

## Vulnerability of disease and Health care facility in Kerala

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**Abstracts:** This paper examines the dimensions of vulnerability of disease occurred in the 2006-2012 period in Kerala state in India. The state has been witnessing high incidence of communicable disease in rural and urban areas. Vulnerability refers to the inability to withstand the effects of a hostile environment. The disease vulnerability calculated by based on the communicable disease occurrence in Kerala State. To assess the physical vulnerability, the Disease Incidence Scores (DIS) are calculated which indicate the ratio between the frequency of a particular disease class in a district and total frequency of the disease class in the State. The average of DIS and DRS was then determined to calculate the Disease Risk Score (DRkS). The Total Disease Risk Score (TDRKS) is computed which is the average of sum of the Disease Risk Score (DRkS). The value of this score ranges from 0.0 – 0.9. A value closer to 0.0 denotes least disease risk while 0.9 represents maximum disease risk. Thiruvananthapuram district has high disease intensity and high disease vulnerability in Kerala. Although Thiruvananthapuram district noticed second rank in allopathy hospital facilities. But the Ayurveda and homeopathy hospital facilities are very low in this District .Kollam and Pathanamthitta districts identified medium disease intensity and vulnerability. Alappuzha district noticed low disease intensity. Kottayam and Idukki districts have medium disease intensity and vulnerability. Ernakulam district have high disease intensity and vulnerability. Thrissur district identified medium disease intensity and vulnerability. These districts have medium Allopathy and homeopathy hospital facilities. Palakkad and Malappuram districts have medium level of disease intensity, vulnerability and hospital facilities. Kozhikkode district have high disease intensity and high disease vulnerability. But the hospital facilities like allopathy, Ayurveda and homeopathy hospital facilities have medium. Wayanad, Kannur and Kasargod districts have medium disease intensity, vulnerability and hospital facilities.

**Key words:** disease intensity, Disease Risk Score (DRkS), Total Disease Risk Score (TDRKS), vulnerability.

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### Introduction

Geographical, cultural, socio economical and environmental factors determine the health condition of the people. While Kerala is the most highly developed Indian State in terms of epidemiological transition and has the highest prevalence of most of the non-communicable diseases (NCD) and risk factors. Kerala with its high population density of 859 people per square kilometres ranks and low in agricultural productivity and compared to the rest of India consumes double the marketed products high in salt, sugar and saturated fat harmful to the health condition of the people.

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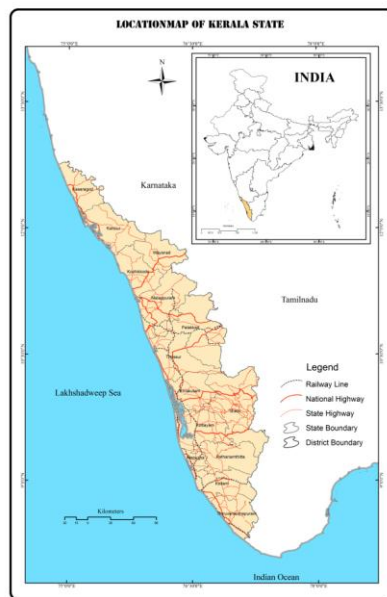
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Vulnerability refers to the inability to withstand the effects of a hostile environment. Vulnerability is a human condition and as such a constant human experience. However, patients and professional health care providers may be regarded as more vulnerable than people who do not suffer or witness suffering on a regular basis. Acquiring a deeper understanding of vulnerability would thus be of crucial importance for health care providers. The political commitment necessary to tackle the growing burden of non communicable diseases (NCDs) has increased in recent years. This has resulted in the development of strategic objectives by the World Health Organization (WHO) and of proposed national standards for the prevention and control of NCDs.

### Study area

Kerala state extends from  $8^{\circ} 18^{\prime}$  North to  $12^{\circ} 48^{\prime}$  North latitude and  $74^{\circ} 52^{\prime}$  East to  $77^{\circ} 22^{\prime}$  East longitude along the coast in the south western part of India .figure 1.1 The state is bounded by Karnataka in the north, Tamilnadu in the East and South and Lakshadweep Sea in the West. With an area of 38863sq km (1.27 percent of the total area of India) the population has about 3, 33, and 87,677 as per2011 census. The state comes into existence on 1<sup>st</sup> Nov 1956 as a result of the re-organization of Indian states, with some territorial adjustments. Presently, there are 14 districts and 63 Taluks.



### Methods

The disease vulnerability calculated by based on the communicable disease occurrence in Kerala State. To assess the physical vulnerability, the Disease Incidence Scores (DIS) are calculated which indicate the ratio between the frequency of a particular disease class in a district and total

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frequency of the disease class in the State. For each disease class, districts are given a value from 14 to 1 in decreasing order of disease occurrences. Then the Disease Rank Score (DRS) is calculated for each district by dividing the rank value that is, 14. The average of DIS and DRS was then determined to calculate the Disease Risk Score (DRkS). The DRkS values are computed for each district for all 11 types of diseases that is, Malaria, Dengue, Leptospirosis, Hepatitis- A, Typhoid, AAD (Diarrhoea), H<sub>1</sub>N<sub>1</sub>, Hepatitis – B, JE/AES, cholera and chikunguniya. The Total Disease Risk Score (TDRKS) is computed which is the average of sum of the Disease Risk Score (DRkS). The value of this score ranges from 0.0 – 0.9. A value closer to 0.0 denotes least disease risk while 0.9 represents maximum disease risk.

Disease Risk Score calculation

$$DRkS = \left[ \frac{DIS + DRS}{2} \right]$$

$$DIS = \frac{df}{sf}$$

$$DRS = \frac{dr}{tr}$$

$$TDRkS = \left[ \frac{DRkS_1 + DRkS_2 + \dots + DRkS_n}{N} \right]$$

Where, N=Number of disease types/ classes, df =Frequency of disease in district, sf=Total frequency of disease in State, dr=District rank in disease occurrence ,tr=Total ranks given to all districts, DIS= Disease Incidence Score,DRS= Disease Rank Score ,DRkS= Disease Risk Score, TDRkS=Total Disease Risk Score.

## Results and Discussion

Kerala State is prone to communicable diseases throughout the year. These are location specific or seasonal phenomena associated with the hygienic character of the State. The district wise data are used to understand the disease vulnerability of Kerala state in the period of 2006-2012.

### Malaria Disease Risk Score

Table 1.1 shows, high Malaria disease risk score(>0.5) observed in Kasargod, Kannur districts. Medium malaria disease risk score (.25-.50) reported in Alappuzha, Pathanamthitta, Eranakulam, Thrissur, Kozhikkode districts. Similarly low disease risk score (<0.25) observed in Malappuram, Idukki, Kottayam, Wayanad, Palakkad, Thiruvananthapuram, Kollam districts.

### Dengue Fever Disease Risk Score

Table 1.1 shows high disease risk score (>0.5) reported in Thiruvananthapuram district (0.78). In Idukki, Kollam, Pathanamthitta, Kottayam, Eranakulam, Thrissur, Wayanad, Kasargod, districts reported

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medium diseases risk score (0.25-0.5). Besides low disease risk score (0.25) observed in Palakkad, Malappuram, Kozhikode, Kannur, Alappuzha districts.

#### **Lepto spirosis Disease Risk Score**

Table 1.1 shows Thiruvananthapuram, Kottayam and Ernakulam district show the high disease risk score ( $>0.5$ ) Medium disease risk score (0.25-0.5) reported in Idukki, Palakkad, Kozhikode, Wayanad, Alappuzha, Thrissur districts. Similarly low disease risk Score ( $<0.25$ ) observed in Pathanamthitta, Kollam, Kasargod, Malappuram, Kannur districts.

#### **Hepatitis A Disease Risk Score**

Table 1.1 shows Kollam, Malappuram and Kozhikkode districts represent high disease risk score ( $>0.5$ ). Medium disease risk score (0.25-0.5) show in Eranakulam, Pathanamthitta, Alappuzha, Idukki, Kasargod, Kottayam, Kozhikode districts. Low disease risk score (0.5) noticed in Wayanad, Thiruvananthapuram, Thrissur, Kannur, Palakkad districts.

#### **Typhoid Disease Risk Score**

Table 1.1 shows high disease risk score ( $<0.5$ ) noticed in Pathanamthitta, Malappuram and Palakkad districts. In Kasargod, Kottayam, Idukki, Kozhikkode, Wayanad, Thiruvananthapuram, Eranakulam, Palakkad districts reported medium disease risk score (0.25-0.5). Low disease risk Score (0.25) observed in Kollam, Alappuzha, Thrissur, Kannur districts.

#### **ADD Disease Risk Score**

Table 1.1 shows the high disease risk score of ADD reported in Thiruvananthapuram Palakkad and Malappuram districts. But Alappuzha, Kottayam, Eranakulam, Kozhikode, Thrissur, Kannur, districts observed medium disease risk score (0.5-0.25). Low disease risk score ( $<0.25$ ) reported Pathanamthitta, Kollam, Idukki, Wayanad, Kasargod districts.

#### **H1N1 Disease Risk Score**

Table 1.1 shows high disease risk not observed in any districts, in the case of H1N1 disease. Some districts like Kollam, Alappuzha, Idukki, Kannur, Eranakulam, Thrissur, Malappuram, Kozhikode, and Thiruvananthapuram noticed medium disease risk score (0.25-0.5). Similarly low disease risk score ( $<0.25$ ) reported in Kasargod, Palakkad, Malappuram, Kannur, and Kozhcode districts.

#### **Hepatitis B Disease Risk Score**

Table 1.1 shows the disease Hepatitis B highly shows in Thiruvananthapuram, Kollam, Pathanamthitta districts. Medium disease risk score (0.25-0.5) reported in Alappuzha, Kottayam, Idukki, Thrissur, Eranakulam, Wayanad districts. Low disease risk score ( $<0.25$ ) observed in Palakkad, Malappuram, Kozhikode, Kannur, Kasargod districts.

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### JE/AES Disease Risk Score

Table 1.1 shows the case of JE/AES high disease risk score (>0.5) noticed in Alappuzha district. Medium disease risk score (0.25-0.5) observed in Malappuram, Kozhikode, Wayanad, Thrissur, Palakkad, Thiruvananthapuram, Kottayam, Kollam, districts. Pathanamthitta, Idukki, Ernakulam, Kannur, Kasargod districts reported low disease risk score (<0.25).

### Cholera Disease Risk Score

Table 1.1 shows high Cholera disease risk score (>0.5) reported in Alappuzha district. Medium disease risk score (0.25-0.5) observed in Malappuram, Thiruvananthapuram, Kottayam, Ernakulam, Palakkad, Kozhikode, Wayanad districts. Kollam, Pathanamthitta, Idukki, Thrissur, Kannur districts. Kasargod districts noticed low disease risk score (<0.25).

### Chikunguniya Disease Risk Score

Table 1.1 shows in the case of Chikunguniya, high disease risk score (>0.5) not observed in any districts. Although Wayanad, Alappuzha, Idukki, Malappuram, Kannur, Thiruvananthapuram, Kasargod, Palakkad, Kozhikode, districts noticed medium disease risk score (0.25-0.5). Pathanamthitta, Kollam, Ernakulam, Thrissur, Kottayam, districts reported low disease risk score (<0.25).

**Table 1.1 Disease vulnerability in Kerala State during 2006-2012**

District	Mal aria	Den gue	Leptos pirosis	Hep atitis A	Typ hoid	A D D	H1 N1	Hep atitis B	JE/ AE S	Cho lera	Chikun guniya	To tal	TD RK S
<b>Thiruvananthapuram</b>	0.24	0.79	0.61	0.12	0.50	0.72	0.54	0.59	0.50	0.33	0.54	5.47	0.50
<b>Kollam</b>	0.21	0.34	0.13	0.94	0.12	0.13	0.27	0.55	0.59	0.05	0.16	3.47	0.32
<b>Pathanamthitta</b>	0.32	0.30	0.08	0.39	0.79	0.09	0.08	0.63	0.11	0.17	0.09	3.05	0.28
<b>Alappuzha</b>	0.28	0.23	0.49	0.31	0.19	0.28	0.31	0.30	0.70	0.64	0.32	4.05	0.37
<b>Kottayam</b>	0.08	0.46	0.55	0.43	0.36	0.37	0.20	0.27	0.43	0.33	0.24	3.72	0.34
<b>Idukki</b>	0.12	0.26	0.31	0.35	0.31	0.16	0.36	0.34	0.11	0.17	0.36	2.86	0.26
<b>Ernakulam</b>	0.36	0.50	0.53	0.27	0.44	0.32	0.45	0.37	0.11	0.45	0.13	3.91	0.36
<b>Thrissur</b>	0.41	0.42	0.44	0.20	0.15	0.48	0.41	0.36	0.39	0.17	0.20	3.62	0.33

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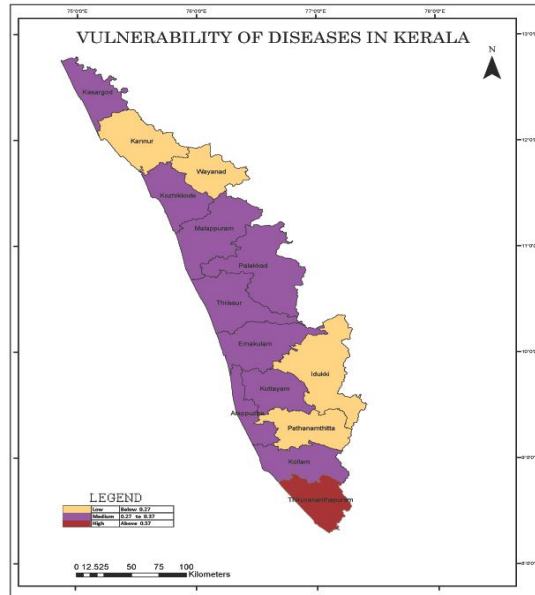
<b>Palakkad</b>	0.17	0.16	0.37	0.23	0.57	0.53	0.12	0.11	0.33	0.50	0.50	3.59	0.33
<b>Malappuram</b>	0.07	0.15	0.24	0.63	0.62	0.58	0.48	0.15	0.25	0.26	0.40	3.83	0.35
<b>Kozhikode</b>	0.43	0.12	0.39	0.58	0.39	0.40	0.45	0.23	0.25	0.41	0.44	4.07	0.37
<b>Wayanad</b>	0.04	0.36	0.35	0.08	0.35	0.20	0.16	0.42	0.25	0.57	0.28	3.06	0.28
<b>Kannur</b>	0.52	0.19	0.20	0.16	0.23	0.43	0.35	0.19	0.11	0.17	0.35	2.90	0.26
<b>Kasargod</b>	0.57	0.38	0.16	0.36	0.27	0.24	0.47	0.08	0.11	0.05	0.58	3.26	0.30

### Total Disease vulnerability (TDRKS) Districts in Kerala State

The State of Kerala is prone to communicable diseases. These are location specific or seasonal phenomena associated with the hygienic character of the State. Table 1.1 and figure 1.2 shows Thiruvananthapuram district identified high disease vulnerability (< 0.50) in Kerala State. In this district noticed high disease risk values. The risk of H1N1, Hepatitis B, Je/AES, Chikunguniya, Leptospirosis, Dengue, Acute diarrheal diseases is high in Thiruvananthapuram district. Medium disease vulnerability identified in the districts of Kozhikkode (0.37) Alappuzha (0.36), Ernakulam (0.35) Malappuram (0.34) Kottayam (0.33) Thrissur (0.32), Palakkad (0.32), Kollam (0.31), Kasargod (0.29), While Low disease risk score occupies in the Idukki (0.25). Kannur (0.26), Wayanad (0.27) and, Pathanamthitta (0.27) districts.



Figure 1.2 vulnerability of disease zone in Kerala State



### Discussion

While considering the vulnerability of disease in Kerala special focus also need to analyse the present condition of the health care facility. The health care system in Kerala comprises mainly under three heads names, Allopathy, Ayurveda, and Homeopathy. The health infrastructure consists of 2724 institutions with 52893 beds. Besides there are 5403 sub enters under Directorate of Health Services. Out of the total institutions 46.44% are under allopathy, 32.2% under Ayurveda and 21.36% under Homeopathy department. Medical services are also provided through the co-operative sector and the private sector. There are 74 hospitals with 6767 beds under the co-operative sector in the State.

Table 1.3 Health Infrastructures in Govt. Sector -2011

Sl. No	System of Medicine	Institutions	Beds
1	Allopathy(DHS)	1255	37750
2	Allopathy(DME)	10	10079
3	Ayurveda(ISM)	874	2860
4	Ayurveda Medical Education	3	1259
5	Homeopathy	582	945
	Total	2724	52893

Source: Allopathy, Medical Education, Ayurveda and Homeo Departments.

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### Density of Allopathy Hospitals in Kerala State

Eranakulam, Thiruvananthapuram, Alappuzha districts constitutes the high density (>4) of allopathic hospitals. Pathanamthitta, Palakkad, Kasargod, Kollam, Kottayam, Thrissur, Malappuram, Kozhikode and Kannur districts shows medium density (2-4) of hospitals. Low density (< 2.) identified in Idukki and Wayanad districts.

### Density of Ayurveda hospitals in Kerala state

High density (> 7) of Ayurveda hospitals identify in Alappuzha district only. Palakkad, Kottayam, Malappuram, Kannur, Kasargod, Kozhikode, Kollam, Eranakulam, Thrissur districts observed medium (7-3.5) density of hospitals. Low density (< 3.5) of Ayurveda hospitals have in Thiruvananthapuram, Idukki, Wayanad, and Pathanamthitta districts.

### Density of Homeopathy Hospitals in Kerala State

Kottayam, Kozhikode, Eranakulam, Alappuzha, districts observed high density (> 4) of hospitals. Medium density (4-2.5) of hospitals identified in Thrissur, Malappuram, Kannur, Kollam, and Kasargod districts. Thiruvananthapuram, Idukki, Palakkad, Wayanad, Pathanamthitta districts shows low (< 2.5) of homeopathic hospitals.

**Figure 1.3 Density of Allopathic ,Ayurveda and homeopathy hospitals in Kerala**

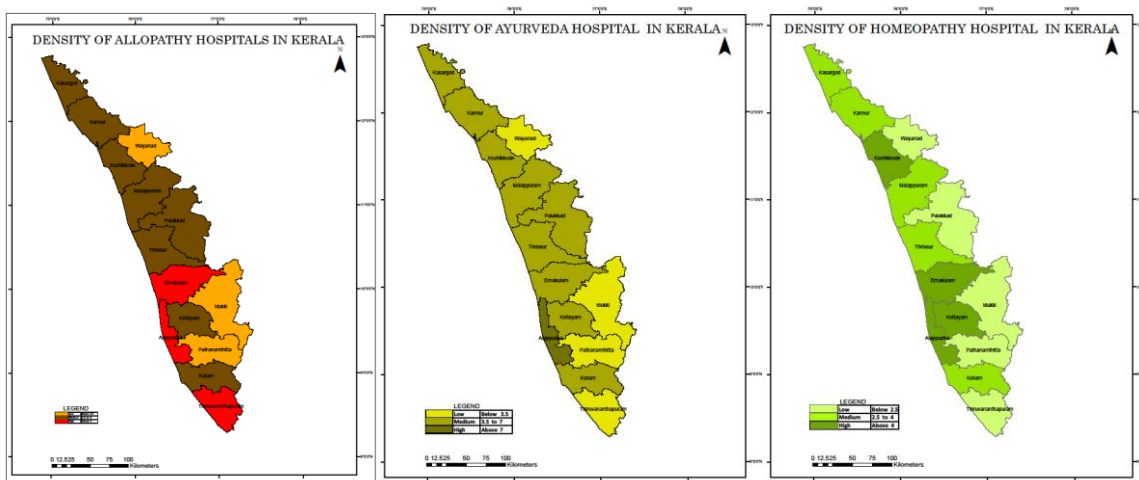






Table 1.2 Kerala: Disease intensity, Vulnerability and Hospital Density

District	Disease Intensity		Disease Vulnerability		Hospital Density					
	Score	Rank	Score	Rank	Allopathy	Rank	Ayurveda	Rank	Homeopathy	Rank
Thiruvananthapuram	4.05	1	0.49	1	5.24	2	1	14	1	14
Kollam	8.22	8	0.31	9	3.41	9	6.23	3	3.45	5
Pathanamthitta	9.55	12	0.27	12	2.42	12	3.4	11	2.04	10
Alappuzha	15.09	14	0.36	3	6.08	1	9.33	1	6.64	1
Kottayam	8.4	9	0.33	6	3.6	6	4.72	6	4.35	3
Idukki	9.59	13	0.25	14	1.2	14	1.47	13	1.47	13
Ernamkulam	5.81	3	0.35	4	4.7	3	6.14	4	4.65	2
Thrissur	8.13	6.5	0.32	7	3.8	4	6.2	2	2.77	7
Palakkad	6.81	5	0.32	8	2.5	11	3.6	10	1.87	12
Malappuram	6.54	4	0.34	5	3.5	8	4.4	8	2.51	8
Kozhikode	5.5	2	0.37	2	3.8	5	5.1	5	4.26	4
Wayanad	8.5	10	0.27	11	1.9	13	2.4	12	1.87	11
Kannur	8.13	6.5	0.26	13	3.5	7	4.5	7	2.89	6
Kasargod	8.77	11	0.29	10	2.8	10	4.11	9	2.51	9

Thiruvananthapuram district has high disease intensity and high disease vulnerability in Kerala. This district has first rank in disease intensity and vulnerability. Although Thiruvananthapuram district noticed second rank in Allopathy hospital facilities. But the Ayurveda and homeopathy hospital facilities are very low in this District. 14<sup>th</sup> rank seen in Ayurveda and homeopathy hospitals. This district identified Acute diarrheal diseases, Dengue fever and Leptospirosis diseases are very high.

Kollam and Pathanamthitta districts identified medium disease in intensity and vulnerability. Alappuzha district noticed low disease intensity. But in the case of disease vulnerability, third position has in this district. While the attractive factories the hospital facilities like allopathy, Ayurveda and homeopathy is very high. All these facilities have first rank in this district. Kottayam and Idukki districts have medium disease intensity and vulnerability. Idukki district have medium hospital facilities. But Kottayam district have allopathy and Ayurveda hospital facilities in medium and homeopathy hospital

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facilities have third position in Kerala. Ernakulam district have high disease intensity and vulnerability. This district has high level of hospital facilities in Allopathy, Ayurveda and homeopathy. Thrissur district identified medium disease intensity and vulnerability. This district has medium allopathy and homeopathy hospital facilities. But the Ayurveda hospital facilities have second rank in this district .Palakkad and Malappuram districts have medium level of disease intensity, vulnerability and hospital facilities. Kozhikkode district have high disease intensity and high disease vulnerability. These two have second rank in this district. But the hospital facilities like Allopathy, Ayurveda and homeopathy hospital facilities have medium. Wayanad, Kannur, Kasargod district have medium disease intensity, vulnerability and hospital facilities

### Conclusion

This paper examined the dimensions of vulnerability of disease occurrence in Kerala, a state in India well known for its social development and implementation of health care policy and facility .Alappuzha district constitute high density of Allopathy, Ayurveda and Homeopathy hospitals. So, this district identified has less disease out break. Idukki, Wayanad and Pathanamthitta districts noticed low vulnerability of disease but here density of Allopathy, Ayurveda and Homeopathy hospitals are comparatively low. The outbreak of the disease is mainly observed in the coastal districts of Kerala .This paper has examined only a few dimensions of vulnerabilities of disease in the fourteen district in Kerala states. Many of these dimensions are worth exploring further and there are many others too. Therefore, to understand vulnerability of disease in a much more comprehensive manner, a multi-institutional and multi-dimensional study needs to reveal the outbreak of the disease.

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**International journal of basic and applied research**

[www.pragatipublication.com](http://www.pragatipublication.com)

ISSN 2249-3352 (P) 2278-0505 (E)

**Cosmos Impact Factor-5.86**

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