INTRODUCTION
Geographical phenomena play a vital role in the distribution of various health conditions or health hazards (diseases) and the study of health hazards in the light of environmental factors in one of the recent additions in the field of systematic geographical researches and is known as Medical Geography. This study represents a new combination of two sciences (Medical and Social) and such a cross fertilization of knowledge will be unique species for the well-being of human societies. Jackques, M. May defined Medical Geography as "the study of the relationship between the pathological factors which have been called 'pathogens' and the geographical factors which we propose to call 'geogens.'"\(^1\)

The International Geographical Union (IGU) constituted a commission on Medical Geography and in its first report discussed at Washington in 1952, defined medical geography as the study of geographical factors concerned with cause and effect of health and diseases. Since then the analysis of health and disease through man's environment relationship has engaged the attention of geographers, and medical geography has emerged as a specific branch of geography.

The various views regarding medical geography are as follows:

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1. Medical geography deals with the distribution of disease and conditions under which it develops.

2. It deals with the effects of natural conditions on the health of the man.

3. The object of medical geography is the study of geographical environment of human societies and its influences on the health of the man.

'Health hazards or diseases' may be defined as a departure from the state of health while 'health' is defined as a "state of complete physical, mental and social well-being and not merely the absence of disease and infirmity".  

It is well known fact that diseases are multiple phenomena and occur only if various factors coincide in time and space. Health hazards are the outcome of maladjustment of the biological processes with the natural phenomena. So the natural and cultural environment in which people live and their dietary habits become the main determinants for the type of disease which they suffer from. In this way the study of diseases in the light of various environmental factors and dietary habits (food consumption) from which they get various nutrients forms the main content of medical geography. Geography could now be included among these disciplines which study human diseases in one form or other. Medical profession though is deeply involved with the remedy of diseases and

health hazards and has not paid due attention to the geographical aspects in the study of various health hazards, particularly those created through the misuse of our environment and after effects of medicine. The environment has always been considered of secondary importance. Thus concentration has been given on the symptoms of the diseases and not on the causes their genesis. On the other hand, as discussed earlier, medical geography seeks to establish the relationship between the health hazards and the environmental conditions. Thus, geographical study of health and diseases can show how they are caused; and can help in nipping these problems in the bud itself. Such geographical studies have been carried out in western countries, but are lacking in India.

Environment provides both opportunity for healthy living for man and conditions responsible for occurrence and spread of diseases. Land including soil cover, water and climatic conditions influence the human habitat to a great extent. They also determine the production of food through agriculture as well as their requirements. Agricultural produces go along in determining the dietary habits and nutrient supply. They are also influenced by the prevailing socio-economic conditions, such as caste, religion, customs, traditions, occupations, income etc. These factors cause variation and provide both opportunity for healthy living for man and living conditions and frequency of health hazards. Further, man is trying to extract maximum benefits from the environment.
In the absence of such researches during the last several decades, no substantial contributions have been made in the field of medical geography of India. However, research in this field has recently been taken up by few scholars. The present study is an humble effort in this direction.

DEVELOPMENT OF MEDICAL GEOGRAPHY

Despite the fact that diseases have been widely studied by the researchers in medicine, very little is known about their geographical distribution. With the movement of the people, disease of various types also move from place to place. The spread of diseases need certain specific environment. A number of articles, letters etc. have been written during fifteenth and sixteenth centuries indicating the relationship of human health hazards and various environmental conditions. During seventeenth and eighteenth centuries further progress has been recorded when a few books were written on medical geography. "Among these Finke a German clinician accumulated a large collection of data in three volumes and named them as Medical Geography." 1

During 19th century medical geography was abandoned but the people were interested to know the germs that caused diseases. It was almost in 1950 that they could know geographical factors are more responsible for germs which cause diseases. Number of publications on

medical geography have been brought out in Germany, the United States of America, United Kingdom and Soviet Socialist Republic which are directly related with the geographical aspects of the health of the people.

Germany published World Atlas of Epidemic Diseases edited by E. Rodenwaldt (1952-56) in three volumes. Dr. May was the first medical geographer who mentioned the work and the American Geographical Society published the Atlas of Diseases in three volumes, i.e.

1. The Ecology of Diseases, 1958
2. Studies in Diseases Ecology, 1961, and

Prof. A.T.A. Learmonth did significant work in this field, he was also the chairman of the standing commission on medical geography of International Geographical Union. Likewise some other foreign writers also worked in this new field in India. McClelland, Macnamara and Chevers attempted to identify the regional factors associated with the prevalence of diseases or geographical factors influencing the occurrence of various diseases.

The modern concept of medical geography in India was laid down in 1930. Capt. A.M.V. Hesterlow was the first researcher who worked on diseases of southern India and related diseases with the environmental factors (1929). The 21st International Geographical Union (IGU) was held in New Delhi in 1968 in which Indian geographers also contributed a few papers on various aspects of medical geography. After IGU Dr. R.P. Mishra (1970) wrote a good reference book on Medical Geography of India. Besides this, several scholars contributed a number of research papers in this emerging branch of geography. Pioneer workers in this field are Dr. Indra Pal, A.K. Tiwari, A. Ramesh, A.B. Mukerji, Rais Akhtar etc. who attempted to study the environmental or communicable/infectious diseases. The work in this emerging field is still in progress in various Indian universities particularly in Agra, Poona, Madras, Calcutta and Sagar.

In 1981, Indian Geographical Society organised a symposium on incidence of infection in chronic diseases at Madras, sponsored by IGU working group of geography of health. Recently Rais Akhtar and A.T.A. Learmonth (1985) edited a good reference book "Geographical Aspects of Health and Diseases in India". Besides this some Indian geographers are also working on various projects related to geography of health.

AIMS AND OBJECTS

The prime object of the present research project is to analyse, on one hand, the relationship between environment
and health hazards, and nutritional status and diseases on the other. It aims at finding out the main causative factors of the living environment which are responsible for the distribution of various environmental health hazards as well as to detect the main deficient nutrients in the diet of the people which may be responsible for various nutritional health hazards. Thus the causative agents of the environment, nutritional status and ill health conditions form the case of the study. The perspectives of this analysis are bio-physical environment, economic attributes of the people and cultural trends of the society. It is presumed that the status of human health depends to a great extent on the quality of living environment as well as the amount and quantity of food one takes. Therefore, the analysis of dietary structure and environmental factors is the pre-requisite of such studies. Nutritional supply depends on biophysical and socio-economic environment. Because of diversity in conditions, these elements are marked areas and marked segments of people who have more than required food, but there are more people and extensive areas which are lacking it. On the other hand, environment of man is the combination of various circumstances in which he lives and the resultant health hazards have a close relation with the environment. Many environmental factors make the atmosphere favourable for the survival of the causative agents of diseases. Epidemiological research in communicable and other diseases usually starts with environmental studies on diseases and their causative agents.
Therefore the main objectives of this research project can, thus be summarised as these:

1. Analysis of occurrence and distribution of diseases.
2. To find out the causative agents of the environment which are responsible for various health hazards.
3. It is hypothesized that most of the diseases are the consequences of improper and insufficient food intake. Therefore it has been thought proper to see the health condition in perspective of the quantity and quality of actual food intake. Effect of socio-economic factors on dietary habits have been also taken into consideration.
4. Lastly, suggestions are to be made for provision of health care facilities in accordance with the necessity of the different parts of the region.

AREA OF THE STUDY

Sagar division of Madhya Pradesh has been selected for the purpose of the present study. This division extends between \(23^\circ 10'\) and \(16^\circ 35'\) North latitudes and \(78^\circ 04'\) and \(80^\circ 36'\) East longitudes; and covers five districts, viz. Sagar, Damoh, Chhatarpur, Panna and Tikamgarh. Total area of this division is 38,428 square kilometers which is about 8.65 per cent of the total area of Madhya Pradesh. In 1981, there were 42,08,208 persons living in 6,770 villages and 32 towns out of total population 82.66 per cent people lived in different size of rural areas. The density of population is 110 persons while sex ratio is 892 females per 1000 males.
The literacy rate of male and female being 35.09 and 12.99 respectively. The highest male and female literacy is reported in Sagar district while Tikamgarh reported the lowest.

There are 137 total medical institutions served by 303 doctors and having 1,440 beds in this division (1984-85). Thus there are 30,717 persons per medical institution in this division as against only 10,314 persons in the State. Similarly, one doctor is supposed to serve 13,888 persons in this area but average for the State is only 10,436. At the same time, there are 2,920 persons per bed in this division.

This division is not only diversified in physical environment but it is socio-economically diversified also. This diversification has its impact on availability and intake of food stuffs as well as on occurrences of diseases. Majority of the working population (70.8 per cent) is engaged in farming, which is dominated by cereals and pulses. About 46 per cent of total cropped area is devoted to different cereals and millets and 27.4 per cent to pulses. These crops are major constituents of the diets of the majority of people. Fruits, vegetables, milk and other livestock products are comparatively used usually less frequently.

Besides local availability and economic status of the people, their cultural beliefs, traditions and customs go along in influencing their consumptional behaviour as well as their way of medical treatment. People of different cultural
communities live in this division. Majority of the population is Hindu (75 per cent) which itself is a collective name of several communities with contrasting customs and traditions. Along with them, Muslims (2.65 per cent), Christians, Sikhs and even Buddhist live in this division. Thus cross community comparison is possible in this division.

SOURCES OF DATA

Disease (Health Hazards) Incidence Cases: The disease incidence data primary health centre wise (PHC) were collected from the offices of the Chief Medical Officers (CMO) of the respective districts for the year 1982, 1983 and 1984. In each PHC all the health intelligence cases were classified according to International classification of diseases. It is a well-known fact that about 50 per cent patients generally go to the respective private hospitals for their treatment. Generally private doctors do not maintain any records of various patients who visit them. Therefore, various private doctors were interviewed on prescribed questionnaire by the scholar himself. Besides above, scholar also tried to collect the information regarding various health hazards during diet/nutritional survey.

NUTRITIONAL DATA: In order to know the nutritional status of the people in both rural and urban areas of the study unit a diet/nutrition survey (family-wise) has been conducted in 22 villages and 9 selected towns (town-wise) through systematic
stratified sampling method. Nine towns were selected on the basis of their various characteristics.

OTHER DATA: In the survey, besides consumption of various food stuffs, food habits, dietary pattern and other influencing causes have been also collected such as purchasing power, drinking water, living and surrounding environmental conditions etc. from various sources and/or through personal observation. The analysis of the dietary questionnaire has been done on the basis of ICMR, New Delhi, NIN, Hyderabad, norms.

Metrological data have been noted from the Regional Meteorological Centre, Nagpur, for the year 1972, 1973, 1974, 1975 and 1976. Population data (density, sex ratio, literacy etc.) have been collected from Census of India, 1981 part II and District Statistics Hand Book of different years. Agriculture data have also been collected from District Statistical Offices and from publications of the State Agriculture Department.

Besides these, the literature had been consulted from the National Institute of Nutrition, Hyderabad, National Environmental Engineering Research Institute, Nagpur (NEERI); the library of Indian Council of Medical Research (ICMR) and National Science Library, New Delhi. Books and journals of Geography, Sociology, Biology, Pharmacy, General Science and Medicine are also consulted for the present study.
PLAN OF THE WORK

The plan of the work is divided into nine chapters which is as follows:

The first chapter titled "Physical Environment" deals with the physiography, climate, geology of soils of the unit while the second chapter "Cultural Environmental Factors" includes population, education, agriculture, industries, housing, family structure, marriage systems. Third chapter deals with various environmental factors which are responsible for the determination of environment. Uncontaminated drinking water, sewage and drainage, solid waste are important factors which pollute our living environment. Fourth chapter includes the main characteristics of foodstuffs containing different nutrient nutrients, nutritive value of foods, nutrients required for different age groups, importance of nutrients and the quantity and quality of foods. Fifth chapter consists of Nutritional Structure of the region. The main components of food, required diet (Balanced diet), importance of diet survey, intake of nutrients in rural and urban places and malnutrition and undernutrition of the area are discussed in this chapter.

Chapter six discusses (in two parts in first part) general concept of diseases such as history of diseases, ecology of diseases, kind of diseases, organ and system of diseases, classification of diseases etc. in the first part
while the other part discusses the diseases of the study region again in two parts (i) Ranking of diseases in rural areas, and (ii) Ranking of diseases in selected urban towns. Intensity of diseases gives a clear picture (Plate No. 9/10) of disease incidence. Their causes are also given in this chapter which are more responsible for the health hazards of the unit.

Chapter seven and eight introduce combinedly the title of the thesis Environmental and Nutritional Deficiency Diseases. Frequency of environmental diseases has been discussed separately. Group-wise diseases with causative agents of the environmental and other respective factors are also put together. Environmental diseases are grouped in nine headings and having the following aspects:

1. Main diseases of the group,
2. Major symptoms of the diseases,
3. Important causes of respective health hazards,
4. Position of PHCs in the group.

Nutritional deficiency hazards are discussed separately in eighth chapter with their distribution. The diseases are correlated with the diet and dietary habits of the people and their status. Various diseases of eye, kwashiorkor goitre etc. are discussed separately primary health centre-wise.

In the last chapter health care facilities of the region are discussed. Besides, various other factors like doctor
population ratio are also considered.

Degree of Originality of the Work: The degree of the originality of the present work up to certain extent depends upon the accuracy of data of various ill-health condition of the area. These data have been recorded by respective hospitals where health hazards are classified according to International classification of diseases. The major delimitation of the study is that in this International classification of diseases the deficiency diseases are not classified according to nutrients wise i.e. vitamin and minerals but are grouped in one class only, so it is not possible to find out the frequency of various deficiency diseases in vitamin wise and/or other important nutrient wise.

During disease survey a problem was faced for private doctors do not maintain any record of the patients who visit them for treatment. So actual frequency of various health hazards is not worked out.