditability in any deal.

Key words: Accountability, transparency, realization

### **INTRODUCTION**

The congress Government led by Mr.Narasimha Rao announced the New Industrial Policy in July 1991. The Industrial Policy statement of 24<sup>th</sup> July 1991 stated that the government would divest part of its holdings in selected PSE. But it neither places any restrict on the extent of disinvestment nor restricts disinvestment in favour of any particular class of investors. The main aim of disinvestment is to correct the fiscal deficit and rehabilitate the sick PSE.s

Disinvestment offers a viable solution to the problem of sick public sector undertaking. Today, profit making PSUs are also being targeted for disinvestment. There is no going back with

respect to disinvestment as it offers benefits for the economy, the tax payer, the stock market and employees.

### **BACKGROUND OF DISINVESTMENT:**

The policy of the government on disinvestment has evolved over a period. Its beginning could be traced to 1991-92, when in a bid to broad base equity, to improve management, to enhance the availability of resources for PSE and yield resources for the exchequer. It was decided to divest up-to 20% of the government equity in selected PSUs in favour of the public sector institutional investment. In 1993 the **Rangarajan Committee**

recommended the need for substantial disinvestment process in PSE.

It stated that the percentage of equity to be diverted could be up-to 49% for industries explicitly reserved for the public sector. Barring a few exceptional cases, it recommended 100% disinvestment of Govt undertakings out of which 51% or more equity by the Govt was recommended only for six industries namely, coal, mineral oil, arms and defence equipments, atomic energy, radioactive minerals and railways transport.

In 1996, the United Front Govt supported the withdrawal of public sector investment from non-core strategic areas to assure the workers and their job security or arrangement of alternative, opportunities for retraining and redeployment.

The Govt has set up a Disinvestment Commission in 1996. The commission made recommendations for the disinvestment of 58 PSE. The Commission has performed various activities to improve the sick public sector enterprises

### **Meaning of Disinvestment**

Disinvestment refers to the sale or closure of a firm or a part of its business.. In other words disinvestment is the process through which privatizations could take place.

### **Meaning of privatization:**

It is the transfer of control of ownership from the public to the private sector. Such a transfer being necessarily associated with market liberalization and deregulation, changes in the macroeconomic context, the competitive environment and the labour market of the country.

It refers to full conversion of property rights from the state of collective owners to private owners.

### **Procedure of Disinvestment:**

Govt of India recently established a new Department for Disinvestment to establish a systematic policy approach to disinvestment and privatization. The Ministry of Disinvestment, Govt of India, headed by Mr. Arun Shourie of 2004, he managed the process of Disinvestment. Now Mr.P.Chidamparam of Finance Minister for Union Government has taken more care on these areas. These offices carry out the disinvestment in accordance with prescribed procedures with the transparency. The procedures are:

The proposals for disinvestment in any PSU based on the recommendations of the Disinvestment Commission or in accordance with declared Disinvestment Policy of the Govt, and are placed for consideration of the Cabinet Committee on Disinvestment (CCD)



After CCD clears the disinvestment proposals, the selection of Advisor is done through a competitive bidding process.

The Advisor assists the Govt in preparation and issue of advertisement in leading newspaper inviting Expression of Interest (EOI) from interested parties.

After receipt of the EOI's prospective bidders are short listed based on pre-determined objective screening criteria/ requirements.

The Advisor, after due diligence of the PSU, prepares the information Memorandum in consultation with the concerned PSU. This is given to the Short listed prospective bidders who have entered into a Confidentiality Agreement.

The draft Share Purchase Agreement and Shareholder's Agreement are also prepared by the Advisor with the help of a Legal Expert.

The prospective bidders hold discussions with the Advisors/the Government/ the Representatives of the PSU for clarifications

Based on the reactions received from the prospective bidders, the Share Purchase Agreement and Share holder Agreement are finalized. Then these are examined and corrected by the Ministry of Law and are approved by the Government. (Technical and Financial Unit are also involved)

The peer group of CCD and Inter Ministerial Group (IMG) have to be evaluated and recommended.

After the transaction is completed then all papers and documents relating to disinvestment has to be re-evaluated by Comptroller and Audit General (CAG) for the purpose of Parliament nod . After the Parliament acceptance then that will be authentically released to public.

### **Objectives of Disinvestment Policy:**

The Disinvestment Policy is aimed at to achieve the following objectives:

The main aim of disinvestment is to provide immediate remedy of financial resources to boost-up further production of sick PSUs.

The Public and Private patterns have joined together to improve the productivity and maximize the sales.

Disinvestment would have a beneficial effect on the capital market. The increase in floating stock would give the market more depth and liquidity, to raise the funds by privatized companies for its expansions.

Disinvestment would release tangible and intangible resources such as large man power locked up in managing

PSUs and release them for redeployment in high priority social sectors.

Disinvestment would expose privatized companies to achieve market discipline and help them become self-reliant.

Private investments are invited to improve the sick public sector enterprises, which would increase economic activity among the public. They have an overall beneficial effect on the economy on employment and tax revenue in the medium term to long term.

The Disinvestment Commission gave the priority to strategic /a trade sale with transfer of management, instead of public offering was recommended by the Rangarajan Committee in 1993.

### **DISINVESTED PUBLIC SECTOR UNDERTAKING:**

Now the Government is very keen on withdrawing the investment from their own units and hand over their part of units to private owners for effective management. For example, there were 14 Public Sector Undertakings were privatized so far. They are:

- Lagan Jute Machinery Company Limited (LJMC)
- Modern Food Industries Limited (MFIL)

- Bharat Aluminum Company Limited (BALCO)
- Computer Maintenance Corporation Limited (CMCL)
- Hindustan Teleprompter Limited (HTL)
- Indo Burma Petroleum Limited (IBP)
- Videsh Sanchar Nigam Limited (VSNL)
- Indian Tourism Development Corporations of India (ITDC)
- Hotel Corporation of India Limited (HCIL)
- Para deep Phosphates Limited (PPL)
- Jessop and company Ltd (JCL)
- Hindustan Zinc Limited (HZL)

### **Disinvestment in Power Sector:**

In India, the only one State like Odissa who have handed over their electricity service to the private owners due to poor administration, maintenance and lack of financial resources of the State government.

### **STRATEGIC AND NON-STRATEGIC CLASSIFICATION:**

On 16<sup>th</sup> March 1999, the Govt classified the Public Sector Enterprises into strategic and non-strategic sale for the purpose of disinvestment.

The Strategic sale of arms, ammunitions, defence equipments, railway transport and

atomic energy have linked with the policy of disinvestment

The rest of the PSE are coming under non-strategic sale of disinvestment process.

#### **Methodology of Disinvestment:**

The Govt followed the policy of open auction sale followed NRI (Non-

Residential Indian) and other persons to participate. This method gave an excellent result in 1994-95 and as against the target of Rs.4000 crore, the realization jumped to Rs.4, 843 crore but later in 1999-2000, the Govt shifted to strategic sale.

Table 1 Quantum of investment in PSUs disinvested under economic reforms in Indi were:

Year	Target	Actual Receipts
1991-92	2500	3038
1992-93	2500	1913
1993-94	3500	Nil
1994-95	4000	4843
1995-96	7000	168
1996-97	5000	380
1997-98	4800	910
1998-99	5000	5371
1999-2000	10000	1860
2000-01	10000	1871
2001-02	12000	5658
2002-03	12000	3348
2003-04	14500	15547
2004-05	4000	2765
2005-06	No Target	1570
2006-07	No Target	Nil
2007-08	No Target	2367
Total	Rs. 96800	Rs.51609

**Source: Government of India, white Paper on Disinvestment of CPSE – 2007**

#### **Interpretation of the Data:**

The above statistical report has evidently proved that Disinvestment process could not be achieved what actually we expected the realization. Except the year of 1991-92, 1994-95,

1998-99 and 2003-04 these year we would have been achieved finest revenue mobilization but rest of the year we didn't receive good return from the target. This is the data which can exhibit the challenges to be faced by the Government in future.

#### **Present Status of this Policy:**

Disinvestment offered a viable solution to provide strength to the sick PSUs. Today profit making PSUs are also being targeted for disinvestment.

From the past data has clearly highlighted that the disinvestment policy could not be useful for our nation and it must be re-examined by the Peer Group so that the PSUs have their own rights to frame all legal policies.

During the year 1991-92 to 2003-04 the Govt planned to mobilize as much as Rs.78300 Crore via disinvestment but we could be actually attracted and realized only Rs.30917 Crore.

This is not tolerated by the Govt and even public also aware of these things. Due to the fiscal deficit, the govt can sell their part of shares to the third party but the dividend could be shared to the third party is not good one.

Govt can also focus more on divestment of PSU, recently July 15<sup>th</sup>,2013,The Hindu Newspaper published about Blue chip companies like IOC, CIL and BHEL to achieve divestment target of Rs.40.000 Crore in this fiscal year.

### **Challenges of Disinvestment Policy in India:**

The major challenges of disinvestment policy have not only to avoid easy selling of sick PSU to the third party but also that would never get bad opinion from the public.

The policy of disinvestment has contributed more on the improvement of financial operations of the Govt. Due to the fiscal deficit and heavy borrowing would make the govt to offer part of sale to the public.

The disinvestment policy has to face lot of challenges in future, which are outlined below:

1. To avoid the part of sale of sick PSU and to rehabilitate them in a healthy measure
2. To ensure the transparency among the employees by which the productivity can be raised
3. Due to poor administration and lack of skilled labour are always a challenging factor in the PSU and it would be re-evaluated.
- 4 In a good public sector, we need good governance would only make the PSU can perform a better way.
5. Most of the profit oriented PSU would never be disinvested and that would be improved by way of skill oriented reform and policies.
6. Heavy-inflow of foreign capital is invited only for adjusting financial mechanism but not invite them in the entire business operation of our country.
7. The Cabinet Committee on Disinvestment and other peer committee are always suggest and

support to rehabilitate the sick PSU and not sell the sick industries.

The disinvestment policy is not merely for mobilizing revenues for the government, it is mainly for opening the productive potential of PSU and for reorienting the Govt away from business to business of governance. The disinvestment process is reform oriented. Reform is a continuous process and it could always to secure positive outcome to the society means welcoming one. But to spoil our wealth of a nation means we have to modify the policy.

### CONCLUSION

The public has a right to know the purpose of privatization of a particular unit, it is necessary to identify in the interest of the economy in general and ensure better quality of the product, cheaper cost and better service for common men in particular.

Eventually, from the above discussion, the disinvested Public Sector Enterprise has not improved in the past two decade; therefore, the government should take appropriate steps to overcome the process of disinvestment and try to make the Public Sector Enterprise healthy in financial side and good governance.

If we follow the efficient administration, best employees, good

operational efficiency and sound financial resources, we will surely achieve good outcome, profit and good governance.

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# ROLE OF CSR IN SOCIAL DEVELOPMENT OF OUR COUNTRY

\* **Y. SHAFEE and J. PRABAKARAN**

\* Muthayammal College of Arts and Science, Rasipuram, Namakkal District.

Email: *ys.shafee@gmail.com*.

## ABSTRACT

Corporate social responsibility (CSR) refers to strategies corporations or firms conduct their business in a way that is ethical, society friendly and beneficial to development of our country. This article analyses the meaning of CSR based on some theories available in literature. It is argued that three theories namely utilitarian, managerial and relational theories of CSR supported by works of other scholars in the area could be used to suggest that CSR becomes an international concern due to globalized nature of business that knows no border. CSR is evolving in its meaning and practice. The article then discusses the role of CSR in development of our country because the very logic of CSR is towards seeing its impact in socially, environmentally and economically. Competencies required by CSR managers are also analyzed in order to have a better understanding of the practical aspects of CSR.

**Keywords:** Corporate social responsibility, CSR development, Competencies of CSR managers, Multinational corporations, Corporate-society relations.

## INTRODUCTION

Today, we live in an age in which companies, businesses and society are more connected and interactive than ever before in the past. Corporations are more aware of their role towards the society. They are responsible bodies that feel a sense duty towards commonwealth and the environment that comes with a growing realisation that they, as an integral part of this society themselves, can contribute to its upliftment and empower of the entire country in turn. consumers and citizens' campaigns can make all the difference.

This is the foundation thought behind the golden handshake between tripartite— companies, society and nation Corporate Social Responsibility.

CSR is a crucial bridge between organizations and society and also a means to create awareness amongst corporates, NGOs, Civic bodies and government of the value and importance of social responsibility to bridge the gap between the privileged and the disadvantaged of society. It facilitates and creates the environment for true good partnership between civil society and business. More and more companies and organizations are

creating an interface to encourage industry commerce and globalisation that can, in turn, improve the bottom line by social good.

Corporate Social Responsibility (CSR) is the soul of every business these days. It has also become the password to not only overcome competition but to ensure sustainable growth. It has been supported not only by the shareholders but stakeholders by and large encompassing the whole community. CSR in truth is the alignment of business operations with social values. It takes into account the interests of stakeholders in the company's business policies and actions. It focuses on the social, environmental, and financial success of a company - the so-called triple bottom line - with the aim to achieve social development while achieving business success. More importantly, CSR is the point of convergence of various initiatives aimed at ensuring socio-economic development of the community which would be livelihood oriented as a whole in a credible and sustainable manner. There does seem to be a glimmer of hope from the rapidly growing field of CSR and from the greater involvement of companies in providing private funds for relief.

The issue of corporate social responsibility (CSR) has been debated since the 1950s. Latest analyses by Secchi

(2007) and Lee (2008) reported that the definition of CSR has been changing in meaning and practice. The classical view of CSR was narrowly limited to philanthropy and then shifted to the emphasis on business-society relations particularly referring to the contribution that a corporation or firm provided for solving social problems. In the early twentieth century, social performance was tied up with market performance. The pioneer of this view, Oliver Sheldon (1923, cited in Bichta, 2003), however, encouraged management to take the initiative in raising both ethical standards and justice in society through the ethic of economizing, i.e. economize the use of resources under the name of efficient resource mobilization and usage. By doing so, business creates wealth in society and provides better standards of living.

The present-day CSR (also called corporate responsibility, corporate citizenship, responsible business and corporate social opportunity) is a concept whereby business organizations consider the interest of society by taking responsibility for the impact of their activities on customers, suppliers, employees, shareholders, communities and other stakeholders as well as their environment. This obligation shows that the organizations have to comply with legislation and voluntarily take initiatives

to improve the well-being of their employees and their families as well as for the local community and society at large.

CSR simply refers to strategies corporations or firms conduct their business in a way that is ethical and society friendly. CSR can involve a range of activities such as working in partnership with local communities, socially sensitive investment, developing relationships with employees, customers and their families, and involving in activities for environmental conservation and sustainability.

### **The Economy**

After initiating far reaching economic reforms of deregulation and liberalization since 1991, India has undergone a paradigm shift. There have also been fundamental and irreversible changes in the economy, government policies, outlook of business and industry and in the mindset of Indians in general. From a shortage economy of food and foreign exchange India has now become a surplus one; from an agro based economy it has emerged as a service oriented one; it is now a front runner in the emerging knowledge based new economy; Indian companies have become globally competitive and 'Brand India' is getting global recognition. India has been recognized as an attractive investment destination for investment and a large and

growing market for business. The fundamentals of the Indian economy have become strong and stable. The macro-economic indicators are at present the best in the history of independent India with high growth, healthy foreign exchange reserves, and foreign investment and robust increase in exports and low inflation and interest rates. The unique feature of Indian economy has been high growth with stability.

The Indian economy has proved its strength and resilience when there have been crisis in other parts of the world including in Asia in recent years. India is rated as the fifth most attractive emerging retail market. It has been ranked second in a Global Retail Development Index of 30 developing countries drawn up by A. T. Kearney. The vibrant capital market comprises of 23 stock exchanges with over 9000 listed companies. The Bombay Stock Exchange is the second largest after NYSE and the stock market trading and settlement system are world class. India also has the third largest investor base in the world and also has one of the world's lowest transaction costs based on screen-based transactions, paperless trading and a T+2 settlements cycle. There has been consistent high growth in recent years and there are definite indications of continuation of this trend in the future. Presently, India is emerging as a global



player in Information Technology and is in the forefront of the unfolding new era of Knowledge Economy, with its large pool of scientific and creative human resources and R&D facilities. There is a change in the mindset of Indians who have become more confident and outward looking. The Indian market is being driven by a powerful new force of entrepreneurship unleashed by the economic reforms and liberalization of recent years.

### **Theories of CSR**

Since there is a great heterogeneity of theories and approaches of CSR, discussion in this article is based on a comprehensive analysis by (Secchi 2007) and it is compared with an analysis by (Garriga and Mele 2004). Secchi has come up with a group of theories based on a criterion what role the theories confer to the corporation and society. The theories are as follows: 1) The utilitarian theory, 2) The managerial theory, and 3) The relational theory (see Table 1). On the other hand, (Garriga and Mele's 2004) analysis maps CSR into four types of territories. They are: 1) Instrumental theories, 2) Political theories, 3) Integrative theories, and 4) Ethical theories. Table 2 describes the theories and the relevant approaches.

There is no doubt that some similarities do exist in both

conceptualizations of CSR and the discussion will be based on emphases and approaches.

There has been a burgeoning parallel interest in understanding the dynamics and peculiarities of CSR in developing economies (Blowfield and Frynas 2005; Newell and Frynas 2007; Idemudia 2011). Authors have contested the immediate transferability of frameworks and conclusions drawn in the developed world to developing countries and have argued for the need for a more nuanced analysis of how CSR manifests itself in emerging markets (Egri and Ralston 2008; Kolk and Lenfant 2010; Kolk and Van Tulder 2010). The context-dependence of CSR has indeed been re-emphasized in recent years and the fact that developing countries present peculiar institutional constellations that affect CSR manifestations is now well recognized (e.g. Jamali and Sidani 2012; Visser 2008). Scholars have suggested for example that philanthropy constitutes the main expression of CSR in the developing world whether because of prevailing cultural norms and expectations (Jamali and Neville 2011; Gao 2009).

### **The four phases of CSR development in India**

The history of CSR in India has its four phases which run parallel to India's historical development and has resulted in

different approaches towards CSR. However the phases are not static and the features of each phase may overlap other phases.

### **The First Phase**

In the first phase charity and philanthropy were the main drivers of CSR. Culture, religion, family values and tradition and industrialization had an influential effect on CSR. In the pre-industrialization period, which lasted till 1850, wealthy merchants shared a part of their wealth with the wider society by way of setting up temples for a religious cause. Moreover, these merchants helped the society in getting over phases of famine and epidemics by providing food from their godowns and money and thus securing an integral position in the society. With the arrival of colonial rule in India from the 1850s onwards, the approach towards CSR changed. The industrial families of the 19th century such as Tata, Godrej, Bajaj, Modi, Birla, Singhania were strongly inclined towards economic as well as social considerations. However it has been observed that their efforts towards social as well as industrial development were not only driven by selfless and religious motives but also influenced by caste groups and political objectives.

### **The Second Phase**

In the second phase, during the independence movement, there was increased stress on Indian Industrialists to demonstrate their dedication towards the progress of the society. This was when Mahatma Gandhi introduced the notion of "trusteeship", according to which the industry leaders had to manage their wealth so as to benefit the common man.

### **The Third Phase**

The third phase of CSR (1960–80) had its relation to the element of "mixed economy", emergence of Public Sector Undertakings (PSUs) and laws relating labour and environmental standards. During this period the private sector was forced to take a backseat. The public sector was seen as the prime mover of development. Because of the stringent legal rules and regulations surrounding the activities of the private sector, the period was described as an "era of command and control". The policy of industrial licensing, high taxes and restrictions on the private sector led to corporate malpractices. This led to enactment of legislation regarding corporate governance, labour and environmental issues. PSUs were set up by the state to ensure suitable distribution of resources (wealth, food etc.) to the needy. However the public sector was effective only to a certain limited extent. This led to shift of expectation from the public to the private sector and their active involvement

in the socio-economic development of the country became absolutely necessary. In 1965 Indian academicians, politicians and businessmen set up a national workshop on CSR aimed at reconciliation. They emphasized upon transparency, social accountability and regular stakeholder dialogues. In spite of such attempts the CSR failed to catch steam.

### **The Fourth Phase**

The fourth phase (1980 until the present) Indian companies started abandoning their traditional engagement with CSR and integrated it into a sustainable business strategy. In the 1990s the first initiation towards globalization and economic liberalization were undertaken. Controls and licensing system were partly done away with which gave a boost to the economy the signs of which are very evident today. Increased growth momentum of the economy helped Indian companies grow rapidly and this made them more willing (Gajare, R.S. (2014). A conceptual study of CSR development in India. In D.B. Patil & D.D. Bhakkad, *Redefining Management Practices and Marketing in Modern Age Dhule, India: Atharva Publications* (p. 152-154)). And able to contribute towards social cause. Globalization has transformed India into an important destination in terms of production and manufacturing bases of

TNCs are concerned. As Western markets are becoming more and more concerned about labour and environmental standards in the developing countries, Indian companies which export and produce goods for the developed world need to pay a close attention to compliance with the international standards.

### **Current State of CSR in India**

As discussed above, CSR is not a new concept in India. Ever since their inception, corporates like the Tata Group, the Aditya Birla Group and Indian Oil Corporation, to name a few, have been involved in serving the community. Through donations and charity events, many other organizations have been doing their part for the society. The basic objective of CSR in these days is to maximize the company's overall impact on the society and stakeholders. CSR policies, practices and programs are being comprehensively integrated by an increasing number of companies throughout their business operations and processes. A growing number of corporates feel that CSR is not just another form of indirect expense but is important for protecting the goodwill and reputation, defending attacks and increasing business competitiveness.

Companies have specialised CSR teams that formulate policies, strategies and goals for their CSR programs and set

aside budgets to fund them. These programs are often determined by social philosophy which have clear objectives and are well defined and are aligned with the mainstream business. The programs are put into practice by the employees who are crucial to this process. CSR programs ranges from community development to development in education, environment and healthcare etc.

For example, a more comprehensive method of development is adopted by some corporations such as Bharat Petroleum Corporation Limited, Maruti Suzuki India Limited, and Hindustan Unilever Limited. Provision of improved medical and sanitation facilities, building schools and houses, and empowering the villagers and in process making them more self-reliant by providing vocational training and a knowledge of business operations are the facilities that these corporations focus on. Many of the companies are helping other peoples by providing them good standard of living.

On the other hand, the CSR programs of corporations like GlaxoSmithKline Pharmaceuticals' focus on the health aspect of the community. They set up health camps in tribal villages which offer medical check-ups and treatment and undertake health awareness programs.

Some of the non-profit organizations which carry out health and education programs in backward areas are to a certain extent funded by such corporations.

Also Corporates increasingly join hands with Non-governmental organizations (NGOs) and use their expertise in devising programs which address wider social problems.

CSR has gone through many phases in India. The ability to make a significant difference in the society and improve the overall quality of life has clearly been proven by the corporates. Not one but all corporates should try and bring about a change in the current social situation in India in order to have an effective and lasting solution to the social woes. Partnerships between companies, NGOs and the government should be facilitated so that a combination of their skills such as expertise, strategic thinking, manpower and money to initiate extensive social change will put the socio-economic development of India on a fast track.

### **Law**

Under the Companies Act, 2013, any company having a net worth of rupees 500 crore or more or a turnover of rupees 1,000 crore or more or a net profit of rupees 5 crore or more should mandatorily spend 2% of their net profits per fiscal on CSR activities. The rules came into effect

from 1 April 2014.

### **Areas of corporate social responsibility**

CSR simply refers to strategies corporations or firms conduct their business in a way that is ethical and society friendly. CSR can involve a range of activities such as working in partnership with local communities, socially sensitive investment, developing relationships with employees, customers and their families, and involving in activities for environmental conservation and sustainability.

Managers should pay particular attention to their social responsibility that can be grouped under eight headings as follows:

#### **1) Ecology and environment quality**

- i) To maintain pollution – free environment.
- ii) To ensure dispersion or spread of industries.
- iii) To ensure beautification and proper land use.

#### **2) Consumption**

- i) To provide true and fair business dealings.
- ii) To provide product warranty and service.
- iii) To ensure control of harmful products.
- iv) Adequate information about product.

#### **3) Community needs**

- i) To provide expert service for local problems.
- ii) To ensure healthcare facilities and education.

#### **4) Government relations**

- i) To encourage restriction on lobbying.
- ii) Controls of business through political action.

#### **5) Minorities and backward communities**

- i) To provide training to the unemployed.
- ii) To provide equal employment opportunity.
- iii) To locate plants and offices in minority areas.
- iv) To encourage minority business by purchasing from them.

#### **6) Labor relations**

- i) To maintain improved occupational health and safety.
- ii) To ensure provision of day-care centers.
- iii) To provide options of flexible working hours.
- iv) Employee's education and training practices.

#### **7) Shareholder relations**

- i) To take care of shareholders interests.
- ii) To make improved financial disclosures.

#### **8) Corporate philanthropy**

- i) To provide financial support for promotion of arts and culture.
- ii) To arrange for special scholarships and gifts for the education industry.
- iii) To provide financial support for charities.

### **Obligation or responsibilities towards different groups**

The Responsibilities of management towards various groups are discussed below :

- i) Business to owners or shareholders.
- ii) Business to customers.
- iii) Business to government.
- iv) Business to suppliers.
- v) Business to community.
- vi) Business to employees.

### **Conclusion**

Roles of CSR in CD refer to the ways the responsible behavior is perceived by development and how impacts are felt by them. sharing the costs the society has to pay due to environmental degradation, transfer of technology from international companies to developing countries, environmental protection measures that done together by corporation.

For many corporation leaders, it is difficult to know where their responsibilities begin and end in relation to building infrastructure, creating economic

opportunities, and access to core services such as health, education and poverty alleviation. Experience has made one thing certain that sustainable CSR solutions at community, provincial and national levels are based on partnerships between government, civil society and business. Transferable skills and knowledge from other related specializations such as environmental management, business ethics, transfer of technology, human resource management and community development, are valued. In short, the skills required by CSR managers are classified as business skills, people skills and technical skills; and the specific skills required are further determined by the mission and vision of the organizations where the CSR managers serve.

CSR organizations in many developing countries including Malaysia consist of local and international firms. As such, this analysis suggests that comparative studies should be conducted on the differences between strategies adopted by the two firms in terms of emphases and orientations in CSR, the specific roles of CSR programs to community and society at large, and specific business, people as well as technical skills that the CSR managers should possess. It is also suggested that studies on how CSR firms strive during the present economic crisis are worthwhile to

embark on; however, they should be aware of the fact that moving towards achieving firms' economic goals should be without jeopardizing the social goals.

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Rasipuram - 637 408, Namakkal District, Tamilnadu. INDIA

Tel: +91-4287-222137 Fax: +91-4287-220227

E-Mail : [info@muthayammal.in](mailto:info@muthayammal.in)

[www.muthayammal.in](http://www.muthayammal.in)



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