CHAPTER I

CHAPTER I

INTRODUCTION

1.1. PRELUDE

The effects of environment on human biological traits have been well recognized. Every change in ecology involves complex interaction between various components of an environment to that of a human body. The both environment and the physical elements of an individual interact with each other and determines the deep impact they make on the organism. Along with the genetic control the other most important factor affecting human body and its organs are extremes of environment, temperature, nutrition and altitude.

Between 20 to 30 million people of the world live permanently at elevations of 3,000 meters or higher and are exposed to a harsh environment, referred to as "high altitude" (Gupta et al.,1989). Men have been familiar since long with the fact that the conditions of life are usually harder and breathing is more difficult in high altitude areas than in the low altitude ones. High altitude is used to mean elevations of 3,000 meters

or higher. Exposures to high altitude provide some of the clearest evidence for the influence of environmental stress on human blood pressure. Because there is no adequate technological solution for reduced oxygen pressure, technical and behavioral adaptive strategies offer less protection than for other climatic stress (Gupta et al., 1989).

Altitude effects are generally notice when an individual reaches a level above 3,000 meters (Gupta et al., 1989). There one experiences mountain sickness which is termed as hypoxia, a clinical syndrome of severe lack of oxygen. Complication of hypoxia includes fatigue, dizziness, breathlessness, headaches, nausea, vomiting, body pain, loss of appetite and ear-ringing. The atmospheric pressure declines with increasing altitude and the partial pressure of oxygen declines correspondingly causing hypoxia (Gupta et al., 1989). The exposure to solar radiation also increases as the altitude increases. Excessive UV exposure results in a number of chronic skin changes. The other functional adaptation to high altitude can also be seen in lung volume, cardiovascular traits such as pulmonary circulation, heart, blood pressure. Apart from this growth potential of an individual also have equal outcome of environmental factors.

The scientific study of high altitude biology dates back to the invention of balloon in1783. Paul Bert, with the publication of his magnum opus in 1878, established

high altitude physiology as a discipline. The next phase of high altitude research comprised a series of expeditions to the high mountains of the Alps, Andes, Rocky and the Himalayas (Gupta et al., 1989).

Respiratory Function:

The human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon dioxide (Zimmermanna, 2014). Every tissue in the human body requires oxygen to function. The lung serves a vital role in the transfer of oxygen from the air to the blood. Red blood cells collect the oxygen from the lungs and carry it to the other parts of the body where it is needed, according to the American Lung Association. The respiratory system which includes air passages, pulmonary vessels, the lungs and breathing muscles aids the body in the exchange of gases between the air and blood and cells. The lung intake of oxygen and removal of carbon dioxide is called gas exchange (Zimmermanna, 2014). Breathing, the vital function of life is possible only through this gas exchange.

Parts of the respiratory system:

- Sinuses: While breathing oxygen enters the nose or mouth and passes through the sinuses. It helps to regulate the temperature and humidity of the air which one breath.

- Trachea: Trachea or the windpipe filters the air that is inhaled.
- Bronchial Tubes: It leads to the lobes of the lungs and it is where the exchange of oxygen and carbon dioxide occurs.
- Diaphragm: The diaphragm is a dome shaped muscle located below the lungs. It separates the chest cavity from the abdominal cavity. It is the muscle used for breathing.

Disease related to respiratory system:

While both environmental factors and genetical factors can also be the other reason for developing respiratory problems. The following problems are some of the common respiratory issues.

- Asthma: Triggers for asthma includes cleaning products, allergies, fumes, cigarette smoke, cold air, medications, chemicals and more.
- Chronic Obstructive Pulmonary disease (COPD): It is caused by emphysema, chronic bronchitis and chronic asthma. This can be caused by both environmental and genetical factors.
- Lung Cancer: It is an overgrowth of abnormal cells.
- Pneumonia: It is an infection in the lungs
- Bronchitis: An infection in the bronchial tubes

- Tuberculosis: It gradually destroys the lungs and other parts of the body.

Apart from the internal and genetical factor, environmental factor has been a direct or indirect cause for change in the human body. Environmental factors must be taken into account when considering human responses to high altitude stress. The various adaptive mechanism triggered by exposure to high altitude are directed toward increasing the availability of oxygen and the pressure of oxygen at the tissue level (Frisancho, 1979). The lung is the first interface between oxygen in the environment and the metabolic machinery of the body. At high altitude, respiration extracts utilizes a high proportion of the overall energy expenditure. Delivery of oxygen is further impaired by a diffusion limitation of oxygen from the air to the blood, which increases with altitude (Schoene, 2001).

Blood pressure:

Worldwide hypertension is found to be a serious cause of premature heart disease, kidney disease and stroke. Blood pressure is the force of the blood against the walls of the blood vessels- the arteries and veins in the body. This pressure helps the blood to circulate in the whole body through the blood vessels. The heart is the principal pumping station that forces the blood through the blood vessels. It pumps around 40,000 liters of blood per day. The force of the pressure of the blood against the wall

determines the blood pressure level of an individual. Blood pressure changes in relation to a person's activity and stress level. High blood pressure or hypertension is one of the most common conditions affecting the adult population. The risk of heart disease and stroke has been found to be related directly to elevated blood pressure levels. Studies say that a hypertensive person is six times more likely to have a heart attack than an individual with normal blood pressure.

Hypertension is a serious health hazard but unfortunately it is often ignored or misunderstood. While western countries have shown remarkable success in reducing the rate of heart disease and stroke-the two most serious complications of uncontrolled hypertension, India still continues to have a much bigger problem with detection and proper control of hypertension. Lack of knowledge and awareness, lack of resources, poor availability of medical facilities and medication, illiteracy and poverty are some of the factors associated with poor results (Gupta, 2008). The complication of hypertension occurs mainly in the form of coronary heart disease and heart attacks, congestive heart failure strokes and kidney failure, all of which contributes to premature death.

Facts to know about blood pressure:

- **Blood pressure as a silent killer:**

The rise in blood pressure hardly shows any visible symptoms for which doctors call it a silent killer. Still now there are thousands of people unless they are affected by other serious disease rushed to the hospital face certain problems associated with untreated hypertension.

- **Blood Pressure as a lifestyle disease:**

Likewise diabetics, hypertension has also been termed as a lifestyle disease. Blood pressure level has much to do with heavy diet, exercise habits, alcohol consumption, smoking, cholesterol elevation and obesity. Lack of physical exercise, high salt intake and an imbalance diet are some of the other reason contributing towards hypertension.

- **Blood Pressure as a risk factor of heart attack:**

Hypertension is always considered as one of the three major risk factor of heart attack. If hypertension is well controlled than there is a less chance of premature death caused by it. Although there is no such measure to cure hypertension, but a little change in lifestyle and some pills can brought blood pressure level under complete control.

Blood pressure has always been discussed with two different numbers- systolic blood pressure or the upper number and diastolic blood pressure or the lower number.

1. Systolic blood pressure:

When the large pumping chamber of the heart i.e. the left ventricle contracts a jet of blood is forced into the large arteries. The blood flows through the arteries as a 'pulse' and this cause an increase in the blood pressure already in the artery. This increase in pressure is called the systolic blood pressure or systole.

2. Diastolic blood pressure:

Diastolic pressure is the minimum arterial pressure during relaxation and expansion of the ventricles of the heart when the ventricles fill with blood. During this resting period the pressure of blood is the lowest in the arteries and this pressure is called the diastolic blood pressure or the diastole.

These two numbers systolic and diastolic, constitutes the blood pressure reading in millimeters of mercury (mmHg). For instance if an individual have blood pressure of 120/80 mmHg, the 120 mmHg is considered as systolic number whereas the 80 mmHg is considered as diastolic number.

Classification:

Based upon the two numbers- systolic and diastolic, the Joint National Committee's Eight Report (2015) has distinguished four categories:

1. Normal
2. Pre-hypertension
3. Stage I Hypertension
4. Stage II Hypertension

Certain risk factors associated with blood pressure:

No definite cause is responsible for the rise of blood pressure level. Most of the experts believe that hypertension is due to a number of different underlying causes and here heredity plays an important role. Apart from heredity such causes like tension and stress, environment and personality, high salt diet, food habits and a tendency to overweight can be considered as the risk factor behind hypertension.

- **Heredity:**

Like the other genetic diseases, hypertension has lots to do with the genes. Several genetic factors are probably responsible for the development of hypertension in children of hypertensive parents (Gupta, 2008). Biological children

of hypertensive parents are noted to have higher blood pressure readings in increasing numbers.

- **Stress:**

Stress has always been a reason for many disease including hypertension and heart disease. Many studies have concluded that people with high stress job suffers from hypertension far more frequently. A peaceful environment and a strong family bonding reduce the stress level resulting in a balance health condition. In recent years yoga and meditation have been adopted as a way of life by millions across the world to get rid of the stress level.

- **Obesity:**

Obesity is often an insidious problem causing many serious diseases. It is on the rise in the most prosperous societies around the world. Dr. Kannel (1967) and his colleagues reported from the Framingham Heart Study that with every 5 kg of weight gain, there is a rise in systolic blood pressure of approximately 4.5 mmHg. Obesity has always been a reason to increase the blood pressure level in almost all socioeconomic groups, both in men as well as in women. It starts most commonly in the late 20's or early 30's. Since hypertension is more prevalent in obese than in non-obese individual, hence people must regularly check their body weight starting

at a much earlier age. Along with hypertension obesity has always been a reason for several other diseases as diabetes mellitus, high cholesterol, coronary heart disease, strokes and likewise. A well balanced diet with low calorie intake and regular exercise can definitely help an individual to overcome obese.

- **High salt intake:**

The risk of developing hypertension is much is salt intake is high. Population studies in different countries with varying amounts of salt intake have suggested that people with high salt consumption are likely to have higher blood pressure readings (Gupta, 2008).

- **Tea and Coffee:**

The contents of caffeine in tea and coffee can slightly increase the blood pressure. Excessive intake of the both results in rise by 3-10 mmHg.

- **Alcohol and smoking:**

Too much consumption of alcohol can raise blood pressure to an unhealthy level. It can have a serious long term effect on blood pressure. Smoking has a harmful effect on blood pressure. The chemicals present in it cause constriction of

the blood vessels and in a few minutes raise blood pressure. It is not only a risk factor of hypertension, but also a deadly risk of heart disease and lung cancer.

Nutritional status:

Nutrition has been a major health issue all over the world. The world is now experiencing dual burden of both over nutrition and under nutrition. A major factor of the increasing prevalence of cardiovascular disease in developing countries is the on-going nutritional transition with progressive shifts to a westernized diet high in saturated fats and sugar, and a more sedentary lifestyle (Popkin 2002).Rao (2001) in his studies stated that the Indian population is passing through a nutritional transition and is expected to witness higher prevalence of adult non-communicable disease. India, in recent past, has made a considerable progress in social and economic fronts but improvement in nutritional status especially of the women is found to be lagging behind (Ghosh et al., 2009). A good nutritional status means that one have a healthy body composition without physical signs of nutrient deficiency; the blood work indicates the adequate protein stores and all other levels are in balance; and have access to regular balanced meals that one can eat without issue. Maintaining a healthy weight, a balanced diet and taking into any special diet considerations into account all ensure an ideal nutritional status.

India is a diversified country with a number of people living in both urban and rural areas. National Family Health Survey-3(2005-06) brought out data on health and nutritional indicators and provides a clear picture of the status of tribal women. According to NFHS-3, 46.6% of tribal women had Body Mass Index (BMI) below18.5, indicating Chronic Energy Deficiency (Kumar et al., 2010). Lots of research studies on tribal population of India are done from time to time. Those studies revealed that prevalence of Chronic Energy Deficiency was high among tribal population.

Nutritional assessments are the interpretation of anthropometric, biochemical (laboratory), clinical and dietary data to determine whether a person or groups of people are well nourished or malnourished (over-nourished or under-nourished).Nutrition is assessed by two types of methods; direct and indirect. The direct method deals with the individual and measure objective criteria, while indirect methods use community health indices that reflect nutritional influences.

Direct Methods of Nutritional Assessment

By direct method nutritional assessment can be done using the ABCD methods. These refer to the following:

A. Anthropometry

B. Biochemical/biophysical methods

C. Clinical methods

D. Dietary methods.

Indirect Methods of Nutritional Assessment include three categories:

- Ecological variables including crop production
- Economic factors e.g. per capita income, population density & social habits
- Vital health statistics particularly infant & under 5 mortality & fertility index

The word anthropometry comes from two words: *Anthropos* means 'human' and *metry* means 'measurement'. Anthropometric values are closely related to nutrition, genetic makeup, environmental characteristics, social and cultural conditions, lifestyle, functional status and health. Anthropometric evaluation is an essential feature of geriatric nutritional evaluation for determining malnutrition, being overweight, obesity, muscular mass loss, fat mass gain and adipose tissue redistribution (Villareal et al., 2005). Anthropometry or the science of the measurements of the human body has been the longest used measure of human variation (Ulijazek and Komlos, 2010).

The change in the body composition that occurs in the human body in the whole life span of an individual are reflected in anthropometric measures. Measurement of human body is an essential part of nutritional studies. Consequently, different

anthropometric indicators are used at different life stages to evaluate the nutritional status.

1.2. IMPORTANCE OF THE PRESENT STUDY

Blood pressure and respiratory disease are a growing problem all over the globe because of its high prevalence and its association with increased risk of health risk diseases. It is growing concern day by day. So also nutritional status is a sensitive indicator of health status. The Indian population is passing through a nutritional transition and is expected to witness higher prevalence of adult non-communicable disease (Rao, 2001). Very few studies are made among the Tawang Monpas of Arunachal Pradesh. Hence the study has been made to highlight the parameters of respiratory function, blood pressure and nutritional status of the high altitude Tawang Monpas.

1.3. OBJECTIVES OF THE STUDY

1) To determine respiratory function in the group

2) To determine the level of blood pressure in the group

3) To determine nutritional status in the group

4) To find out the correlation between respiratory and anthropometric characteristics

5) To find out the correlation between blood pressure and nutritional status.

1.4. MATERIALS AND METHODS:

The present research proposes to study the effects of altitude in respect of respiratory function, blood pressure and nutritional status among the Monpas residing in the high elevation of approx. 10,000 feet above sea level in the Tawang district of Arunachal Pradesh. Purposive sampling technique has been used and also house to house survey has been done to collect the data. Altogether 500 household have been taken into concern.

For Pulmonary Function Tests:

Pulmonary function tests were carried out with the help of Helios 702 Spirometer (manufacturer: Recorders and Medicare Systems P Ltd.). To collect necessary data 239 males and 215 females were selected in the age group of 18-82 years. Before conducting the tests the subjects were asked whether they have any respiratory problems or not. Subjects with any kind of respiratory problems were excluded from pulmonary function tests. Tests were carried out in morning in post absorptive phase. Readings were taken in standing position. Age, height and body weight were recorded in years, centimeters and kilograms respectively.

To find out the respiratory functions the following measurements on lung functions were recorded using Helios 702 Spirometer:

1. Forced Vital Capacity (FVC),

2. Forced Expiratory Volume for one second (FEV 1.0) and

3. FEV1/FVC

1. Forced Vital Capacity (FVC):

Forced Vital Capacity is the amount of air which can be forcibly exhaled from the lungs after taking the deepest breath possible. FVC is used to determine both the presence and severity of lung disease. It is measured in a test known as spirometry a type of pulmonary function test. In spirometry testing, a mask is placed over the face. Measurements are taken as one breathe in and then breathe out (exhale) as forcefully as possible. It begins with the person taking as deep a breathe as possible and then exhaling as forcibly for as long as possible.

2. Forced Expiratory Volume for one second (FEV 1.0):

Forced Expiratory Volume for One Second measures the total amount of air that can be forcibly exhaled in the first second of the FVC test. Healthy people generally expel around 75% to 85% in the first second of the test. The FEV1 is

decreased in obstructive lung disease; to minimal decreased in restrictive lung disease.

3. FEV1/FVC:

The FEV1/FVC ratio is a calculated ratio used in the diagnosis of obstructive and restrictive lung disease. It represents the proportion of a person's vital capacity that they are able to expire in the first second of forced expiration (FEV1) to the full Forced vital Capacity (FVC). The result of this ratio is expressed as FEV1/FVC%. According to American Thoracic Society the chart for percentage of predicted FEV1/FVC% value:

Table 1: Classification of FEV1/FVC

Percentage of Predicted FEV1/FVC Value	Results
≥80%	Normal
70%-79%	Mildly Abnormal
60%-69%	Moderately Abnormal
50%-59%	Moderate To Severely Abnormal
35%-49%	Severely Abnormal
≤35%	Very Severely Abnormal

Source: American Thoracic Society

For Blood pressure measurement:

For counting blood pressure altogether 524 individual are taken into concern of which 267 are adult males and rest 257 are adult female individuals of Tawang. As the study is made on the adults of Tawang the age group varies from 18-76 years of age in males and 18-70 years of age in the female category. Blood pressure is measured by using an inflatable device named as Sphygmomanometer. It consists of an inflatable arm cuff attached to an air pump and a column of mercury. The rubber cuff is wrapped around the upper arm (mostly in the left arm) tight enough to temporarily stop the blood from passing through the brachial artery. Now a stethoscope is positions over the brachial artery just below the cuff. Air is pumped into the cuff until the pressure stops the blood flow through the artery. Once the pressure in the rubber cuff starts dropping, a sound becomes audible through the stethoscope and the number on the mercury column at this point becomes the systolic blood pressure. After some seconds gradually the sound disappears altogether as the pressure is released from the cuff giving a sound in the stethoscope this gives the diastolic blood pressure. Hence if an individual have blood pressure counting of 120/80 mmHg the 120 unit is measured as the systolic blood pressure and the unit 80 is measured as the diastolic blood pressure level.

According to Joint National Committee-8 (2015) if the systolic blood pressure and diastolic blood pressure values fall into different categories, the overall classification is determined based on the higher of the two blood pressures. Pre-hypertension is not considered a disease, but identifies those who are likely to progress to Stage I or Stage II Hypertension in the future (JNC-8). Following is the chart of different stages of blood pressure level based upon the classification of JNC-8:

Table I.1: Classification of blood pressure

Classification	Systolic Blood Pressure (mmHg)	Diastolic Blood Pressure (mmHg)
Normal	<120	<80
Prehypertension	120-139	80-89
Stage I Hypertension	140-159	90-99
Stage II Hypertension	≥160	≥100

Source: Joint National Committee, 2015

For nutritional status:

For evaluating nutritional status altogether 524 individual are taken into concern of which 267 are adult males and rest 257 are adult female individuals of Tawang (same data of blood pressure measurement). Nutritional status will be found out with the help following anthropometric measurements-

(1) Height Vertex: The vertical distance between the vertex and the floor. It is measured in centimeters. Instrument used: Anthropometer.

(2) Body Weight: The body weight of the subject concern in kilogram (kg). It is measured by weighing machine.

(3) Waist Circumference: It is measured by putting the tape around the waist in horizontal position. It is measured in centimeters. Instrument used: Tape

(4) Hip Circumference: It is measured by putting the tape around the bulging part of hip in horizontal position. It is measured in centimeters. Instrument used: Tape

Parameters taken for nutritional studies are:

1. Body Mass Index (BMI):

Body Mass Index is considered as one of the best variables for the anthropometric measurements in nutritional studies. BMI is the simplest acceptable tool for determining relative body fatness in both clinical and epidemiological studies and was recommended as universal criterion of overweight and obesity (Prentice and Jebb, 2001; World Health Organization, 2014). It usually defines body fatness as an index of weight relative to height and is generally considered a valid index of adiposity (Gundogdu, 2008).

Overweight and obesity represents a rapidly growing threat to the healthy populations in a worldwide scenario. The formula of BMI is:

$$BMI = \frac{\text{Weight in Kilograms}}{\text{Height in meters}^2}$$

According to World Health Organization for Asian adults classification of BMI chart is as given below:

Table I.2: Classification of BMI

Categories of Classification	BMI (kg/m²)	Risk Factors
Underweight	<18.5	Low
Normal	18.5-22.9	Average
Overweight	23-24.9	Increased
Obese I	25.29.9	Moderate
Obese II	≥30	Severe

Source: WHO, 2000b

2. Waist Circumference:

Waist circumference is an essential predictor to calculate body fat in adult population of all ages. It is strongly associated with health related issues especially with obesity related diseases. The cut off points of waist circumference for South Asians according to WHO:

Table I.3: Classification of Waist Circumference

Health risk	For Male	For Female
Abdominal Obesity	≥90	≥80

Source: WHO, 2011b

3. Waist to Hip Ratio (WHR):

Waist to Hip Ratio is other important parameters to evaluate the body fat. The WHR has been used as an indicator or measure of health, and the risk of developing serious conditions. Waist to Hip Ratio is the dimensional ratio of the circumference of the waist to that of the hips. It is calculated as waist circumference divided by hip circumference. The formula of WHR is as given below:

$$\text{WHR} = \frac{\text{Waist Circumference}}{\text{Hip Circumference}}$$

WHR is an easy and accurate way to measure the body fat. It can also help to predict the risk for heart disease and diabetes. According to World Health Organization the WHR chart for both male and female are as given below-

Table I.4: Classification of WHR

Health risk	Category for Male	Category for Female
Abdominal Obesity	>0.90	>0.85

Source: WHO, 2011b

4. Waist to height ratio (WHtR):

Waist to height ratio is an essential parameter to calculate the prevalence of central obesity in the body. It is measured to find out the distribution of body fat. Higher values of WHtR indicate higher risk of obesity related cardiovascular diseases; it is correlated with abdominal obesity (Lee et al., 2008). WHtR is receiving increasing attention as a measure of abdominal obesity in children and adolescent that is linked to obesity related cardiovascular risk in adulthood (Gruson et al., 2010). It is calculated as waist circumference divided by height measurement. The formula of WHtR is as given below:

$$\text{WHtR} = \frac{\text{Waist Circumference}}{\text{Hip Circumference}}$$

Table I.5: Classification of WHtR

Health Risk	Category for Male	Category for Female
Abdominal Obesity	>0.50	>0.50

5. Conicity Index:

Conicity index is another very reliable parameter to measure abdominal obesity. In 1991, Rodolfo Valdez proposed the conicity index to assess obesity and body fat distribution (Valdez 1991). The index includes the measurement of weight, height and waist circumference. The formula of conicity index is:

$$CI = \frac{\text{Waist circumference (m)}}{0.109 \times \sqrt{\frac{\text{Weight (kg)}}{\text{Height (m)}}}}$$

Conicity index was classified on the basis of four quartiles-

Table I.6: Classification of Conicity Index

Classification	Male	Female
1st Quartile	<1.15	<1.19
2nd Quartile	≥1.15 but <1.21	≥1.19 but <1.27
3rd Quartile	≥1.21 but <1.26	≥1.27 but <1.32
4th Quartile	≥1.26	≥1.32

1.5. CULTURAL GROUP AND THE STUDY AREA

India is composed of twenty nine (29) states and seven (7) union territories. Of the twenty nine (29) states Arunachal Pradesh occupies the most north-eastern position among the other states of India. Arunachal Pradesh, the land of the dawn possess a total population of 13, 82,611(Census of India, 2011). The state nourishes different people in its hilly terrains. It is the home of twenty six major tribes and 110 sub tribes and minor tribes. According to the Census of India 2011 the Scheduled Tribe (ST) population constitutes 68.8% of the total population and rest belongs to the other categories (non-APST). The state is one of the linguistically richest regions. There are about as many as 50 distinct languages in addition to innumerable dialects and sub-dialects. There are 16 districts in the state.

Table I.7: Population and density of Arunachal Pradesh according to 2011 census

District	District Headquarter	Area in Sq Km	Population		
			Person	Male	Female
Tawang	Tawng	2,172	49,977	29,151	20,826
West Kameng	Bomdila	7,422	87,013	49,568	37,445
East Kameng	Seppa	4,134	78,413	38,974	39,439
Papum-Pare	Itanagar	2,875	1,76385	90,447	85,938
Lower Subansiri	Ziro	10,135	82,839	41,935	40,904
Upper Subansiri	Daporijo	7,032	83,205	41,974	41,231
West Siang	Along	8,325	1,12,272	58,589	53,683
East Siang	Pasighat	4,005	99,019	50,467	48,552
Upper Siang	Yingkiong	6,188	35,289	18,657	16,632
Upper Dibang Valley	Anini	13,029	7,984	4,396	3,552
Lower Dibang Valley	Roing	3,900	53,986	28,127	25,859
Lohit	Tezu	11,402	1,45,538	76,544	68,994
Changlang	Changlang	4,662	1,47,951	77,289	70,662
Tirap	Khonsa	2,362	1,11,997	57,992	54,005
Krung-Krungmey	Koloriang	6,340	89,717	44,226	45,491
Anjaw	Hawai	8,600	21,089	11,686	9,403
Total		83,743	13,82,611	7,20232	6,62,379

Source: Economic and statistics Department, Itanagar, Arunachal Pradesh

1.5.1 The people:

Monpas are a major tribe of Arunachal Pradesh. The tribe is one of the most populous tribes of the state and is considered as one of the major tribal communities in the entire region. Monpas inhabits the high altitude region so also the mountainous region of Bomdila in West Kameng district. Tawang is a centre place for most of the Monpa tribes. The Monpa tribe is subdivided into six (6) subgroups depending on the variation of their inhabitance -(a) Tawang Monpa (b) Dirang Monpa (c) Lish Monpa (d) Bhut Monpa (e) Kalaktang Monpa (f) Panchen Monpa.

The Tawang Monpas belong to the Mongoloid stock. They have a well-built body structure with fair complexion. The people of this tribe are generally courteous, friendly, gentle and industrious. Dr.Verrier Elwin's description of the Monpas as; *"Gentle, friendly, courteous, industrious, good to animals, good to children, you see in the Monpas the influence of the compassionate Lord Buddha on the ordinary man".*

1.5.1.A. Geographical location and demographic profile:

Tawang, the Land of Dawnlit Mountains is situated in the Tibetic region. In the eastern border of Tawang district, it is bounded by West Kameng district. In the western boundary it shares its border with Bhutan whereas Tibet in the northern side. The district is a continuous chain of hills and mountains of the great Himalayan range and it

occupies an area of 2,085 square kilometers. It is situated at the elevation of approximately 3,048meters (10,000 ft). The highest mountain peak in the district is known as Gourichen which is approximately 22,500 feet above sea level (Census of India, 2011). The sky kissing Gourichen and her sister mountains are filled with white snow whole winter. The name Tawang is believed to have derived its name from the Tawang Monastery. The Tibetic area of Arunachal Pradesh comprises the Monpa tribes.

Tawang Monpa inhabits the hilly terrain of Tawang district. Tawang Monpa is one of the subgroups of the Monpa tribe. The Monpa tribe of Arunachal Pradesh lives in different altitude of the state, who follows Buddhist religion and professes Mahayana Buddhism. The Tawang Monpas call themselves Brahmi Monpa, who differ from rest of the Monpas with regard to their language and culture.

1.5.1.B. Demography:

According to the Census of India, 2011 Tawang had a population of 49,977 of which male and female were 29,151 and 20,826 respectively and 3.61 percent of the state population spread over 2172 sq km of the district (Census of India, 2011). The district has a density of 23 persons per sq. km and the sex ratio is 714 females per 1000 males. The literacy rate is 59 percent and work participation rate is 57.1 percent.

Tawang the district headquarter which is the only town in the district has a population of 11,202 persons as per 2011 Census and falls under Class IV towns classifies by population size.

1.5.1.C. Religion:

The Monpas are Buddhist by religion and the Tawang Monastery which is the Asia's second largest Monastery is considered as the fountain head of their spiritual life. Monastery plays a vital role in their day to day life. Monpas follow Tibetan Buddhism which they adopted in the 17th century. It is seen that in every household small Buddhist altars are offered with a burning butter lamp and are given water offerings in little cups.

1.5.1.D. Language:

They belong to the Tibeto-Burman family of languages. The Monpas speak Tshangla, which is also understood by the Bhutanese and Tibetans as they share similar origin. According to Blench (2014), five groups may be distinguished:

- The Sherdukpen, Lish, and Sartang languages show no obvious relationship to other languages of the region and they comprise a small language isolate cluster.
- The Tawang language is an East Bodish language, and is a variety of Dakpa.

- The languages of the Zemithang, Mago and Thingbu villages are additional East Bodish varieties that are not intelligible with Tawang.
- The Tshangla language comprises closely related dialects spoken in the villages of Senge, Nyukmadung and Lubrang .

1.5.1.E. Occupation:

Agriculture is the main source of livelihood of the Tawang Monpas. More than 70% of the population is engaged in agriculture and its allied cultivation of food crops, commercial crops, rearing of yak, sheep, goat, etc. Butter and churpy (local cheese) are the products of yak and are exchanged with food grains through 'Barter System' (Census of India, 2011). The agricultural practices include terrace cultivation and also shifting cultivation. With the passage of time apart from cultivation the tribe has engaged themselves in various other professions like many are practicing office employees, doctors, engineers, banking, business and other such non-agricultural services.

1.5.1.F. Culture:

TheTawang Monpas are highly influenced by the Tibetans and the Buddhist way of life. With a number of monasteries (Gompas), Tawang has a serene and mesmerizing ambience. The tribe is known for their artistic creations including beautiful Thangka

painting, carpet making, weaving and wood carving. The Monpa occupies a prominent place in this art and they carve magnificent masks for ceremonial dances. They depend on the nature for various products. They manufactured paper from the local Sukso tree. There is a printing press in the Tawang Monastery where they used to print religious books on those papers and wooden blocks. They are also known for making wooden bowls and bamboo weaving.

1.5.1.G. Festivals:

Monpas are known for their colourful festival. The native of Tawang celebrates three main festivals namely, Torgya, Losar and Choskar harvest. They celebrate Losar as a new year festival is perhaps the most important festival of the tribe which they organize with full gaiety. It falls in the late February or early part of March and is continues to 8-15 days. The significance of Choskar festival is associated with harvesting of crops for better cultivation and the prosperity of the villagers and also to protect the grains from insects and wild animals. The Yak and the lion dance are the most famous dances of the Monpa tribe. The dancer used to wear a heavy mask on their head. The mask is double the size of a human head. In yak dance the masked man represent the member of the family who was believed to be the discoverer of Yak with the help of a magical bird. According to the natives traditionally the lion dance signifies

that prosperity of a region depends on the relationship and co-operation among all living beings on this earth. Hence the native continues to keep their cultural and religious heritage intact today.

1.5.1.H. Administrative Status:

Presently, the administration of Tawang district is divided into three subdivisions: Tawang, Lumla and Jang. Tawang sub-division is divided into two administrative circles: Tawang and Kitpi. Lumla sub-division is divided into three administrative circles: Dudunghar, Lumla and Zemithang. Jang sub-division is divided into five administrative circles: Jang, Mukto, Bongkhar, Thingbu and Lhou.

1.5.1.I: Dress:

The Tawang Monpas have their own unique attire. Their traditional attire is so well designed that it suits to the chilling climatic condition of Tawang. They both wear a head-wear made of yak hair (*Ngama-shom*), with long tassels. The males wear a short woolen trouser called as *Kangnom* and a full length woolen trouser called *Dhorna* with a shirt over it known as Toh-thung.It is covered by a black woolen coat called *Ali-phudhung* or *Khanjar.* On the contrary women wear a sleeveless gown of light red in colour with white stripes in it (*Shingka*) which is made of endi silk. On the top of it an endi silk shirt which is lavishly embroidered is worn (*Kyanchen*).

1.5.1.J. House pattern:

For extreme cold, the natives construct their houses with stone and wood with plank floors. The doors and windows are beautifully carved with various designs in it. These patterns of houses keep their interiors warm during the winter season.

1.5.1.K. Food habits:

The Tawang Monpas follow a very heavy and nutritious diet. They are usually non-vegetarian. They eat chicken, beef, pork, mutton and the meat of fowl and yak. They are very much fond of milk products like churpi, ghee and butter. The fruits consumed are oranges, peaches, pomegranates, apples and sugarcane.The Monpas are quite fond of spicy food and so chilies are used extensively in their preparations. *Chamin* (local chutney), the grinding of chilies with fermented cheese is very much appreciated by the natives. The use of fermented cheese as a key ingredient in almost all of their traditional preparation is widely practice in every household. They used to take butter tea in which they used to mix yak butter and salt to the tea. They believe that this cup of hot butter tea used to keep them warm in the chilling cold.

1.6. STATISTICAL CONSIDERATION

In order to interpret the data adequately the following statistical measures are incorporated.

Mean:

Mean is the central value of a distribution. Simple or arithmetic average of a range of values or quantities, computed by dividing the total of all values $\bar{x}$ by the number of values. It is calculated by the following formula:

$$\text{Mean } \bar{x} = \frac{\sum x}{n}$$

where $\bar{x}$= Mean Value

$\sum x$=Total of all Values

n = Total number of observation

Standard Deviation (S.D):

Standard Deviation is a measure of the extent to which individual items vary. It is a quantity expressing by how much the members of a group differ from the mean value of the group. It is calculated by the formula-

$$\text{Standard Deviation (S.D)} = \delta = \frac{\sum(x-\bar{x})^2}{n-1}$$

Where $\bar{x}$= is the mean, x is the individual observation and 'n' is the total number of observation.

Pearson Correlation Coefficient:

The Pearson Correlation Coefficient is a very helpful statistical formula that measures the strength between variables and relationships. In the field of statistics, this formula is often referred to as the Pearson R test between two variables. It distinguishes to determine just how strong that relationship is between those two variables. The coefficient value can range between -1.00 and 1.00. If the coefficient value is in negative range, then that means the relationship between the two variables is negatively correlated. If the value is in the positive range, then that means the relationship between the two variables is positively correlated. The formula to find out Pearson Correlation

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[\,n\sum x^2 - (\sum x)^2\,]\,[\,n\sum y^2 - (\sum y)^2\,]}}$$

Where:

n = number of pairs of scores

$\sum xy$ =sum of the products of paired scores

$\sum x$ =sum of x scores

$\sum y$ =sum of y scores

$\sum x^2$ =sum of squared x score

$\sum y^2$ =sum of squared y scores