Differentials in Basal Metabolic Rate, Body Mass Index and Diabetes in selected states of India

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1.1: Introduction

'Health is wealth' is that what we learnt from the elders since early childhood. This aphorism has been derived from the experiences of several millennia passed on and enriched from generation to generation. A society burdened with unhealthy person cannot be prosperous. Health is really the wealth.

Health is often equated with 'absence of disease'. We however know that many unhealthy persons do not exhibit symptoms of diseases. A person may be unhealthy because he does not get enough food to eat or the food he gets may not nutritious enough to keep his body in optimal working condition. He looks weak and tired. Sooner or later he may become a victim of one or several of diseases i.e. a problem of nutritional deficiency and diminished immunity (Mishra, 2007).

Rapidly changing diets and lifestyles are fuelling the global obesity epidemic (WHO, 2003). According to recent estimates, there are more than one billion overweight people worldwide, and some 300 million of these are estimated to be clinically obese (WHO, 2002). Once considered a problem related to affluence, obesity is now fast growing in many developing countries and in poor neighbourhoods of the developed countries (WHO, 2003; WHO, IASO, & IOTF, 2000). Even in countries like India, which are typically known for high prevalence of under nutrition, significant proportions of overweight and obese now coexist with the undernourished (Popkin, 2002).

Most of the people put on weight for one very simple reason; their energy intake is greater than their energy expenditure. In other words, they consume more calorie than they use, and the extra calories are stored as fat. Because of changing lifestyle we are becoming less physically active than it was before.

As a result, overweight and obesity and associated chronic health problems, such as diabetes, hypertension, cardiovascular disease, cancer, and musculoskeletal disorders, are increasing rapidly, particularly among the middle-class, urban populations (WHO, 2003; Popkin, 1998; Tanaka & Nakanishi, 1996; Saw & Rajan, 1997)

It is therefore necessary to know the minimum energy to know the dynamics of variations in energy. To know this we can calculate the minimum energy requirement by using height, weight and age. It has also been seen that height is a factor in determining the basal

metabolism, since in comparing individuals of like body weight and age, but widely varying height, the taller individual has usually the greater metabolism; this is likewise due without doubt to the fact that the taller individual has the larger amount of active protoplasmic tissue. In general, large bodies give off larger amounts of heat than smaller ones, but there is no direct relationship between the total body weight and the total heat production. But while the uniformity in energy requirement is of great significance in dietary studies and in the arrangement of dietaries, from the standpoint of pure physiology and for the application of physiological values to a study of pathological cases, it is of much more importance for us to know how constant is, the basal metabolism with, different individuals (Benedict, 1915). It is also found that there is variation in minimum energy requirement what we call Basal Metabolic Rate (BMR) according to different climatic conditions. Not only this there are several other factors which affect BMR like age, sex, diet, physical activities, hormones, barometric pressure (altitude), pregnancy in women, body temperature, disease, drugs and even racial factors (Chatterjee,1992 and Babsky et.al., 1970).

1.2: Review of Literatures

1.2.1: Basal Metabolism

"Basal metabolism has been defined as the condition of minimal or fundamental exchange, the irreducible minimum of exchange of energy which is characteristic for the individual. It is the minimal activity of the body which maintains the functions of respiration, circulation, and secretion (Lahey and Jordan, 1921).

It may also be considered as "the sum total of all the vital activities of the quiet organism in the post-absorptive condition; i.e., the minimum of maintenance metabolism unaffected by extraneous factors. This may be expressed in terms of heat produced or of gaseous exchange incidental to heat production carbon dioxide production and oxygen consumption. Using this basal metabolism as a standard, we may then measure definitely the superimposed factors." (Benedict and Talbot, 1921)

One would expect age to have a definite bearing on metabolism, and research has proved this to be true. "The level of the metabolism varies greatly with age. During the first few days of life it is very low, then rises rapidly during infancy, and reaches its highest level in the almost unexplored period between the ages of 2 and 6 years. After this it falls rapidly until about the 18th year when the curve flattens out. Between the ages of 20 and 40 there is comparatively little change; but after this a slight fall, so that by the eightieth year the line is about 10 per

cent, below the average level for the ages of 20 to 40. There seems to be an stimulation to the basal metabolism during the period of growth" (Du Bois, 1916).

Du Bois is pertinent: “We can rest assured that the actual variations of the basal metabolism are smaller than the variations of the measurements” (Du Bois, 1924).

Careful analysis of metabolism measurements obtained on athletes, normal men and women, and normal and atrophic infants, leads to the conclusion that the metabolism or heat output of the human body, even at rest, does not depend upon Newton’s law of cooling, and is, therefore, not proportional to the body surface. While certain disturbances in this supposed relationship between the heat production and the body surface may correctly be ascribed to errors in the formulae used for computing body surface, nevertheless the vast bulk of the evidence, particularly with athletes and with infants, and to a considerable extent with so called normal individuals, shows that the variations between metabolism and body surface are far outside of any possible errors in formulae.

Body composition, i.e., the proportion of inert body fat and active protoplasmic tissue, has a great influence upon the basal metabolism. The tendency toward the greater metabolism shown by athletes in comparison with non-athletes may thus be explained by the greater muscular development as indicating a larger proportion of active protoplasmic tissue. The apparent influence of sex, as brought out in the comparison of the metabolism of men and women, may also be attributed to the greater proportion of inert body fat in the latter, with a consequent smaller amount of active protoplasmic tissue.

We have still another very important factor; namely, the stimulus to cellular activity. This stimulus is influenced by a number of factors. One of these factors is age, and it has been noted that with the growing organism of youth, there is a much greater cellular activity than with the adult, and a consequent higher metabolism. It has been brought out, however, that in old age there may be actual atrophy of protoplasmic material.

Sleep has also been shown to have an influence upon the basal metabolism, the stimulus to the cellular activity being greater with an individual when he is lying awake than when he is asleep.

It is clear that the basal metabolism of an individual is a function, first, of the total mass of active protoplasmic tissue, and second, of the stimulus to cellular activity existing at the time the measurement of the metabolism is made. Apparently at present no law can be laid down that will cover both of these important variables in the basal metabolism of an individual (Benedict, 1915).

"Basal metabolism is a convenient starting point for measuring the various heat increments as heat increments of: fever, feeding, lactating, gestating, working, keeping warm in cold weather, and so on" (Bordy, 1974).

1.2.2: Overweight or Obesity and Diabetes

Problems of overweight and obesity are caused by chronic imbalance between energy intake and actual energy needs of the body. In many developing countries, with increasing urbanization, mechanization of jobs and transportation, availability of processed and fast foods, and dependence on television for leisure, people are fast adopting less physically active lifestyles and consuming more "energy-dense, nutrient-poor" diets (WHO, 2003; Bell, Ge, & Popkin, 2002; Popkin, 2002, 2001; Popkin, Horton, Kim, Mahal, & Shuigao, 2001; Drewnowski & Popkin, 1997). As a result, overweight and obesity and associated chronic health problems, such as diabetes, hypertension, cardiovascular disease, cancer, and musculoskeletal disorders, are increasing rapidly, particularly among the middle-class, urban populations (WHO, 2003; Popkin, 1998; Tanaka & Nakanishi, 1996; Saw & Rajan, 1997).

Overweight and obesity are most closely related to non-insulin dependent diabetes mellitus (NIDDM) or Type 2 diabetes (Ishikawa-Takata, Ohta, Moritaki, Gotou, & Inoue, 2002; Ko, Chan, Cockram, & Woo, 1999; Seidell, 1997; McKeigue, Shah, & Marmot, 1991). It is estimated that more than two-thirds of all diabetes mellitus cases can be linked to overweight conditions (Seidell, 1997). Developing countries account for an increasing share of diabetes cases. More than half of the world's newly diagnosed cases of diabetes come from India and China (McLellan 2002). Overweight and obesity have also been closely associated with ischaemic heart disease (Willett, Manson, Stampfer, Colditz, Rosner, Speizer, et al., 1995; Kannel, D'Agostino, & Cobb, 1996), hypertension (Stamler, Stamler, Riedlinger, Algera, & Roberts, 1978; Dyer & Elliott, 1989; Ishikawa-Takata et al., 2002; Ko et al., 1999), dyslipidaemia (Ishikawa-Takata et al., 2002; Despres, 1994; Ko et al., 1999), and cancer (Lew & Garfinkel, 1979; Shike, 1996). WHO estimates that approximately 58% of diabetes mellitus, 21% of ischaemic heart disease, and 8-42% of certain cancers can be attributed to BMI above 21 kg/m^2 (WHO, 2002).

Overweight conditions have been linked with gallstones and liver abnormalities (Stampfer, Maclure, Colditz, Manson, & Willett, 1992); low back pain (Deyo & Bass, 1989; Garzillo & Garzillo, 1994; Han, van Leer, Seidell, & Lean, 1995); osteoarthritis of the hands and wrist (Carman, Sowers, Hawthorne, & Weissfeld, 1994); reduced lung function, airways hyper responsiveness, and asthma symptoms (Tantisira & Weiss, 2001; Gibson, 2000; Shaheen,

1999; Camargo, Weiss, Zhang, Willett, & Speizer, 1999; Mishra, 2003); and sleep apnoea (Millman, Carlisle, McGarvey, Eveloff, & Levinson, 1995; Young, Palta, Dempsey, Skatrud, Weber, & Badr, 1993). Obesity has also been associated with menstrual dysfunction (Douchi, Kuwahata, Yamamoto, Oki, Yamasaki, & Nagata, 2002; Lake, Power, & Cole, 1997; Hartz, Barboriak, Wong, Katayama, & Rimm, 1979); reproductive disorders including infertility (Pettigrew & Hamilton-Fairley, 1997; Rich-Edwards, Goldman, Willett, Hunter, Stampfer, Colditz, et al., 1994; Zaadstra, Seidell, van Noord, te Velde, Habbema, Vrieswijk, et al., 1993; Hartz et al., 1979); increased abortion rates (Hamilton-Fairley, Kiddy, Watson, Peterson, & Franks, 1992); and pregnancy complications and adverse pregnancy outcomes (Lake et al., 1997; Kliegman & Gross, 1985). WHO typically defines adult overweight as a body mass index (BMI)1 of 25.0−29.9 kg/m2; and adult obesity as a BMI ≥ 30.0 kg/m2. However, it is observed that in Asian populations health risks associated with overweight and obesity occur at lower levels of BMI than in north America or Europe (Ko et al., 1999; Deurenberg-Yap, Yian, Kai, Deurenberg, & van Staveren, 1999), and it is now being suggested that lower cut off points for BMI be used to categorize overweight and obese conditions for Asian populations (WHO, IASO, & IOTF, 2000). Moreover, there is greater realization that both the amount of body fat and its distribution are important in determining health risks associated with overweight conditions. In many Asian populations, abdominal or central obesity (measured by waist circumference or the ratio of waist to hip circumference) is found to be more common than obesity defined by BMI (McKeigue et al., 1991). A study in India observed that about 20% of adults who were not overweight or obese as per the BMI definition still had abdominal obesity (Gopalan, 1998).

Previous research on obesity in India has found the prevalence of obesity to be higher among women (Misra, Pandey, Devi, Sharma, Vikram, & Khanna, 2001; Zargar, Masoodi, Laway, Khan, Wani, Bashir, et al., 2000; Gopinath, Chadha, Jain, Shekhawat, & Tandon, 1994), and among economically better off persons (Griffiths & Bentley, 2001; Singh, Beegom, Verma, Haque, Singh, Mehta, et al., 2000; Dhurandhar & Kulkarni, 1992). Urban residence, family history of obesity, childbearing, and sedentary lifestyle have also been linked to obesity (Bhasin, Chaturvedi, Gupta, & Aggarwal, 2001; Griffiths & Bentley, 2001; Tiwari, Wagh, & Babar, 1998; Dhurandhar & Kulkarni, 1992). Several studies have related overweight conditions with diabetes, hypertension, and heart disease (Venkatramana & Reddy, 2002; Misra et al., 2001; Singh et al., 2000; Gopinath et al., 1994).

According to Petrucelli (2008) metabolic syndrome is the association of risk factors for CHD and diabetes in certain individuals. Its prevalence has increased along with the higher obesity rates of the US population.

Obesity is related to various disease conditions, such as diabetes mellitus, dyslipidaemia, hypertension, and coronary heart disease (NIHCDP, 1985). The effect of abdominal obesity, as measured by waist-to-hip ratio (WHR), on these conditions differs from overall adiposity, as reflected in body mass index (BMI) [Vague, 1956; Hartz et.al. 1984]. Although alcohol is one of the sources of calorie intake, a recent review showed an inconsistent relation between alcohol intake and obesity (Hellerstedt et.al. 1990). Several reports have demonstrated that the independent associations of alcohol intake with obesity differ between gender, age, and race (Hellerstedt et.al. 1990; Armellini et.al. 1993).

Obesity, alcohol abuse, and smoking are behavioural risk factors for a variety of adverse health outcomes. Approximately 30.4% of adults in the United States are obese, 8.5% abuse alcohol or are alcohol dependent, and 22.5% are current smokers, resulting in significant health problems and associated costs (Hedley et.al. 2004; US DHHS, 2004).

1.3: Need of the study

India has a large variation in climate from region to region, due to its vast size. India experiences climate from four major climate groups and the epidemic of Obesity is becoming prominent in low-middle income countries like India. According to National Family Health Survey-3 (NFHS-3) obesity, the other side of poor nutrition is a substantial problem among several groups of women in India, particularly urban women, well-educated women, women from households with a high standard of living, and among Sikhs. Fifteen per cent of ever-married women are overweight or obese, up from 11 per cent in NFHS-2. (IIPS, 2007)

Men are also less likely to be obese (1 per cent) than women (3 per cent). Again, the pattern of differentials in the percentage overweight or obese is similar for men and women. One-quarter of Sikh and Jain men and men in households in the highest wealth quintile are overweight or obese. Only 57 per cent of men and 52 per cent of women have a BMI within the normal range of 18.5-24.9.

According to literatures there is an interrelationship between obesity and non-insulin dependent diabetes mellitus (NIDDM) or type-2 diabetes. Diabetes is a non-communicable disease, commonly known as ‘sugar’ illness. A person has diabetes when the body fails to

produce or properly use insulin to convert sugar, starch, etc., into energy. Diabetes affects all ages although the number with this illness climbs drastically with age. Over 2 per cent of women and men age 35-49 have diabetes. By age 50-54, over 5 per cent of men have diabetes. Diabetes is much more prevalent in urban areas (1,374 per 100,000 among women and 1,383 per 100,000 among men) than in rural areas (641 per 100,000 among women and 860 per 100,000 among men).

A study in India observed that about 20% of adults who were not overweight or obese as per the BMI definition still had abdominal obesity (Gopalan, 1998). McNeill G_et.al. (1987) in their study measured values agreed well with values predicted by equations based on BMR measurements in Asian men of higher body weight, but were below values predicted by the new FAO/WHO/UNU prediction equations by an average of 12.1 per cent (P less than 0.0001). They said the over prediction could be a reflection of allometric or climatic influences on BMR rather than evidence for metabolic adaptation to a low plane of energy nutrition.

There have been debates about the necessity of adjusting for the possible biological effects of obesity, such as blood pressure, cholesterol, and glucose levels, (Shaper et.al. 1997; Manson et.al. 1987; Jousilahti 1996) to assess the effect of BMI on health outcomes.

India is a developing country with much scope of urbanisation and concentration of population in big cities and urban way of life. Modernisation also plays an important role for sedentary life. So in near future obesity would emerge as a challenging problem for India. Therefore, attention should be given to account for this coming future as a preventive measure.

Healthcare providers and policy makers need to appreciate the importance of obesity, its consequences and prevention and develop effective policies and programmes to prevent it, as '**Prevention is better than cure**'. Henceforth, intensive research on the dynamics of obesity is needed to formulate effective program in order to enhance the quality of life for all.

1.4: Objectives

The main objective of the study is to assess the differentials in Basal Metabolic Rates (BMR) and Body Mass Index (BMI) by gender across the selected states in India. However, the specific objectives of the study are:

1. To study the differentials in Basal Metabolic Rate (BMR), Body Mass Index (BMI) and Diabetes by sex of the selected states of India
2. To assess the differentials in BMR, BMI and Diabetes by socio-economic and demographic indicators in selected states of India
3. To study the effect of Socio-economic and demographic indicators on BMR, BMI and Diabetes in selected states of India

1.5 Methodology of the Study

1.5.1: Data and Method

The present study relies on NFHS-III for understanding the gender differentials in Basal Metabolic Rate, Body Mass Index and Diabetes in selected states of India. The third National Family Health Survey (NFHS-3) was conducted in 2005-06. NFHS-3 collected information from a nationally representative sample of 124,385 women age 15-49 and 74,369 men age 15-54 in 109,041 households. The survey provides data on weight and height for male and female in the age group 15 to 54, and other background characteristics. The Uniscale is a digital scale for weighing both children and adults. The scale has a 150 kg capacity and weighs in 0.1 kg increments. The scale is solar powered; therefore, there are no batteries to replace. And the height of the subject was measured by placing the measuring board on a hard, flat surface against a wall, table, tree or staircase making the board stable as many walls and floors are not at perfect right angles; if necessary, adjusting underneath the height board to stabilize it during the measurement by keeping small piece of rocks. Those measurements were taken by trained investigators.

1.5.2: Variable Used

BMR, BMI and Diabetes will be used as main dependent variables for the study. The Independent variables will be various socio-demographic indicators like age, sex, highest educational level, place of residence, religion, caste/tribe, wealth index, occupation, alcohol and tobacco use. Bivariate and regression analysis are carried out to examine the relationship between dependent variables and different socio-economic and demographic characteristics. Regression analysis (logistic regression) will further indicate the intensity or effect of the determinants of dependent variables. For binary logistic, BMR, BMI and Diabetes has been taken as dependent variable and independent variables are Age, Residence, Education, Religion, Ethnicity, Wealth Quintile, Alcohol Use, Tobacco use etc.

1.5.3: Calculation of BMR and BMI

The closest prediction of the daily heat production of a subject or BMR can be made by the use of the multiple regression equations, (Harris and Benedict, 1919)

For men,

$$\mathbf{h} = 66.4730 + 13.7516\,\mathbf{w} + 5.0033\,\mathbf{s} - 6.7550\,\mathbf{a}$$

For women,

$$h = 655.0955 + 9.5634\,w + 1.8496\,s - 4.6756\,a$$

Where,

- h = total heat production per 24 hours
- w = weight in kilograms
- s = stature in centimetre
- a = age in years

These equations have been tabulated for values of weight from 25.0 to 124.9 kg, for stature from 151 to 200 cm and for age from 21 to 70 years, so that the most probable basal metabolism of an unknown subject may be easily determined.

The body mass index (BMI), or Quetelet index, is a heuristic proxy for human body fat based on an individual's weight and height.

The general formula for calculating Body Mass Index (BMI) is

$$BMI = \frac{Weight(K}{Height(m^2)}$$

A BMI of less than 18.5 kg/m2 is defined as underweight, indicating chronic energy deficiency. A BMI in the range of 18.5 and 24.9 kg/m2 is defined as normal; 25.0 and 29.9 kg/m2 as overweight; and more than 30.0 kg/m2 as obese (WHO, 2003)

1.5.4: Selection of States

State		***Climate***
Himachal Pradesh	:	*Mountain and Humid Subtropical*
Rajasthan	:	*Arid and Semi-arid*
Manipur	:	*Humid Subtropical*
Orissa	:	*Tropical wet and dry and Humid Subtropical*
Madhya Pradesh	:	*Humid Subtropical, Tropical wet and dry and Semi-arid*
Kerala	:	*Tropical wet*

India has a large variation in climate from region to region, due to its vast size. India experiences climate from four major climate groups; Tropical rainy climatic group, Dry climate group, Humid sub-tropical climate group, Mountain climate. Based on these climate states has been selected. The states are Himachal Pradesh, Rajasthan, Kerala, Orissa, Manipur and Madhya Pradesh. The states are also from each region of the regions classified by NFHS.

The geography of India describes the physical features of India, a country in South Asia that lies entirely on the Indian Plate in the northern portion of the Indo-Australian Plate. The country lies to the north of the equator between 8°4' and 37°6' north latitude and 68°7' and 97°25' east longitude (Research, Reference and Training Division, GOI, 2007). It is the

seventh-largest country in the world, with a total land area of 3,287,263 square kilometres (1,269,219 sq mi). India measures 3,214 km (1,997 mi) from north to south and 2,993 km (1,860 mi) from east to west. It has a land frontier of 15,200 km (9,445 mi) and a coastline of 7,517 km (4,671 mi). (India Official website, 2012; Manorama Yearbook , 2006)

The existence of a wide variety of regional distributions of rainfall regimes, temperature ranges and pressure-wind systems over the subcontinent, therefore, is most convenient to study according to climatic regions. Among the best known climatic classifications are those of *Köppen*, Thornthwaite and Kendrew (Thomas A. Blair, 1942). In this study we are using *Köppen classification for selecting the states.*

Fig. 1: Climatic zones in India, based on the Köppen classification system
Source: Wikipedia

1.6: Results and Conclusions

1.6.1: Overview of Basal Metabolic Rate, Body Mass Index and Diabetes across the states by sex and age

The problem of the difference in the metabolism of men and women, dealt with in the past by a number of writers. The average daily (24 hours) basal heat production of men is 1632 calories whereas that of women is 1349 calories. Thus women have an average daily heat production about 300 calories less than that of men. But women are smaller than men. An overview of the age differential in Mean basal metabolic rate is shown in appendix 8.

1.6.1.1: Differentials in Basal Metabolic Rate (BMR)

The calculated mean BMR shows differentials across the states. The minimum BMR ranges from 980 calorie in Kerala to 1080.59 in Himachal Pradesh and the maximum ranges from 2052.40 calorie in Himachal Pradesh to 2257.19 calorie in Manipur among male but among female the minimum BMR ranges from 1003.56 calorie in Manipur to 1053.47 calorie in Kerala.

Table 1: Sex differential in mean Basal Metabolic Rate among selected state of India, 2005-06

States	Mean		Std. Dev.		Male		Female		Obs	
	Male	Female	Male	Female	Min	Max	Min	Max	Male	Female
Himachal Pradesh	1464.32	1286.82	153.03	90.18	1080.59	2052.40	1029.36	1722.50	**695**	**1745**
Rajasthan	1459.85	1275.21	157.93	90.02	1042.09	2067.20	1049.34	1689.90	**1005**	**2090**
Manipur	1447.83	1298.00	142.06	83.24	1065.97	2257.19	1003.56	1819.24	**2679**	**1987**
Orissa	1392.12	1249.13	150.20	85.59	1006.42	2089.82	1023.93	1608.84	**1077**	**1705**
Madhya Pradesh	1424.70	1254.18	143.41	88.44	1029.95	2174.55	1034.62	1792.82	**1961**	**3156**
Kerala	1518.60	1328.79	179.65	105.65	980.28	2146.71	1053.47	1901.58	**778**	**1822**
INDIA	**1445.12**	**1281.56**	**169.42**	**102.68**	**980.28**	**2452.76**	**991.48**	**1988.26**	**49192**	**52910**

Looking in the India's mean BMR, it ranges from 980.28 to 2452.76 calories among male and from 991.48 to 1988.26 calorie among female. The highest mean BMR is found in Kerala and lowest in Orissa in case of both male and female. In Kerala it is 1518.60 calorie (1.5 Kcal) and 1328.79 calorie (1.3 Kcal) for male and female respectively whereas it is 1392.12 calorie (1.4 Kcal) and 1249.13 calorie (1.2 Kcal) for male and female in Orissa and the mean BMR of both the male and female for India are 1445.12 calorie and 1281.56 calorie respectively.

1.6.1.2: Differentials in Body Mass Index (BMI)

Body Mass Index (BMI) of the states where Manipur has the highest percentage of male (76.07 per cent) and female (69.49 per cent) having normal BMI. Himachal Pradesh, Kerala, Orissa, Madhya Pradesh and Rajasthan have 67.25, 64.92, 61.07, 59.25 and 59.13 per cents male having normal BMI respectively. In Himachal Pradesh, Rajasthan, Madhya Pradesh, Orissa and Kerala 60.73, 56.51, 53.00, 52.87 and 52.86 per cent of female are having normal BMI respectively. The male and female having normal BMI are 60.42 per cent and 52.64 per cent respectively in India. The highest percentage of underweight male are found in Madhya Pradesh (35.51 per cent) and lowest percentage in Manipur (12.88 per cent) and among female Orissa has the highest percentage (38.8 per cent) and Manipur has the lowest (12.6 per cent). But 28.16 per cent of male and 30.74 per cent of female in India are underweight according to the study. Also 11.42 per cent of male and 16.63 per cent of female are overweight in India.

Table 2: Sex differential in Body Mass Index among selected states of India, 2005-06

States	Underweight		Normal		Overweight		Total	
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*
Himachal Pradesh	19.79	24.3	67.35	60.73	12.86	15.00	**695**	**1,745**
Rajasthan	32.79	32.3	59.13	56.51	8.09	11.18	**1,005**	**2,090**
Manipur	12.88	12.6	76.07	69.49	11.05	17.89	**2,679**	**1,987**
Orissa	32.02	38.8	61.07	52.86	6.91	8.37	**1,077**	**1,705**
Madhya Pradesh	35.52	38.1	59.25	53.00	5.23	8.86	**1,961**	**3,156**
Kerala	13.75	15.0	64.92	52.87	21.33	32.14	**778**	**1,822**
INDIA	**28.16**	**30.74**	**60.42**	**52.64**	**11.42**	**16.63**	**49,192**	**52,910**

The highest percentage of overweight male is found in Kerala (21.33 per cent) and the lowest in Madhya Pradesh (5.23 per cent). In case of female, highest percentage of overweight is also found in Kerala (32.14 per cent) and lowest in Orissa (8.37 per cent).

1.6.1.3: Differentials in the prevalence of Diabetes

There are differential in the prevalence of diabetes in India and selected states. The prevalence of diabetes is low in India, 1.36 per cent among male and 1.14 per cent among female.

Table 3: Sex differential with Diabetes among selected states of India, 2005-06

States	No		Yes		Don't Know		Total	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
Himachal Pradesh	98.77	98.20	0.30	1.12	0.93	0.68	**695**	**1745**
Rajasthan	98.85	99.18	0.41	0.37	0.74	0.45	**1,005**	**2090**
Manipur	96.63	98.10	1.29	1.03	2.08	0.87	**2,678**	**1987**
Orissa	96.31	95.26	1.59	0.80	2.10	3.93	**1,076**	**1704**
Madhya Pradesh	98.87	98.55	0.65	0.95	0.48	0.50	**1,961**	**3156**
Kerala	92.94	96.82	3.98	2.80	3.08	0.39	**778**	**1822**
INDIA	**96.78**	**97.80**	**1.36**	**1.14**	**1.86**	**1.06**	**49,188**	**52896**

The highest percentage of both diabetic male (3.98 per cent) and female (2.80 per cent) are found in Kerala and lowest diabetic male are found in Himachal Pradesh (0.30 per cent) and Rajasthan has the lowest percentage of diabetic female (0.37 per cent). The percentage of diabetic male in Orissa, Manipur, Madhya Pradesh and Rajasthan are 1.59, 1.29, 0.65 and 0.41 per cents respectively and female having diabetes in Himachal Pradesh, Manipur, Madhya Pradesh and Orissa are 1.12, 1.03, 0.95 and 0.80 per cents respectively.

1.6.2: Differentials in Basal Metabolic Rate, Body Mass Index and Diabetes of different socio-economic and demographic indicators

It is also proper for us to consider here, therefore, first, what is the influence upon the basal metabolism of changes in the socio economic and demographic characteristics, noting if possible what variations in metabolism may be found which has essentially a constant mass of active protoplasmic tissue and a constant body surface, but with varying intensity of stimulus.

According to National Family Health Survey, more than one-third (36 per cent) of women age 15-49 in India have a BMI below 18.5 indicating chronic nutritional deficiency, including 16 per cent who are moderately to severely thin. Nationally, 34 per cent of men age 15-49 have a BMI below18.5, and more than half of these men are moderately to severely under nourish. The highest proportions of undernourished men, two in five, are in Madhya Pradesh and Rajasthan.

Obesity, the other side of poor nutrition, is a substantial problem among several groups of women in India. Fifteen per cent of ever-married women are overweight or obese, up from 11 per cent in NFHS-2.

1.6.2.1: Basal Metabolic Rate and Socio economic and demographic Indicators

The mean Basal Metabolic Rates differ across different socio economic and demographic characteristics in India and the selected states. The mean BMR is highest among age group 21 to 29 and decreases with increasing age. The highest mean BMR is found in Kerala and lowest in Orissa in all the age group.

The mean BMR is higher in urban area as compared to rural area. The highest mean BMR is found in Kerala for both male (1531.97 calorie) and female (1342.31 calorie) in urban area and lowest among male in Orissa (1466.01 calorie) and among female in Madhya Pradesh (1296.09 calorie). The mean BMR of India for both male and female also shows rural urban differentials.

As the level of education increases the mean BMR increases but the highest means are found in Kerala, for those who have no education (1489.70 calorie), primary (1423.03 calorie), secondary (1518.03 calorie) and higher (1596.01 calorie) level of education among male. The highest mean BMR for female who has no education are found in Manipur (1268.05 calorie), primary in Rajasthan (1290.13 calorie), secondary and higher level of education in Kerala (1332.46 calorie & 1347.24 calorie) respectively. The lowest BMR means are found in Orissa for those who has no education (131263 calorie), primary (1358.13 calorie) and secondary (1426.36 calorie) level of education and in higher level of education it is found in Manipur (1596.01 calorie) among male. The lowest mean BMR for female are found in Orissa (no education 1211.33 calorie, primary 1245.99 calorie, secondary 1287.35 calorie and higher level of education 1313.86 calorie).

The mean BMR by religion is highest in Kerala for both male (Hindu 1496.02 calorie, Muslim 1556.62 calorie and others 1549.55 calorie) and female (Hindu 1314.45 calorie, Muslim 1349.26 calorie and others 1340.12 calorie). The mean BMR is lowest in Orissa among all religions for both male (Hindu 1391.98 calorie, Muslim 1395.35 calorie and others 1400.75 calorie) and female (Hindu 1249.31 calorie, Muslim 1223.96 calorie and others 1250.74 calorie).

The highest mean BMR by caste/tribe is found among Other Backward Classes (OBC) are having highest BMR among male (1524.95 calorie) and female (1331.09 calorie) of Kerala. In case of other castes except SC, ST and OBC, it is highest among male (1543.87 calorie)

and female (1332.64 calorie) of Kerala. But the lowest mean male and female BMR is found in Orissa for all ethnic groups except OBC female of Madhya Pradesh (1247.84 calorie).

There is a positive relationship between wealth quintile and BMR. In Kerala, the mean BMR of poor quintile male is 1415.48 calorie and for female it is 1277.89 calorie, middle quintile male is 1439.46 calorie and that of female is 1277.19 calorie and the rich quintile male mean BMR is 1539.09 calorie and for female it is 1335.98 calorie.

Occupational status shows differential in mean BMR as the highest mean BMR is found among the male in case of sale workers of Kerala (1565.57 calorie) and professional, technical, administrative, and managerial occupations has the highest mean BMR among female in Himachal Pradesh (1346.41 calorie). But the lowest mean BMR for male is found among the skilled or unskilled production workers of Orissa (1214.20 calorie) and that of female are found among the agricultural workers in Orissa (1210.05 calorie).

Alcohol and Tobacco use has effect on the metabolic activities of our body. Among the male who use alcohol the highest and lowest mean BMR is found in Kerala (1482.35 calorie) and Orissa (1378.56 calorie) respectively but the highest and lowest mean BMR of those male who do not use alcohol is also found in Kerala and Orissa. The mean BMR of the female who use alcohol is found highest in Rajasthan (1324.07 calorie) and lowest in Madhya Pradesh (1205.14 calorie) and who do not use alcohol the highest mean BMR is found in Kerala (1328.82 calorie) and lowest in Orissa (1252.27 calorie).

Similarly the mean BMR of those who use tobacco are found highest in Kerala in both male (1482.35 calorie) and female (1261.47 calorie) and lowest in Orissa (1378.56 calorie) among male and Himachal Pradesh (1206.67 calorie) among female.

There is a close relationship between basal metabolic rate and body mass index of an individual. A person having more fat mass tends to have higher BMR than person having less fat. The highest mean BMR of normal male (1493.00 calorie) and female (1300.98 calorie) are found in Kerala but lowest are found in Orissa in case of both male (1411.64 calorie) and female (1271.98 calorie).

The highest mean BMR of those who are diabetic is found in Himachal Pradesh (1673.22 calorie) among male and among female (1372.26 calorie) in Kerala and the lowest is found in Orissa (1429.15 calorie) among male and in Manipur (1281.48 calorie) for female. Those who do not have diabetes have lower BMR but the highest among them is found in Kerala for both male (1522.09 calorie) and female (1327.79 calorie), similarly, the lowest is found in Orissa for both male (1249.83 calorie) and female (1249.83 calorie).

Table 4: Differential in Basal Metabolic Rate among selected states by different Socio-economic and Demographic Indicators, 2005-06									
	Background		Himachal Pradesh	Rajasthan	Manipur	Orissa	Madhya Pradesh	Kerala	INDIA
Age	21-29	*M*	1499.96	1487.42	1487.67	1438.62	1463.98	1574.88	1486.80
		F	1298.87	1298.16	1314.23	1275.27	1278.88	1348.01	1299.19
	30-39	*M*	1469.35	1476.29	1444.95	1385.52	1427.23	1534.20	1450.04
		F	1289.26	1273.57	1300.62	1246.50	1248.67	1332.66	1280.27
	40-49	*M*	1416.92	1400.36	1393.02	1343.21	1370.52	1448.35	1383.10
		F	1265.10	1243.76	1263.25	1208.41	1224.74	1297.18	1253.06
Residence	Urban	*M*	1510.08	1502.92	1485.69	1466.01	1467.33	1531.97	1497.51
		F	1335.13	1306.92	1317.77	1296.83	1296.09	1342.31	1321.42
	Rural	*M*	1457.45	1438.21	1428.71	1375.42	1406.01	1510.57	1416.11
		F	1280.74	1261.79	1287.19	1237.92	1236.14	1320.98	1260.11
Education	No Education	*M*	1350.07	1407.15	1361.81	1312.63	1371.61	1489.70	1363.06
		F	1250.67	1259.60	1268.05	1211.33	1230.68	1261.27	1244.21
	Primary	*M*	1387.93	1416.99	1396.35	1358.13	1399.35	1423.03	1394.64
		F	1269.56	1290.13	1285.99	1245.99	1257.26	1281.67	1273.32
	Secondary	*M*	1466.72	1482.13	1444.99	1426.36	1435.96	1518.03	1467.34
		F	1298.09	1309.62	1305.42	1287.35	1292.90	1332.46	1312.68
	Higher	*M*	1540.65	1552.90	1494.56	1522.58	1522.47	1596.01	1550.64
		F	1324.61	1329.49	1319.88	1313.86	1326.01	1347.24	1345.09
Religion	Hindu	*M*	1462.56	1455.17	1459.55	1391.98	1418.33	1496.02	1440.47
		F	1286.63	1272.95	1303.12	1249.31	1249.88	1314.45	1276.60
	Muslim	*M*	1525.09	1483.26	1451.57	1395.35	1473.96	1556.62	1446.32
		F	1334.84	1288.54	1295.24	1223.96	1291.65	1349.26	1290.40
	Others	*M*	1531.64	1541.29	1431.14	1400.75	1501.94	1549.55	1510.32
		F	1279.32	1328.43	1289.53	1250.74	1290.29	1340.12	1324.48
Ethnicity	SC	*M*	1432.02	1428.62	1455.95	1354.99	1389.26	1410.21	1404.50
		F	1278.77	1258.89	1308.54	1224.44	1249.03	1290.40	1262.02
	ST	*M*	1409.97	1383.48	1419.30	1336.78	1378.27	1383.54	1375.29
		F	1268.97	1231.62	1281.76	1219.02	1222.35	1246.65	1238.51
	OBC	*M*	1434.57	1471.59	1460.21	1410.08	1422.20	1524.95	1443.16
		F	1277.03	1279.96	1297.10	1251.40	1247.84	1331.09	1277.17
	Other	*M*	1483.72	1499.90	1455.70	1444.41	1495.71	1543.87	1487.60
		F	1292.49	1296.86	1302.95	1272.21	1292.86	1332.64	1302.48
Wealth	Poor	*M*	1401.03	1405.78	1386.84	1340.26	1387.60	1415.48	1363.81
		F	1255.22	1246.10	1264.68	1217.26	1228.22	1277.89	1231.31
	Middle	*M*	1402.96	1436.56	1410.43	1404.84	1432.40	1439.46	1418.23
		F	1255.53	1266.96	1275.55	1251.42	1248.32	1277.19	1259.15
	Rich	*M*	1495.18	1517.21	1490.85	1489.24	1489.65	1539.09	1518.63
		F	1298.73	1303.36	1316.37	1300.65	1300.92	1335.98	1321.56

Occupation	Not working	*M*	1537.33	1540.36	1511.29	1492.83	1486.16	1536.12	1518.72
		F	1288.35	1289.54	1306.69	1263.33	1280.55	1340.54	1300.26
	Prof., tech, manager	*M*	1495.47	1541.72	1496.15	1536.94	1486.86	1561.77	1533.00
		F	1346.41	1339.02	1321.02	1317.45	1280.87	1339.81	1331.04
	Clerical	*M*	1482.52	1506.81	1439.75	1438.11	1498.10	1559.39	1501.94
		F	1313.13	1233.17	1332.87	1310.29	1246.99	1307.90	1311.53
	Sales	*M*	1503.95	1501.40	1487.70	1455.36	1454.73	1565.57	1496.94
		F	1274.23	1327.37	1313.72	1246.10	1304.40	1305.56	1305.42
	Agric-employee	*M*	1424.74	1440.58	1414.13	1366.18	1411.72	1464.55	1399.72
		F	1264.44	1261.22	1266.71	1210.05	1226.29	1256.72	1237.42
	Service	*M*	1505.56	1441.98	1461.27	1471.33	1429.45	1515.58	1466.29
		F	1329.62	1265.06	1311.84	1262.28	1233.52	1307.64	1280.39
	Skilled	*M*	1432.44	1441.19	1433.66	1359.38	1405.56	1502.62	1433.23
		F	1288.84	1250.52	1300.11	1214.20	1236.46	1288.43	1262.59
Alcohol Use	No	*M*	1465.22	1467.43	1455.26	1416.03	1433.21	1518.89	1451.55
		F	1286.82	1275.03	1297.71	1252.27	1255.56	1328.82	1282.76
	Yes	*M*	1462.84	1434.33	1441.86	1361.42	1409.32	1518.34	1434.48
		F	1280.92	1324.07	1313.96	1206.96	1205.14	1323.99	1230.11
Tobacco Use	No	*M*	1498.90	1504.43	1470.56	1433.79	1452.19	1554.31	1493.28
		F	1287.98	1277.89	1301.89	1268.41	1259.24	1329.73	1288.91
	Yes	*M*	1430.12	1440.95	1441.00	1378.56	1416.05	1482.35	1418.52
		F	1206.67	1247.57	1292.85	1214.04	1230.04	1261.47	1226.76
Body Mass Index	Underweight	*M*	1331.29	1346.23	1305.49	1290.98	1327.36	1334.41	1314.26
		F	1201.94	1203.55	1203.00	1182.98	1187.39	1202.77	1191.35
	Normal	*M*	1466.57	1485.77	1442.94	1411.64	1459.76	1493.00	1456.83
		F	1287.70	1286.19	1286.89	1271.98	1274.67	1300.98	1285.49
	Overweight	*M*	1657.29	1731.05	1647.36	1687.93	1688.54	1715.30	1705.97
		F	1420.58	1426.69	1408.20	1411.21	1419.04	1433.36	1435.88
Diabetes	No	*M*	1464.04	1460.17	1448.17	1393.07	1424.85	1522.09	1445.50
		F	1287.01	1274.88	1298.01	1249.83	1253.46	1327.79	1281.20
	Yes	*M*	1673.22	1476.58	1478.98	1429.15	1489.12	1490.56	1472.43
		F	1305.36	1326.76	1281.48	1345.42	1342.21	1372.26	1332.96
	Don't Know	*M*	1425.82	1407.78	1413.79	1326.81	1303.89	1449.52	1405.65
		F	1227.90	1304.99	1315.65	1212.32	1227.38	1262.61	1258.99

1.6.2.2: Body Mass Index and Socio-economic and Demographic Indicators

Age is a factor for change in body mass index of a person. In age group 21-29, the highest percentage of underweight, normal weight and overweight male are found in Madhya Pradesh (40.71 per cent), Manipur (80.95 per cent) and Kerala (15.57 per cent) respectively and that of female in Orissa (40.81 per cent), Manipur (75.18 per cent) and Kerala (22.56 per cent). The highest percentage of underweight males is found in Madhya Pradesh and in Orissa among female in age group 30-39.

The highest percentage of overweight is found concentrated in the age group 40-49 for both male and female. The highest 22.62 per cent is found for male in Himachal Pradesh and 40.49 per cent for female in Kerala.

The rural urban differentials exist in body mass index. As the prevalence of underweight is higher in rural and those of overweight is higher in urban. The highest prevalence of underweight is found in rural area of Madhya Pradesh 40.77 per cent in male and for female it is found to be highest (42.75 per cent) in rural Orissa but the least percentage is found in rural Manipur for both male (13.59 per cent) and female (13.79 per cent). It is also found that the percentage of underweight and overweight is higher among female than among male in both rural and urban areas.

As the level of education increases the prevalence of underweight decreases but it is contradictory for overweight, as the level of education increases the prevalence of overweight increases. Madhya Pradesh has the highest percentage of underweight male (44.51 per cent) with no education and Orissa (51.63 per cent) has the highest percentage of underweight female with no education but the lowest percentage is found in Manipur both for male and female. Kerala has the highest percentage of overweight male (18.15 per cent) and female (19.18 per cent) with no education. The prevalence of overweight increases with higher level of education and is highest in Kerala for both male (29.83 per cent) and female (31.09 per cent).

The highest percentage of underweight is found in Madhya Pradesh both in male (36.28 per cent) and female (39.05 per cent) and is lowest in Manipur both for male and female among the Hindu. The highest percentage of overweight is found to be highest in Kerala for both the sexes (20.45 per cent for male and 27.64 per cent for female). The highest percentage of underweight is found in Orissa both for male (47.22 per cent) and female (58.61 per cent) among the Muslim. The percentage of overweight is found to be highest in Himachal Pradesh among male (20.00 per cent) and among female (37.08 per cent) in Kerala and lowest among

male (4.85 per cent) in Manipur and for female in Orissa. The percentage of normal weight male is found to be highest in Manipur (79.79 per cent) and for female (65.98 per cent) it is in Himachal Pradesh. The percentage of overweight male is found to be highest in Rajasthan (28.73 per cent) and that of female in Kerala (38.33 per cent), the lowest percentage of overweight is found in Manipur among male (8.30 per cent) and among female in Himachal Pradesh (10.95 per cent) in case of other religion.

But the highest percentage of underweight is found in Madhya Pradesh among male (27.22 per cent) and among female (39.80 per cent) in Orissa. The lowest percentage is found in Manipur for both the sex. Manipur has the highest percentage of normal weight male and female. OBC in Kerala have the highest percentage of overweight male (22.82 per cent) and female (34.29 per cent) and the lowest percentage of overweight is found among the STs of Himachal Pradesh. The prevalence of overweight is found to be highest in the rich quintile and is highest in Kerala among male (24.40 per cent) and female (34.69 per cent) but it is found to be lowest in Rajasthan among poor quintile among male (0.93 per cent) and among female (1.51 per cent) in Orissa. The highest percentage of underweight is found among male (42.86 per cent) in Madhya Pradesh and among female (52.79 per cent) in Orissa and lowest is found among rich quintile male (9.97 per cent) and female (9.29 per cent) in Manipur. Manipur has the highest percentage of normal weight male and female in all the quintiles.

Occupation is the major determinant of physical activity, those who are engaged in muscular works will be more physically fit than who do not. In general professional, technical, administrative, and managerial occupations have the highest percentage of overweight as they are sedentary workers and the agricultural, skilled and non-skilled workers have the least percentage of overweight.

The highest percentage of overweight is found in Kerala among non-working (34.82 per cent), followed by sale worker (32.51 per cent), professional, technical, administrative, and managerial occupation (31.76 per cent) in Orissa but lowest percentage is found among non-working (2.34 per cent), followed by agricultural worker (2.70 per cent) in Madhya Pradesh among male. It is found to be highest in clerical worker (41.42 per cent) in Himachal Pradesh, professional, followed by non-working (34.82 per cent), technical, administrative, and managerial occupation (33.82 per cent) in Kerala among female but lowest among agricultural worker in Orissa (1.86 per cent) followed by service worker (4.30 per cent) in Madhya Pradesh.

The skilled and non-skilled worker of Madhya Pradesh has the highest percentage of underweight male (40.69 per cent) and 58.52 per cent of clerical worker in Madhya Pradesh, 52.07 per cent of skilled and unskilled worker and 52.03 per cent of agricultural worker in Orissa has the highest percentage of underweight female. Percentage of male with normal weight is found to be highest in Manipur among the agricultural workers (82.67 per cent) and lowest among the skilled and un-skilled male worker of Madhya Pradesh (54.64 per cent) and for female it is found to be lowest in Madhya Pradesh among clerical worker (15.20 per cent).

The highest percentage of overweight male and female is found in Kerala (23.53 per cent in male and 46.12 per cent in female) and lowest in Madhya Pradesh among male and Orissa among female among those who use alcohol and underweight is found to be highest in Madhya Pradesh among male and female.

Highest percentage of underweight male and female are found in Madhya Pradesh (34.90 per cent) and Orissa (37.81 per cent) respectively but lowest in Manipur and Kerala who do not use alcohol.

Overweight is found to be highest among the non-smoking male and female but the highest percentage is found in Kerala both for male (26.52 per cent) and female (32.30 per cent) and among the tobacco user the highest percentage is found in male and female of Kerala. Highest percentage of underweight is found among tobacco user and is found highest in Rajasthan (35.49 per cent) among male and in Orissa (48.90 per cent) among female. Lowest percentage of underweight is found among not using tobacco in Kerala (10.46 per cent) among male and in Manipur (12.17 per cent) among female. Normal male and female are found to be highest in Manipur among tobacco user and not using tobacco.

The percentage of overweight is high among diabetic and is found highest in Himachal Pradesh among male (80.97 per cent) and in Kerala among female (66.67 per cent). Among the non-diabetic, the highest percentage of overweight is found in Kerala among male (21.29 per cent) and female (31.27 per cent). The highest percentage of underweight is found among male who do not know whether they have diabetes or not in Madhya Pradesh (50.00 per cent). Similarly among female it is found to be highest in Orissa (42.89 per cent). In Rajasthan, 25.51 per cent male and 25 per cent female are found to be underweight among diabetic.

Table 5: Differential in Body Mass Index across states in different Socio-economic and Demographic Indicators																							
Background		SEX	Himachal Pradesh			Rajasthan			Manipur			Orissa			Madhya Pradesh			Kerala			INDIA		
			Uw	Nw	Ow	Uw	Nw	Ow	Uw	Nw	Ow	Uw	Nw	Ow	Uw	Nw	Ow	Uw	Nw	Ow	Uw	Nw	Ow
Age	21-29	M	22.97	72.78	4.24	39.79	56.13	4.09	13.25	80.95	5.80	33.29	62.13	4.58	40.71	57.55	1.74	18.03	66.40	15.57	32.07	60.90	7.03
		F	34.36	58.37	7.27	36.50	58.16	5.35	15.81	75.18	9.01	40.81	54.81	4.38	40.35	56.53	3.12	20.35	57.09	22.56	35.10	55.21	9.69
	30-39	M	19.80	67.25	12.95	27.19	62.51	10.30	11.97	75.14	12.89	31.83	61.68	6.49	31.86	63.77	4.37	8.66	65.71	25.62	25.51	61.45	13.04
		F	19.40	64.56	16.04	31.14	56.24	12.62	9.91	68.60	21.49	37.02	53.05	9.93	40.39	50.48	9.13	13.27	51.19	35.55	29.72	51.23	19.05
	40-49	M	16.14	61.24	22.62	29.90	59.12	10.98	13.56	70.13	16.30	30.69	58.94	10.37	33.40	55.76	10.84	15.18	62.65	22.17	26.35	58.45	15.20
		F	15.97	58.83	25.20	27.74	54.46	17.80	11.20	60.31	28.49	37.94	49.24	12.82	31.78	51.15	17.07	10.08	49.42	40.49	24.74	50.36	24.90
Residence	Urban	M	11.84	66.67	21.49	22.22	61.11	16.67	11.48	70.97	17.55	21.60	61.24	17.16	23.54	65.02	11.45	13.31	61.43	25.26	19.55	61.14	19.31
		F	13.58	54.30	32.12	24.56	52.36	23.08	10.50	65.01	24.50	21.84	55.23	22.92	27.77	50.64	21.59	12.46	51.04	36.50	19.50	51.52	28.97
	Rural	M	20.99	67.45	11.56	38.10	58.13	3.78	13.59	78.65	7.76	34.37	61.03	4.60	40.77	56.72	2.51	14.02	67.01	18.97	32.94	60.02	7.04
		F	25.61	61.54	12.85	35.58	58.27	6.15	13.79	71.93	14.27	42.75	52.30	4.95	42.60	54.02	3.39	16.46	53.92	29.62	36.78	53.24	9.98
Education	No edu	M	31.14	56.58	12.28	38.56	58.19	3.25	17.32	78.29	4.39	39.32	60.25	0.43	44.51	53.61	1.88	0.00	81.85	18.15	38.88	57.20	3.92
		F	25.03	65.05	9.93	34.99	57.30	7.72	16.92	66.81	16.27	51.63	45.91	2.45	43.50	52.08	4.41	19.21	61.61	19.18	39.91	51.76	8.34
	Primary	M	23.78	70.49	5.73	39.09	57.09	3.82	18.61	73.69	7.70	35.84	60.65	3.50	39.11	58.32	2.57	16.67	72.54	10.79	34.20	59.21	6.59
		F	24.60	61.37	14.04	28.49	55.41	16.10	12.07	71.62	16.31	35.54	57.86	6.60	40.04	50.44	9.52	20.32	54.60	25.08	30.62	54.00	15.39
	Secondary	M	20.55	67.86	11.59	32.20	59.20	8.60	12.76	78.87	8.37	28.16	63.79	8.05	36.02	59.50	4.48	14.69	64.04	21.27	25.62	61.52	12.86
		F	24.28	59.77	15.94	30.00	50.52	19.48	12.60	68.84	18.56	27.87	57.32	14.81	28.93	55.13	15.94	14.63	51.21	34.16	23.77	52.46	23.78
	Higher	M	11.19	67.45	21.36	15.30	63.29	21.41	9.95	70.17	19.88	21.30	54.25	24.46	13.86	69.71	16.42	8.95	61.22	29.83	13.91	62.91	23.17
		F	22.67	56.33	21.00	17.61	62.88	19.51	8.40	72.63	18.97	18.50	61.71	19.79	16.92	60.10	22.98	13.17	55.74	31.09	15.89	55.02	29.09
Religion	Hindu	M	19.96	67.26	12.78	34.21	58.33	7.47	14.32	71.41	14.27	32.10	61.17	6.73	36.28	59.27	4.45	15.41	64.14	20.45	28.78	60.36	10.87
		F	24.37	60.56	15.07	32.42	57.35	10.23	12.58	68.12	19.30	38.58	53.15	8.28	39.05	53.53	7.42	17.12	55.23	27.64	31.91	52.79	15.30
	Muslim	M	20.00	60.00	20.00	24.48	65.86	9.66	15.36	79.79	4.85	47.22	46.93	5.85	29.24	62.39	8.37	11.45	68.88	19.67	27.94	61.20	10.87
		F	13.08	65.98	20.94	33.95	49.79	16.26	20.10	61.64	18.26	58.61	41.39	0.00	34.05	45.63	20.32	11.88	51.05	37.08	29.48	51.65	18.87
	Others	M	10.57	75.60	13.82	15.77	55.49	28.73	10.31	81.39	8.30	13.56	63.73	22.71	27.22	51.22	21.55	10.73	61.98	27.28	19.73	59.78	20.49
		F	24.07	64.97	10.95	12.87	49.40	37.73	10.94	73.79	15.27	39.80	44.51	15.70	20.39	55.76	23.85	13.48	48.19	38.33	18.96	52.73	28.32

Ethnicity	SC	M	19.50	73.40	7.11	39.98	55.78	4.24	11.61	70.94	17.45	40.09	53.09	6.82	39.89	57.81	2.30	16.68	70.02	13.30	33.54	58.64	7.82
		F	26.04	61.51	12.45	36.29	55.45	8.26	10.71	69.77	19.53	49.81	46.89	3.30	40.80	52.03	7.18	20.53	59.87	19.60	36.53	51.83	11.64
	ST	M	23.33	76.67	0.00	53.82	44.12	2.06	10.02	83.68	6.30	34.99	64.15	0.86	40.20	55.66	4.14	46.67	46.67	6.67	37.16	58.82	4.02
		F	25.30	63.20	11.50	49.63	47.39	2.98	10.53	77.85	11.62	51.70	46.26	2.04	47.64	50.55	1.81	60.20	26.42	13.38	45.09	50.33	4.58
	OBC	M	30.14	58.69	11.17	29.85	63.56	6.59	14.82	72.78	12.40	30.81	63.71	5.48	38.49	57.57	3.94	15.22	61.96	22.82	28.18	61.38	10.44
		F	26.99	61.84	11.17	29.54	61.31	9.15	12.67	73.95	13.38	37.03	54.45	8.52	39.61	54.06	6.33	15.23	50.48	34.29	31.70	53.15	15.15
	Other	M	17.56	66.61	15.83	22.23	60.74	17.03	13.71	74.32	11.98	25.90	60.87	13.24	22.64	66.59	10.77	10.83	66.51	22.66	22.88	60.70	16.42
		F	23.16	60.09	16.75	26.95	52.49	20.56	13.59	65.63	20.79	29.36	57.17	13.47	26.57	53.79	19.64	13.62	53.96	32.42	24.56	52.90	22.54
Wealth	Poor	M	23.47	74.19	2.35	42.75	56.32	0.93	15.16	83.00	1.84	38.00	60.30	1.70	42.86	55.44	1.70	27.03	67.56	5.41	40.97	56.86	2.17
		F	29.25	64.24	6.50	40.76	55.76	3.49	18.18	74.44	7.38	52.79	45.70	1.51	46.50	51.69	1.82	27.71	61.54	10.75	47.60	48.99	3.41
	Middle	M	25.92	69.73	4.35	38.92	56.04	5.05	16.29	78.80	4.91	31.66	63.06	5.28	38.08	59.03	2.89	20.19	70.18	9.63	31.38	62.41	6.21
		F	30.44	64.82	4.74	34.57	59.24	6.19	16.92	72.42	10.66	32.04	62.89	5.07	38.83	54.89	6.28	26.00	58.84	15.16	35.34	55.47	9.20
	Rich	M	17.03	65.63	17.34	21.25	63.09	15.66	9.97	72.17	17.86	20.08	61.33	18.59	20.82	66.37	12.81	11.80	63.80	24.40	17.05	62.19	20.76
		F	22.04	59.23	18.73	24.20	55.81	19.99	9.29	66.96	23.75	19.43	58.91	21.66	23.59	54.45	21.96	13.39	51.92	34.69	18.42	53.84	27.74
Occupation	Not working	M	12.18	79.02	8.80	20.00	76.96	3.04	12.34	79.88	7.77	35.36	58.80	5.83	37.09	60.56	2.34	25.05	54.94	20.01	26.35	63.68	9.96
		F	24.95	59.95	15.09	30.32	54.02	15.66	13.71	67.55	18.74	34.40	54.61	10.99	32.02	52.79	15.19	12.87	52.31	34.82	25.89	52.98	21.14
	Prof., tech, manager	M	17.46	63.35	19.19	13.95	67.12	18.93	9.70	64.44	25.87	7.96	60.28	31.76	12.53	72.39	15.08	8.82	70.61	20.57	13.72	61.48	24.81
		F	12.75	51.16	36.09	14.79	59.98	25.24	12.82	61.81	25.36	12.13	66.47	21.40	24.33	58.60	17.07	12.97	52.38	34.65	15.65	54.93	29.42
	Clerical	M	15.44	56.48	28.08	21.89	57.72	20.39	14.16	74.52	11.32	17.89	66.12	15.99	13.83	71.38	14.80	8.89	66.67	24.45	16.49	63.71	19.79
		F	7.99	50.60	41.42	33.33	57.25	9.42	8.68	57.61	33.71	0.00	83.54	16.46	58.52	15.20	26.27	21.14	56.31	22.56	21.57	52.48	25.95
	Sales	M	16.20	61.76	22.04	23.81	61.13	15.05	10.85	66.63	22.52	24.04	59.46	16.49	26.89	66.78	6.33	11.38	56.11	32.51	20.25	59.82	19.93
		F	27.14	65.43	7.43	10.69	62.14	27.17	8.51	64.77	26.73	32.61	57.78	9.61	27.03	52.57	20.40	24.53	41.62	33.84	21.10	53.23	25.68
	Agric-employee	M	24.80	68.35	6.84	39.85	56.48	3.67	13.06	82.67	4.27	34.25	62.76	2.99	39.42	57.88	2.70	13.10	73.81	13.09	35.19	59.39	5.42
		F	26.46	66.80	6.74	34.16	60.18	5.67	14.25	74.35	11.40	52.03	46.10	1.86	45.23	52.71	2.06	26.07	57.98	15.94	43.20	51.42	5.38
	Service	M	12.36	67.64	20.00	33.62	57.37	9.01	11.90	76.83	11.27	27.31	56.42	16.28	25.39	66.76	7.85	5.99	74.00	20.01	22.99	62.51	14.51
		F	4.67	47.67	47.67	37.15	46.45	16.40	3.66	77.96	18.38	29.28	66.30	4.42	49.08	46.62	4.30	14.51	58.22	27.28	27.12	54.51	18.37
	Skilled	M	23.06	70.03	6.90	34.84	58.34	6.82	15.19	74.92	9.89	36.78	59.73	3.49	40.69	54.64	4.67	16.50	63.92	19.58	29.68	60.40	9.92
		F	23.61	59.84	16.55	39.76	52.58	7.65	11.91	72.40	15.69	52.07	46.94	0.99	41.13	54.89	3.98	21.87	55.78	22.35	35.90	52.32	11.78

Alcohol	No	M	19.85	69.93	10.22	33.29	58.35	8.36	13.24	75.46	11.30	30.39	61.12	8.49	34.90	59.51	5.59	13.65	67.50	18.85	28.17	60.15	11.67
		F	24.29	60.71	14.99	32.39	56.52	11.09	12.83	69.59	17.58	37.81	53.19	9.00	37.68	53.26	9.05	15.00	52.97	32.03	30.37	52.77	16.86
	Yes	M	19.70	63.13	17.17	31.09	61.72	7.19	12.59	76.56	10.85	34.11	61.00	4.90	36.64	58.78	4.59	13.84	62.62	23.53	28.15	60.86	10.99
		F	0.00	77.29	22.71	10.88	53.25	35.88	3.16	63.31	33.53	52.00	48.00	0.00	54.28	43.71	2.01	15.51	38.37	46.12	46.37	46.78	6.85
Tobacco	No	M	14.83	69.01	16.16	26.41	60.48	13.11	11.29	74.98	13.73	36.17	55.98	7.85	28.28	61.44	10.28	10.46	63.02	26.52	21.87	61.38	16.75
		F	23.96	60.85	15.20	31.20	57.40	11.40	12.17	70.87	16.95	33.20	55.77	11.03	37.10	53.36	9.54	14.71	52.99	32.30	28.79	53.33	17.88
	Yes	M	24.70	65.71	9.60	35.49	58.55	5.96	13.36	76.40	10.24	34.72	59.81	5.48	33.23	60.95	5.82	17.10	66.85	16.05	31.64	59.89	8.47
		F	45.95	52.55	1.50	43.68	47.35	8.97	13.23	67.66	19.11	48.90	47.57	3.54	43.07	51.31	5.61	36.03	43.98	19.99	45.22	47.51	7.27
Diabetes	No	M	19.85	67.38	12.77	32.86	59.15	7.99	12.66	76.56	10.78	31.95	61.16	6.90	35.61	59.11	5.28	14.11	64.60	21.29	28.27	60.47	11.25
		F	24.47	60.74	14.79	32.35	56.60	11.05	12.58	69.58	17.84	38.90	52.89	8.20	38.43	53.17	8.39	15.38	53.36	31.27	30.94	52.77	16.29
	Yes	M	0.00	19.03	80.97	26.51	26.51	46.99	17.18	52.81	30.00	20.72	62.07	17.21	12.14	86.82	1.04	6.45	67.75	25.80	16.47	57.47	26.06
		F	8.36	55.52	36.12	25.00	39.12	35.88	15.64	63.82	20.54	4.28	47.97	47.75	11.43	26.52	62.05	0.00	33.33	66.67	11.76	42.65	45.59
	DK	M	20.00	80.00	0.00	26.18	73.82	0.00	20.62	67.51	11.87	42.13	57.87	0.00	50.00	50.00	0.00	12.49	70.81	16.70	31.10	59.69	9.21
		F	21.52	67.72	10.76	29.47	50.00	20.53	14.23	65.73	20.04	42.89	52.66	4.45	29.85	70.15	0.00	28.57	71.43	0.00	32.47	51.73	15.79

Note: * 'do not use alcohol'; ** 'using alcohol'; *** 'do not use tobacco'; **** 'using tobacco'; **UW** 'Underweight'; **NW** 'Normal Weight'; **OW** 'Overweight'

SC 'Schedule Caste; **ST** ' Schedule Tribe'; **OBC** ' Other Backward Class'; **No** 'do not have diabetes'; **Yes** 'have diabetes; **DK** ' do not know'

1.6.2.3: Diabetes and Socio-economic and Demographic Indicators

There are variations in the prevalence of diabetes among the different socio economic and demographic characteristics and is very low across the selected states but the prevalence is as high as 3 per cent in the age group 40-49 among male and 2.84 per cent among female in India. But the highest prevalence among male (8.94 per cent) and female (7.19 per cent) in age group 40-49 followed by 2.89 per cent in male and 2.08 per cent in female among 30-39 age group is found in Kerala but it is found to be lowest in age group 21-29 in Himachal Pradesh and Kerala among male and the percentage of male and female who do not know whether they have diabetes is also highest among age group 40-59.

People residing in urban have the higher percentage of diabetes than in rural. The highest percentage is found both in male and female with diabetic in Kerala. But the highest percentage is found in urban male of Kerala and urban female of Orissa who do not know if they have diabetes or not.

As the level of education increases from primary to higher the prevalence of diabetes also increases except with no education. The highest percentage of diabetes is found in Kerala among male with higher education level (5.22 per cent) and female with primary level of education (6.40 per cent) and lowest among male in Himachal Pradesh and Kerala with no education. The highest percentage of diabetes is found among female with no education in Orissa and of male in Himachal Pradesh and Rajasthan. Male and female with primary level of education it is found lowest in Rajasthan. In Rajasthan female with higher level of education is having lowest percentage of diabetes. The highest percentage of male in Kerala with primary level of education and female in Orissa with no education do not know whether they have diabetes or not.

Muslim has the highest percentage of diabetic male but the highest percentage female with diabetes is found in other religion in India. The Hindu and Muslim of Kerala have the highest percentage of male and female with diabetes. But Muslims of Himachal Pradesh and Orissa has almost no diabetic male and female. In Kerala, 4.22 per cent of Hindu and 4.79 per cent of other religions have the highest percentage of male and female who do not know if they have diabetes or not. The highest percentage of diabetic male are found in Rajasthan (0.89 per cent) and diabetic female in Kerala (13.27 per cent) among ST but it is lowest among male in Himachal Pradesh and Kerala and among female in Rajasthan. The highest percentage of diabetes is found both male and female among OBC of Kerala but found lowest among male in Himachal Pradesh and among female in Rajasthan. The highest percentage of

diabetes is found in Kerala for both male and female among other. In Kerala, 13.33 per cent of male among ST do not know if they have diabetes or not.

The prevalence of diabetes among the highest wealth quintile is far greater than the prevalence among those in the lowest wealth quintile. The highest percentage of diabetes is found to be highest among rich quintile for both male (4.78 per cent) and female (3.00 per cent) in Kerala. But the prevalence of diabetes is lowest in Himachal Pradesh among male in poor quintile and among female in Orissa and Kerala in the poor quintile.

In middle quintile, the highest percentage of diabetes is found in Himachal Pradesh, Rajasthan, Madhya Pradesh and Kerala among male and among female in Rajasthan. In Himachal Pradesh four per cent of male among poor do not know if they have diabetes or not. The highest percentage of diabetic male is found among the clerical workers (8.89 per cent) and professional, technical, administrative, and managerial occupations (8.82 per cent) of Kerala. In Himachal Pradesh, female in the service work found to be highest in the prevalence of diabetes as compared to male female do not know if they have diabetes or not and it is highest in female service workers (15.89 per cent).

The prevalence of diabetes is found to be highest for both male and female among the alcohol user and non-user in Kerala. The lowest percentage of diabetic male among alcohol user is found in Madhya Pradesh (0.25 per cent). Among tobacco user the highest percentage of diabetic male and female is found in Kerala (3.62 per cent) and in Manipur (1.41 per cent) respectively. It is also found that in both male and female who are not using alcohol and tobacco have higher percentage of diabetes than those who are using the substances in India.

The highest percentage of diabetes is found among the overweight and normal and lowest is found among underweight while looking at the body mass index of the male as well as women. Kerala has the highest percentage of diabetic male among overweight (4.81 per cent) and Madhya Pradesh has the highest diabetic female among overweight (6.68 per cent). Normal weight male and female of Kerala has the highest percentage of diabetes (4.15 per cent male and 1.76 per cent female). The highest percentage of diabetic male and female are found in Kerala (1.87 per cent) and Manipur (1.28 per cent) among underweight respectively. The lowest percentage of diabetic male and female among overweight are found in Madhya Pradesh (0.13 per cent) and Rajasthan (1.18 per cent) and Manipur (1.18 per cent) respectively. The highest percentage of male and female who do not know if they are diabetic or not is found in Kerala among normal weight (3.36 per cent) and in Orissa among underweight (4.35 per cent).

Table 6: Differential in prevalence of Diabetes across states in different Socio-economic and Demographic Indicators																							
	Background	SEX	Himachal Predesh			Rajasthan			Manipur			Orissa			Madhya Pradesh			Kerala			INDIA		
			No	Yes	DK	No	Yes	DK	No	Yes	DK	No	Yes	DK	No	Yes	DK	No	Yes	DK	No	Yes	DK
Age	21-29	M	99.44	0.00	0.56	98.65	0.28	1.07	98.11	0.57	1.32	97.62	0.64	1.75	99.34	0.66	0.00	99.18	0.00	0.82	98.11	0.42	1.47
		F	99.32	0.30	0.38	99.42	0.24	0.34	98.37	0.48	1.15	97.48	0.17	2.35	99.74	0.13	0.13	99.55	0.30	0.15	99.10	0.23	0.66
	30-39	M	99.01	0.50	0.50	99.36	0.32	0.32	97.02	1.11	1.87	97.04	0.59	2.37	98.88	0.67	0.45	93.86	2.89	3.25	97.08	0.95	1.97
		F	98.62	0.72	0.66	99.19	0.29	0.52	98.48	0.88	0.64	95.23	1.07	3.70	98.95	0.77	0.28	97.32	2.08	0.60	97.93	1.05	1.02
	40-49	M	97.69	0.39	1.92	98.49	0.71	0.80	93.91	2.61	3.48	93.73	4.11	2.16	98.26	0.62	1.13	86.01	8.94	5.05	94.63	3.14	2.23
		F	95.91	2.95	1.15	98.84	0.66	0.51	96.95	2.31	0.73	91.53	1.48	6.99	96.23	2.44	1.33	92.40	7.19	0.41	95.33	2.84	1.83
Residence	Urban	M	99.12	0.88	0.00	99.49	0.25	0.25	96.71	1.60	1.69	95.55	3.86	0.59	99.68	0.32	0.00	89.08	6.14	4.78	97.01	1.80	1.19
		F	98.85	0.96	0.19	98.65	0.54	0.81	97.77	1.17	1.06	96.93	1.63	1.45	97.80	2.02	0.17	96.88	3.12	0.00	97.45	1.84	0.71
	Rural	M	98.72	0.21	1.07	98.52	0.49	0.99	96.58	1.14	2.28	96.48	1.08	2.44	98.52	0.80	0.68	95.26	2.68	2.06	96.66	1.11	2.23
		F	98.12	1.15	0.74	99.41	0.30	0.30	98.28	0.96	0.77	94.87	0.61	4.52	98.87	0.49	0.63	96.78	2.61	0.61	97.98	0.76	1.26
Education	No education	M	97.15	0.00	2.85	97.26	0.78	1.96	97.32	0.67	2.01	95.94	0.64	3.42	99.12	0.59	0.29	100	0.00	0.00	95.91	1.33	2.76
		F	97.20	1.05	1.75	99.12	0.35	0.53	96.85	2.12	1.03	94.16	0.00	5.84	98.59	0.63	0.78	95.73	2.13	2.13	97.83	0.80	1.38
	Primary	M	100	0.00	0.00	99.37	0.00	0.63	95.34	1.41	3.25	96.01	2.11	1.88	98.79	0.40	0.80	90.20	2.93	6.86	96.59	1.19	2.23
		F	97.81	1.75	0.44	99.52	0.48	0.00	98.60	1.40	0.00	95.83	1.33	2.84	99.34	0.65	0.01	93.06	6.40	0.54	97.41	1.32	1.27
	Secondary	M	98.71	0.39	0.90	99.52	0.27	0.21	96.56	1.20	2.23	96.47	1.69	1.84	98.73	0.65	0.62	93.04	3.95	3.01	97.07	1.29	1.64
		F	98.33	1.19	0.48	99.09	0.55	0.36	98.40	0.67	0.93	96.79	0.99	2.22	98.06	1.69	0.25	96.58	2.99	0.43	97.71	1.50	0.79
	Higher	M	98.76	0.29	0.95	99.40	0.60	0.00	97.05	1.61	1.33	97.18	2.35	0.47	98.90	1.10	0.00	94.03	5.22	0.75	97.33	1.84	0.83
		F	99.83	0.17	0.00	99.44	0.00	0.56	98.46	0.49	1.05	93.63	3.41	2.95	97.82	2.18	0.00	99.28	0.72	0.00	98.49	1.12	0.39
Religion	Hindu	M	98.74	0.31	0.96	98.77	0.38	0.85	96.88	1.29	1.83	96.29	1.57	2.14	98.85	0.62	0.53	91.57	4.21	4.22	96.99	1.30	1.71
		F	98.16	1.14	0.70	99.47	0.27	0.27	97.87	1.20	0.93	95.37	0.68	3.95	98.74	0.76	0.50	98.09	1.71	0.20	97.93	1.05	1.02
	Muslim	M	100	0.00	0.00	99.25	0.75	0.00	95.53	2.98	1.49	100	0.00	0.00	98.74	1.26	0.00	95.63	3.82	0.54	95.30	1.75	2.95
		F	100	0.00	0.00	96.44	1.37	2.19	97.96	1.26	0.78	100	0.00	0.00	98.55	0.80	0.66	95.29	4.14	0.57	97.19	1.44	1.37
	Others	M	100	0.00	0.00	100	0.00	0.00	96.57	0.87	2.56	95.48	4.52	0.00	99.77	0.23	0.00	94.23	3.30	2.47	96.81	1.42	1.77
		F	99.23	0.77	0.00	100	0.00	0.00	98.54	0.67	0.79	88.85	6.36	4.79	92.57	7.43	0.00	95.28	4.04	0.68	97.40	1.61	0.99

Ethnicity	SC	M	100	0.00	0.00	98.77	0.00	1.23	95.19	3.21	1.60	95.33	2.17	2.50	99.04	0.48	0.48	92.23	3.33	4.44	96.74	1.32	1.93
		F	98.82	0.39	0.79	98.82	0.55	0.63	97.07	2.35	0.59	96.41	0.77	2.82	99.32	0.35	0.33	95.56	3.54	0.90	97.66	1.06	1.28
	ST	M	100	0.00	0.00	98.22	0.89	0.89	97.55	0.38	2.07	96.11	0.43	3.46	98.76	0.41	0.82	86.67	0.00	13.33	96.90	0.54	2.56
		F	95.98	1.34	2.68	100	0.00	0.00	98.54	0.28	1.18	90.65	0.18	9.16	98.21	0.77	1.02	86.73	13.27	0.00	97.75	0.53	1.72
	OBC	M	97.06	0.00	2.94	98.46	0.65	0.89	95.44	1.11	3.45	96.00	2.73	1.26	99.24	0.57	0.19	90.59	5.79	3.62	97.18	1.24	1.58
		F	98.79	0.60	0.60	99.46	0.28	0.26	96.86	1.51	1.63	97.22	0.78	2.01	99.24	0.39	0.36	96.59	3.10	0.31	98.12	0.96	0.92
	Other	M	98.65	0.47	0.87	100	0.00	0.00	96.73	1.53	1.74	97.31	1.25	1.44	98.14	1.15	0.71	94.97	3.02	2.01	96.31	1.72	1.96
		F	98.10	1.41	0.49	98.54	0.57	0.89	98.26	1.08	0.65	95.53	1.16	3.31	97.19	2.41	0.40	97.24	2.38	0.38	97.53	1.47	0.99
Wealth	Poor	M	95.31	0.00	4.69	98.14	0.62	1.24	96.83	0.56	2.60	96.29	0.90	2.81	99.01	0.57	0.42	94.60	2.71	2.69	96.43	0.98	2.59
		F	96.75	2.17	1.08	99.31	0.29	0.40	98.99	0.50	0.50	94.23	0.00	5.77	99.00	0.27	0.72	100	0.00	0.00	97.85	0.56	1.60
	Middle	M	99.27	0.00	0.73	99.02	0.00	0.98	96.70	1.42	1.88	98.76	0.62	0.62	99.42	0.00	0.58	98.25	0.00	1.75	97.43	0.68	1.89
		F	97.91	0.35	1.75	99.81	0.00	0.19	98.15	0.67	1.18	97.06	1.18	1.76	98.91	0.73	0.36	96.83	1.90	1.27	98.12	0.85	1.04
	Rich	M	98.99	0.45	0.56	99.34	0.46	0.20	96.51	1.44	2.05	94.74	3.63	1.62	98.37	1.11	0.52	91.87	4.78	3.35	96.76	1.95	1.29
		F	98.42	1.25	0.33	98.78	0.61	0.61	97.89	1.32	0.79	95.93	1.91	2.16	97.62	2.21	0.16	96.68	3.00	0.31	97.64	1.61	0.74
Occupation	Not working	M	100	0.00	0.00	100	0.00	0.00	98.28	0.33	1.38	100	0.00	0.00	97.77	0.00	2.23	95.01	4.99	0.00	98.03	0.80	1.17
		F	98.42	1.02	0.57	98.76	0.62	0.62	97.98	0.74	1.28	96.39	0.88	2.72	98.60	1.28	0.12	96.28	3.31	0.41	97.67	1.35	0.98
	Prof., tech, manager	M	97.57	0.92	1.50	98.94	1.06	0.00	94.31	3.01	2.68	95.48	3.39	1.13	98.84	0.09	1.07	91.18	8.82	0.00	96.43	2.54	1.02
		F	96.84	3.16	0.00	100	0.00	0.00	98.46	0.77	0.77	89.13	5.40	5.47	98.27	1.73	0.00	97.97	2.03	0.00	97.95	1.53	0.51
	Clerical	M	100	0.00	0.00	100	0.00	0.00	95.35	3.94	0.71	96.45	3.55	0.00	97.85	2.15	0.00	88.88	8.89	2.23	95.85	2.88	1.26
		F	94.97	0.00	5.03	100	0.00	0.00	96.73	0.00	3.27	100	0.00	0.00	100	0.00	0.00	100	0.00	0.00	98.88	1.02	0.10
	Sales	M	98.42	0.00	1.58	100	0.00	0.00	95.00	2.21	2.79	97.01	2.49	0.50	98.92	0.10	0.98	93.50	4.06	2.44	97.01	1.48	1.51
		F	93.68	6.32	0.00	100	0.00	0.00	98.09	1.91	0.00	96.23	1.89	1.89	85.09	11.20	3.71	98.47	1.53	0.00	96.55	2.06	1.39
	Agric-employee	M	98.29	0.86	0.86	99.29	0.00	0.71	97.46	0.90	1.64	95.52	1.00	3.49	98.46	0.88	0.66	94.05	1.19	4.76	96.30	1.23	2.47
		F	98.55	0.72	0.72	99.75	0.13	0.13	98.07	1.41	0.52	93.61	0.31	6.07	99.27	0.00	0.73	95.64	1.45	2.91	98.22	0.58	1.20
	Service	M	100	0.00	0.00	100	0.00	0.00	100	0.00	0.00	96.38	3.62	0.00	100	0.00	0.00	96.01	0.00	3.99	97.28	1.24	1.48
		F	84.11	15.89	0.00	98.18	0.00	1.82	96.34	3.66	0.00	97.10	0.00	2.90	94.80	2.64	2.56	94.56	5.44	0.00	96.91	1.67	1.42
	Skilled	M	98.85	0.00	1.15	97.87	0.82	1.31	96.33	0.77	2.90	96.87	1.65	1.48	99.38	0.62	0.00	92.80	3.60	3.60	97.13	1.09	1.78
		F	98.33	0.00	1.67	98.49	0.55	0.97	98.37	0.56	1.07	91.38	0.00	8.62	98.46	0.93	0.61	98.85	1.15	0.00	97.73	0.91	1.36

Alcohol	No*	M	98.71	0.09	1.20	98.93	0.39	0.68	96.13	1.76	2.11	97.16	1.57	1.28	98.51	0.88	0.62	94.54	3.82	1.64	96.91	1.33	1.76
		F	98.20	1.13	0.68	99.23	0.37	0.40	98.12	1.05	0.83	95.70	0.86	3.44	98.56	0.98	0.46	96.85	2.76	0.39	97.83	1.15	1.01
	Yes**	M	98.87	0.64	0.49	98.57	0.48	0.96	97.03	0.92	2.06	95.22	1.63	3.15	99.53	0.25	0.22	91.51	4.12	4.36	96.57	1.41	2.02
		F	100	0.00	0.00	85.88	0.00	14.12	96.84	0.00	3.16	89.39	0.00	10.61	98.19	0.00	1.81	92.25	7.75	0.00	96.51	0.45	3.04
Tobacco	No***	M	98.65	0.60	0.75	99.07	0.65	0.28	95.76	2.02	2.23	97.76	1.79	0.45	98.33	1.00	0.66	93.63	4.33	2.04	97.14	1.62	1.24
		F	98.17	1.14	0.69	99.34	0.32	0.35	98.51	0.75	0.75	96.25	0.86	2.88	98.72	1.03	0.24	96.77	2.84	0.39	97.94	1.13	0.93
	Yes****	M	98.89	0.00	1.11	98.75	0.31	0.93	96.89	1.08	2.03	95.84	1.53	2.63	99.04	0.54	0.42	92.24	3.62	4.14	96.59	1.22	2.20
		F	100	0.00	0.00	97.60	0.91	1.49	97.56	1.41	1.04	93.46	0.69	5.84	97.72	0.57	1.71	100	0.00	0.00	96.74	1.22	2.04
Body Mass Index	Underweight	**M**	99.06	0.00	0.94	99.08	0.33	0.59	94.95	1.73	3.33	96.21	1.03	2.76	99.11	0.22	0.67	95.33	1.87	2.80	97.15	0.79	2.05
		F	99.01	0.39	0.60	99.30	0.29	0.41	97.74	1.28	0.98	95.56	0.09	4.35	99.33	0.29	0.39	99.26	0.00	0.74	98.44	0.44	1.12
	Normal	**M**	98.81	0.08	1.11	98.89	0.18	0.92	97.26	0.90	1.85	96.40	1.62	1.99	98.64	0.96	0.40	92.49	4.15	3.36	96.87	1.29	1.84
		F	98.22	1.03	0.75	99.35	0.26	0.40	98.23	0.95	0.82	95.35	0.73	3.92	98.87	0.48	0.66	97.71	1.76	0.52	98.03	0.92	1.05
	Overweight	**M**	98.11	1.89	0.00	97.60	2.40	0.00	94.25	3.51	2.23	96.04	3.96	0.00	99.87	0.13	0.00	92.77	4.81	2.41	95.40	3.10	1.50
		F	96.81	2.71	0.48	97.99	1.18	0.82	97.84	1.18	0.97	93.34	4.57	2.09	93.32	6.68	0.00	94.20	5.80	0.00	95.87	3.12	1.01

Note: * 'do not use alcohol'; ** 'using alcohol'; *** 'do not use tobacco'; **** 'using tobacco'; **SC** 'Schedule Caste; **ST** 'Schedule Tribe'; **OBC** 'Other Backward Class'; **No** 'do not have diabetes'; **Yes** 'have diabetes; **DK** ' do not know'

1.6.3: Effect of various socio demographic indicators on Basal Metabolic Rate, Body Mass Index and Diabetes

The body's generation of heat is known as thermogenesis and it can be measured to determine the amount of energy expended. BMR decreases with age generally (as people usually don't maintain lean body mass) and with the loss of lean body mass. Increase in muscle mass increases BMR. Aerobic fitness level, a product of cardiovascular exercise, while previously thought to have effect on BMR, has been shown in the 1990s not to correlate with BMR, when fat-free body mass was adjusted for. New research has, however, come to light that suggests anaerobic exercise does increase resting energy consumption. Illness, previously consumed food and beverages, environmental temperature, and stress levels can affect one's overall energy expenditure as well as one's BMR. Basal metabolism is usually by far the largest component of total caloric expenditure. However, the Harris-Benedict equations are only approximate and variation in BMR (reflecting varying body composition), in physical activity levels, and in energy expended in thermogenesis make it difficult to estimate the dietary consumption any particular individual needs in order to maintain body weight.

The basal metabolic rate varies between individuals. One study of 150 adults representative of the population in Scotland reported basal metabolic rates from as low as 1027 kcal per day (4301 kJ) to as high as 2499 kcal (10455 kJ); with a mean BMR of 1500 kcal (6279 kJ). Statistically, the researchers calculated that 62.3 % of this variation was explained by differences in fat free mass. Other factors explaining the variation included fat mass (6.7 %), age (1.7%), and experimental error including within-subject difference (2 %). The rest of the variation (26.7 %) was unexplained. This remaining difference was not explained by sex nor by differing tissue sized of highly energetic organs such as the brain (Alexandra M Johnstone et.al. 2005).

The BMI is generally used as a means of correlation between groups related by general mass and can serve as a vague means of estimating adiposity. The duality of the BMI is that, whilst easy-to-use as a general calculation, it is limited in how accurate and pertinent the data obtained from it can be. Generally, the index is suitable for recognizing trends within sedentary or overweight individuals because there is a smaller margin for errors (Jeukendrup, A. and Gleeson, M. 2005).

1.6.3.1: Factors affecting Basal Metabolic Rate

The logistic regression result explains the differential even after controlling various socio-cultural, economic and demographic factors and each state under study in India. From the analysis it is found that there are differentials in Basal Metabolic Rate, Body Mass Index and Diabetes among various socio economic and demographic characteristics of population. Literatures have shown that age has significant effect on basal metabolism, as the age increases there is more likely to have lesser BMR in both the sex. The analysis show that in Manipur and Orissa, the male residing in rural areas are less likely to have BMR greater than the mean BMR than the urban areas and female in Himachal Pradesh, Manipur, Orissa, Madhya Pradesh and Kerala are less likely to have BMR greater than the mean BMR. As the level of education increases, there is likelihood of having BMR greater than the mean and is shown highly significant in Manipur and Orissa among male with primary, secondary and higher level of education as compared with no education. There is significant difference in male with higher level of education and tend have BMR greater than mean BMR in all the states. In case of secondary level education, female in all states are more likely to have BMR greater than mean BMR and is found highly significant in Himachal Pradesh, Rajasthan, Orissa and Madhya Pradesh. With higher level of education, it is more likely to have BMR greater than mean BMR among female in all states and is found highly significant except Manipur ($p=0.05$ level of significance). Muslim male of Rajasthan and Kerala are more likely to have BMR greater than mean as compared with Hindu but female among Muslim and other religions are more likely to have BMR greater than mean BMR in Kerala. Scheduled Tribes of Himachal Pradesh and Rajasthan (both male and female) are less likely to have BMR greater than mean BMR among male but in Orissa male are more likely to have BMR greater than mean BMR. The male among OBC in Orissa Madhya Pradesh and Kerala are more likely to have BMR greater than the mean BMR and show highly significant difference but in Rajasthan it is more likely to have BMR greater than mean BMR among OBC female. In Orissa, Madhya Pradesh and Kerala it is more likely to have BMR greater than mean and are highly significant in Madhya Pradesh and Kerala among other ethnic group male. In Orissa among female of other ethnic group, it more likely to have BMR greater than mean BMR. In all the states except Kerala it is more likely to have BMR greater than the mean BMR and is highly significant in Rajasthan, Manipur and Orissa among the rich quintile male.

Table 7: Odds ratio showing the likelihood of having greater than mean BMR by different socioeconomic & demographic Indicator																	
Background		***SEX***	**Himachal Pradesh**		**Rajasthan**		**Manipur**		**Orissa**		**Madhya Pradesh**		**Kerala**		**INDIA**	
POR	Rural	*M*	0.92		1.17		0.75	***	0.69	**	1.03		0.87		0.96	
		F	0.67	***	0.96		0.75	***	0.76	**	0.77	*	0.67	***	0.76	***
Education	Primary	*M*	1.10		1.38		2.33	***	1.79	***	1.27		0.64		1.16	***
		F	1.32		1.33	*	1.35		1.73	***	1.19		1.09		1.21	***
	Secondary	*M*	2.26	*	1.89	***	2.63	***	3.31	***	1.84	***	1.85		1.77	***
		F	1.96	***	1.66	***	1.40	**	2.46	***	2.12	***	2.23	**	1.61	***
	Higher	*M*	2.68	*	3.44	***	3.00	***	5.02	***	4.66	***	4.60	**	2.90	***
		F	2.12	***	2.40	***	1.42	**	3.52	***	3.36	***	3.35	***	2.27	***
Religion	Muslim	*M*	1.87		1.63	**	1.30		0.84		1.14		1.65	**	1.09	*
		F	1.03		1.22		1.31		0.75		1.19		1.60	***	1.21	***
	Others	*M*	1.85		1.28		0.98		0.67		0.84		1.14		1.43	***
		F	1.13		0.87		1.11		0.70		0.68		1.35	**	1.70	***
Ethnicity	ST	*M*	0.29	**	0.58	**	1.23		1.74	**	1.16		0.93		0.90	*
		F	0.64		0.63	**	0.78		1.22		0.81		0.42		0.88	**
	OBC	*M*	0.67		1.20		1.08		2.28	***	1.64	***	2.82	***	1.23	***
		F	0.73		1.48	***	0.88		1.20		0.95		1.12		1.09	**
	Other	*M*	1.19		0.81		1.26		1.75	**	2.29	***	3.56	***	1.42	***
		F	0.99		1.12		0.91		1.43	*	1.22		1.23		1.09	**
Wealth Index	Middle	*M*	1.06		1.02		1.11		1.33		1.30		0.97		1.58	***
		F	0.92		1.20		0.96		1.49	**	1.06		0.88		1.47	***
	Rich	*M*	2.06	*	1.75	***	2.18	***	1.98	***	1.40	*	1.49		2.76	***
		F	1.42		2.08	***	1.88	***	1.83	***	1.57	***	1.61		2.61	***
Occupation	Prof., tech, manager	*M*	0.39	**	0.43	*	0.70	*	0.78		0.72		1.83		0.83	**
		F	2.27	***	1.71		0.76		1.14		0.38	***	0.69	*	0.89	*
	Clerical	*M*	0.47	*	0.38	*	0.45	***	0.41	*	0.80		1.83		0.70	***
		F	0.81		0.35	*	1.04		4.31		0.13	***	0.51	**	0.81	*
	Sales	*M*	0.50	*	0.38	**	0.77		0.85		0.88		2.60	*	0.95	
		F	0.58		1.12		1.29		0.74		1.47		0.72		1.05	
	Agric-employee	*M*	0.33	***	0.37	**	0.53	***	0.74		0.99		1.86		0.71	***
		F	0.74	**	1.12		0.64	***	0.73	*	0.64	***	0.42	***	0.70	***
	Service	*M*	0.63		0.27	**	0.68		1.53		0.83		1.83		0.79	**
		F	5.46		1.00		0.93		1.21		0.28	***	0.71		0.78	***
	Skilled	*M*	0.42	**	0.33	**	0.55	***	0.69		1.10		2.41	*	0.82	**
		F	1.01		0.68	**	0.87		0.90		0.78	*	0.56	***	0.77	***
A use	Yes	*M*	1.50	**	0.94		1.12		0.91		0.90		1.59	**	1.11	***
		F	0.73		18.53	**	1.44		1.16		0.83		1.45		1.05	
T Use	Yes	*M*	0.61	**	0.87		0.75	***	0.65	**	0.84		0.66	**	0.72	***
		F	0.47		0.70	**	0.95		0.64	***	0.75	**	1.05		0.54	***
Diabetes	Yes D	*M*	1.00		4.11		1.20		0.77		0.80		0.73		1.13	
		F	1.41		0.60		0.43	*	2.11		6.51	***	2.44	***	1.77	***
	DK D	*M*	0.39		1.34		0.71		0.77		0.58		0.59		0.83	*
		F	0.50		1.55		1.28		0.88		0.91		0.66		0.85	

Note: (***) = p < 0.010 level of significance; (**) = p < 0.050 level of significance; (*) = p < 0.100 level of significance

The BMR among female is more likely to be higher than the mean BMR among rich quintile and is found highly significant in Rajasthan, Manipur, Orissa and Madhya Pradesh. In India the middle and rich quintile in both the sex show highly significant difference in the BMR and it is greater than the mean compared with poor quintile. Male who are in professional, technical, administrative, and managerial occupations are less likely to have BMR greater than the mean BMR in Himachal Pradesh, Rajasthan and Kerala. In Himachal Pradesh among female it is more likely to have BMR greater than mean BMR but female Madhya Pradesh (highly significant) and Kerala are less likely to have BMR greater than the mean BMR. Among male clerical workers in Himachal Pradesh, Rajasthan, Manipur and Orissa and female in Rajasthan and Madhya Pradesh are less likely to have BMR greater than the mean BMR and it is found highly significant among female in Madhya Pradesh and among male in Manipur. Among the agricultural workers, male in Himachal Pradesh, Manipur and Rajasthan and female in Himachal Pradesh, Manipur, Orissa, Madhya Pradesh and Kerala are less likely to have BMR greater than mean. Similarly among service worker and skilled and un-skilled worker, male in Rajasthan and female in Madhya Pradesh are less likely to have BMR greater than the mean (highly significant in Madhya Pradesh service worker) as compared with the non-workers. Skilled and unskilled worker males in Himachal Pradesh, Rajasthan and Manipur (highly significant) it is less likely to have BMR greater than mean BMR except Kerala and among females in Rajasthan, Madhya Pradesh and Kerala (highly significant) as compared with non-workers. Male using alcohol is more likely to have BMR greater than the mean BMR and is showing highly significant in India. In Himachal Pradesh and Kerala among male and in Rajasthan among female who use alcohol are more likely to have BMR greater than mean BMR than those who do not use. In Himachal Pradesh, Manipur, Orissa and Kerala it is less likely to have BMR greater than mean BMR among male who use tobacco and in Rajasthan, Orissa and Madhya Pradesh among females. In Madhya Pradesh and Kerala female with diabetes are more like to have BMR greater than mean BMR and is found highly significant but it is less likely to have BMR greater than mean BMR in Manipur among female. Male who don't know whether they have diabetes or not are less likely to have BMR greater than mean BMR than who do not have diabetes in India.

1.6.3.2: Factors affecting Body Mass Index

The analysis shows that even after controlling for various factors, age has significant effect on Body Mass Index, there is more likely to be overweight as the age increases in both the sex across the states. Rural male and female are less likely to be overweight than urban male and female and it is showing highly significant in all the states among female but in Manipur it is showing significant difference among male. It is highly significant for both the sex in India. Male and female who attain higher level of education are more likely to be overweight in India and is showing significant difference in Orissa and Madhya Pradesh among male and in Madhya Pradesh among female but it is less likely among female in Manipur. Female in Orissa and Madhya Pradesh who attain secondary level of education are more likely to be overweight than those who have no education. Muslim female are more likely to be overweight than Hindu in Rajasthan, Manipur, Madhya Pradesh and Kerala and is highly significant in India but among male it is less likely to be overweight in Manipur (highly significant). In other religious groups it is more likely to be overweight than Hindu in Orissa and in India as a whole also found highly significant among male. In case of female of other religions they are less likely to be overweight than the Hindu. The likelihood of overweight is more among ST male in Madhya Pradesh and less likely in Orissa among male and among female in Rajasthan and Orissa and is found highly significant in India (female). In Manipur it is less likely to be overweight among OBC female and male in other ethnic groups than the SC. It is more likely to be overweight in middle and rich wealth quintile among male and female than in poor wealth quintile male and female and it is found to be highly significant in India. It is more likely to be obese among male in middle quintile in Rajasthan and Manipur than the male in poor quintile.

In Rajasthan, Manipur, Orissa and Madhya Pradesh for both the sex in rich quintile it is more likely to be overweight than the poor quintile male and female. Male who are professional, technical, administrative, and managerial occupations are more likely to be overweight than the non-workers and is found significant correlation in Manipur and Orissa and India as whole and among female in Himachal Pradesh it is more likely to be overweight than non-workers and is found highly significant. It is more likely to be overweight among male who are in sale work in Manipur and Orissa and is found highly significant in India.

Table 8: Odds ratio showing the likelihood of Overweight by different socio-economic & demographic Indicators																			
Background			Himachal Pradesh		Rajasthan		Manipur		Orissa		Madhya Pradesh		Kerala		INDIA	
Age	30-39	*M*	3.66	**	2.57	***	2.26	***	1.51		2.49	**	2.03	***	2.24	***
		F	2.85	***	2.96	***	2.90	***	3.35	***	5.44	***	2.20	***	2.81	***
	40-49	*M*	8.45	***	3.32	***	2.87	***	3.35	***	7.78	***	1.90	**	2.88	***
		F	5.92	***	4.69	***	4.58	***	5.40	***	11.06	***	2.95	***	4.18	***
POR	Rural	*M*	0.97		0.61		0.72	**	0.73		0.61		0.86		0.77	***
		F	0.52	***	0.52	***	0.65	***	0.47	***	0.47	***	0.75	***	0.61	***
Education	Primary	*M*	0.48		0.73		1.45		5.12		0.98		0.32		1.18	*
		F	1.11		1.33		1.05		1.24		1.77	**	0.91		1.27	***
	Secondary	*M*	0.56		1.23		0.94		8.34	**	1.83		0.63		1.54	***
		F	1.50		1.32		1.09		2.00	**	2.14	***	1.86		1.71	***
	Higher	*M*	0.78		1.85		1.34		17.18	***	4.76	***	1.06		2.00	***
		F	1.67		0.91		0.64	*	1.48		2.26	**	1.88		1.77	***
Religion	Muslim	*M*	2.35		1.06		0.38	***	0.35		1.32		1.22		1.02	
		F	1.01		1.49	*	1.85	**	1.00		1.84	**	1.62	***	1.35	***
	Others	*M*	0.97		1.28		0.88		7.41	***	1.86		1.12		1.58	***
		F	0.82		2.15	*	1.30		1.86		0.50	*	1.35	**	1.60	***
Ethnicity	ST	*M*	1.00		0.85		0.73		0.13	**	4.08	*	0.74		0.76	**
		F	0.86		0.65		0.55	*	1.04		0.54		0.43		0.61	***
	OBC	*M*	1.36		1.43		0.88		0.42	*	1.67		1.23		1.08	
		F	0.71		1.16		0.56	*	1.53		0.78		1.03		1.08	
	Other	*M*	1.46		1.95		0.75		0.69		2.14		1.26		1.29	***
		F	0.91		1.35		1.14		1.64		1.19		0.89		1.10	*
Wealth	Middle	*M*	1.31		4.68	**	2.36	**	1.94		1.75		1.78		2.33	***
		F	0.70		1.55		1.42		2.08		1.77		1.10		2.06	***
	Rich	*M*	4.02		9.26	***	6.54	***	3.46	***	4.12	***	3.70	*	5.81	***
		F	2.48	*	3.51	***	3.42	***	5.98	***	4.06	***	2.41	**	4.53	***
Occupation	Prof., tech, manager	*M*	0.69		3.15		2.46	***	3.52	**	1.84		0.62		1.60	***
		F	2.09	***	1.31		1.40		0.97		0.59		0.89		0.92	
	Clerical	*M*	1.66		3.77		0.91		1.87		1.83		0.83		1.19	
		F	2.31		0.43		1.76		0.71		0.91		0.55	*	0.82	
	Sales	*M*	1.34		3.88		2.18	***	3.32	*	1.73		1.58		1.84	***
		F	0.27	**	1.79		1.27		1.75		0.76		0.90		1.11	
	Agric-employee	*M*	0.36		3.71		0.70		1.52		2.92		0.78		1.04	
		F	0.48	***	0.85		0.66	**	0.79		0.45	**	0.47	**	0.56	***
	Service	*M*	1.18		3.16		1.08		1.82		2.42		1.02		1.33	**
		F	8.29	*	0.92		0.81		0.55		0.24	*	0.65		0.83	**
	Skilled	*M*	0.46		3.81		1.44		1.51		3.52		1.18		1.30	**
		F	1.46		0.66		0.81		0.27	*	0.62		0.62	**	0.68	***
A use	Yes A	*M*	2.18	***	1.06		0.95		1.35		1.10		1.79	**	1.24	***
		F	4.26		6.41	***	3.63	***	1.00		0.63		1.59		1.15	
T Use	Yes T	*M*	0.44	***	0.64	*	0.96		0.77		0.79		0.59	**	0.65	***
		F	0.11	***	0.69		1.00		0.59	*	0.80		1.14		0.58	***
Diabetes	Yes D	*M*	14.81	*	23.25	***	2.56	**	0.79		0.18		0.92		1.62	***
		F	1.68		2.82		0.70		3.25	**	6.26	***	3.00	***	2.18	***
	DK D	*M*	1.00		1.00		0.90		1.00		1.00		0.69		1.11	
		F	0.72		1.22		1.55		0.73		1.00		1.00		1.22	

Note: (∗∗∗) = p < 0.010 level of significance; (∗∗) = p < 0.050 level of significance; (∗) = p < 0.100 level of significance

There is no significant difference among both the sex in service worker except in Himachal Pradesh where female are eight times more likely to be overweight and in Madhya Pradesh where female are less likely to be overweight as compared with non-working category. Among the skilled and non-skilled workers female in Orissa and Kerala are less likely to be overweight than non-working category and is found highly significant in India for both the sex. Male and female who use alcohol it is more likely to be overweight and is found highly significant among male in Himachal Pradesh and Kerala and among female in Rajasthan and Manipur. In India it is highly significant among male. In case of tobacco consumption it is less likely to be overweight among tobacco user than those who do not consume tobacco. It is found significant in Himachal Pradesh, Rajasthan and Kerala and highly significant both male and female in India. It is found significant among female in Himachal Pradesh and Orissa and in India as a whole. Significant difference is found among male and female who are diabetic to those who are not diabetic but there is no significant difference among those who do not know whether they are diabetic or not. In Himachal Pradesh, Rajasthan, Manipur and India as a whole male who are diabetic are more likely to be overweight than non-diabetic and is found to be highly significant in Rajasthan. In Orissa, Madhya Pradesh, Kerala and India female with diabetes are more likely to be overweight than having no diabetes and is found highly significant.

1.6.3.3: Factors affecting Diabetes

The analysis shows that even after controlling for various factors, age has significant effect on diabetes, as the age increases there is more likely to have diabetes in both male and female and is found highly significant in India and selected states as a whole. Female who are residing in rural areas are less likely to have diabetes than female in urban areas and is found to be highly significant in India. Female with secondary level of education are more likely to have diabetes and is also found to be highly significant in India and it is more likely to have diabetes among female with primary level of education than female with no education. As the level of education increases it is less likely to have diabetes among male and is significant in India. But there is no significant difference when looking at the states. Muslim male and female are more likely to have diabetes than the Hindu and is found to be highly significant in Muslim female. In case of other religions significant difference is found among female as they are more likely to have diabetes than the Hindu. It is less likely to have diabetes among ST and OBC male than SC male and is found highly significant among ST male in India.

Rich quintile female are more likely to have diabetes than the poor quintile female and is highly significant in the selected states as a whole. But female of middle quintile are less likely to have diabetes than the poor quintile female. There is no significant difference found among male in wealth quintiles. The female who are engaged in agricultural work are less likely to have diabetes than non-working and those female who are in service work are more likely to have diabetes. In India, male who use alcohol are more likely to have diabetes than those who do not use alcohol but on the contrary male who use tobacco are less likely to have diabetes in the selected states as a whole and in India. Those who are overweight are more likely to have diabetes than who are underweight and is found highly significant among female in the selected states as a whole and India.

Male who are overweight are more likely to have diabetes in India but no significant difference is shown among selected states as a whole and female with normal weight are more likely to have diabetes than who are underweight in India. Male whose basal metabolic rate is greater than mean BMR are more likely to have diabetes and shown significant relationship in India.

Table 9: Odds ratio showing the likelihood of having Diabetes by different Socio-Economic & Demographic Indicators								
	Background	Selected States				INDIA			
		Male		*Female*		*Male*		*Female*	
Age	30-39	2.06	**	3.25	***	2.17	***	4.37	***
	40-49	6.07	***	9.12	***	7.48	***	11.84	***
POR	Rural	0.88		1.08		0.90		0.68	***
Education	Primary	1.36		1.40		0.81		1.37	*
	Secondary	1.55		1.20		0.78		1.61	***
	Higher	1.04		0.65		0.70	*	1.14	
Religion	Muslim	2.21	**	2.02	***	1.47	**	1.40	**
	Others	1.18		1.85	**	0.77		1.06	
Ethnicity	ST	0.36	*	0.78		0.41	***	0.74	
	OBC	0.92		0.86		0.74	*	0.76	
	Other	0.65		0.90		0.85		0.84	
Wealth	Middle	0.85		1.48		0.66	**	1.09	
	Rich	1.55		2.60	***	1.55	**	1.08	
Occupation	Prof., tech, manager	2.75		1.31		1.45		0.99	
	Clerical	3.27		1.00		1.48		0.66	
	Sales	1.92		1.80		1.00		1.31	
	Agric-employee	1.73		0.54	*	1.17		0.75	
	Service	0.39		2.22	*	0.80		1.11	
	Skilled	1.85		0.74		0.88		0.81	
A^{+} Use	Yes	1.23		0.51		1.27	*	0.58	
T^{++} Use	Yes	0.66	*	0.94		0.78	*	1.32	
BMI	Normal	1.12		1.59		1.25		1.48	**
	Overweight	1.50		3.25	***	1.77	**	2.57	***
BMR	>mean BMR	1.40		1.40		1.29	*	1.32	

Note: (***) = p < 0.010 level of significance; (**) = p < 0.050 level of significance; (*) = p < 0.100 level of significance;
$^{+}$ 'Alcohol'; $^{++}$ 'Tobacco'

1.6.4: Discussion and Conclusions

From the study we found that there are variations in the Basal Metabolic Rate between male and female and also within the same sex determined by the socio-economic and demographic characteristics. Highest mean BMR is found in Kerala both for male and female and lowest mean BMR is found in Orissa for both the sex. The mean BMR of India clearly shows that there is variation in the metabolism of both the sex, may be because of climatic variation or other socio-economic and demographic factors. One of the major factors that affect BMR is the age. BMR decreases with increase in age which marks the physical deterioration where all cellular function becomes retarded and in turn become a victim of many degenerative diseases. Logistic regression result also shows that socio economic and demographic factors also have some effect on BMR in some states like rich people are more likely to have higher BMR than the poor. Similarly those who are engaged in manual works are more likely to have higher BMR than the sedentary worker. Those persons who are highly educated tend to have higher BMR and those who reside in rural areas are less likely to have higher BMR than those in urban areas. From the finding it is evident that BMR is also highly correlated with Diabetes as those who are diabetic are more likely to have BMR greater than mean BMR and also significant difference is found in some states. It is also found that those who use alcohol are more likely to have higher BMR than those who do not use but it is contradictory for tobacco use. Similarly while looking in body mass index higher percentage of overweight male are found in older age group and is highest in Kerala for both the sex. Logistic regression result also shows that age is highly correlated with overweight showing highly significant result. While looking at the place of residence those who are residing in urban areas are more likely to be overweight than the rural areas. There is higher percentage of overweight found among those who attain higher level of education and it shows variation among states as the literacy level of each state are not similar but no significant result is found in logistic regression among the states but there is more likelihood of being overweight among those who attain higher education in India. Like in metabolism, wealth is also an important factor for being overweight in male as well as in female and significant difference is found between rich and poor in almost all states and in India as whole. The present study found that according to the level of physical activity where occupation is taken as proxy for

physical activity it is found that those who are sedentary workers are more likely to be overweight than those who are physically active for example those professional worker engineer etc. (moderate physical activity) and agricultural worker (heavy physical activity) it is more likely that the sedentary worker will be more overweight than those who are moderate where the physical activity is more and is showing significant difference in some states. It also clearly shows that alcohol users are closely related with overweight as those who use alcohol are more likely to overweight than those who do not use and is contradiction for tobacco use as they are less likely to be overweight as compared with those who do not use tobacco. Overweight is highly correlated with diabetes according to our finding. Though the percentage of diabetes is very low in India as well as in the selected states there is variation in the prevalence of diabetes among various socio-economic and demographic indicators across the states and even between sexes. Highest percentage of diabetic male and female are found in older age group residing in urban areas than those who have higher level of education in the rich quintile among less physically active professionals those who are overweight mostly. Logistic regression result showed high correlation between those indicators with diabetes.

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APPENDIX

Appendix 1: Sample Size Male								
Background		Himachal Predesh	Rajasthan	Manipur	Orissa	Madhya Pradesh	Kerala	INDIA
Age	21-29	232	387	1032	373	716	244	18160
	30-39	260	343	945	401	694	277	17439
	40-49	202	274	701	302	552	257	13589
	Total	**695**	**1005**	**2678**	**1076**	**1961**	**778**	**49188**
Residence	urban	91	336	899	198	598	292	17528
	rural	604	669	1779	878	1363	486	31660
	Total	695	1005	2678	1076	1961	778	49188
Education	no	45	281	178	278	527	11	10120
	primary	82	175	253	253	386	102	8771
	secondary	432	407	1548	419	748	531	23057
	higher	136	142	699	125	300	134	7222
	Total	**695**	**1005**	**2678**	**1075**	**1961**	**778**	**49170**
Religion	Hindu	677	874	1385	1053	1766	474	40708
	Muslim	6	113	262	10	138	183	5680
	Others	12	18	1032	13	58	121	2800
	Total	695	1005	2678	1076	1961	778	49188
Ethnicity	SCs	130	178	169	190	323	90	9249
	STs	33	124	632	275	377	15	4123
	OBCs	88	465	420	281	825	276	19309
	Others	444	238	1456	330	437	397	16507
	Total	695	1005	2678	1076	1961	778	49188
Wealth	Poor	55	355	424	593	1097	37	16764
	Middle	176	225	883	191	270	114	10165
	Rich	464	426	1370	292	594	627	22260
	Total	695	1005	2678	1076	1961	778	49188
Occupation	Not working	59	28	227	40	69	20	1827
	prof., tech, manager	86	80	295	52	145	68	3496
	Clerical	61	33	107	33	72	45	1953
	sales	82	103	319	118	159	123	6397
	Agric-employee	151	309	964	477	705	84	16187
	Service	27	47	104	32	46	50	2400
	Skilled	225	401	661	322	761	388	16856
	total	691	1002	2676	1075	1957	778	49116
Alcohol Use	no	431	775	1192	605	1262	366	30648
	yes	264	230	1486	471	699	412	18539
	Total	695	1005	2678	1076	1961	778	49187
Tobacco Use	no	346	299	618	264	469	392	17498
	yes	349	706	2060	812	1492	386	31690
	Total	695	1005	2678	1076	1961	778	49188
Diabetes	No	686	993	2588	1036	1939	723	47606
	Yes	2	4	35	17	13	31	668
	DK	6	7	56	23	9	24	914
	Total	695	1005	2678	1076	1961	778	49188
Body Mass Index	Underweight	138	330	345	344	697	107	13854
	Normal	468	594	2037	657	1162	505	29718
	Overweight	89	81	296	74	103	166	5616
	Total	695	1005	2678	1076	1961	778	49188

Appendix 2: Sample Size Female								
Background		Himachal Predesh	Rajasthan	Manipur	Orissa	Madhya Pradesh	Kerala	INDIA
Age	21-29	670	803	820	688	1226	664	21464
	30-39	632	740	729	614	1109	672	19012
	40-49	443	547	438	403	821	486	12419
	Total	1745	2090	1987	1704	3156	1822	52896
Residence	urban	195	621	702	324	950	667	18502
	rural	1550	1469	1285	1380	2206	1155	34394
	Total	1745	2090	1987	1704	3156	1822	52896
Education	no	362	1409	431	728	1795	47	22291
	primary	290	227	229	315	507	187	7461
	secondary	873	303	927	539	625	1171	17773
	higher	219	150	401	122	229	417	5366
	Total	1744	2090	1987	1704	3156	1822	52891
Religion	Hindu	1682	1859	1172	1652	2828	994	42555
	Muslim	14	203	157	14	237	532	6836
	Others	48	28	658	37	92	297	3505
	Total	1745	2090	1987	1704	3156	1822	52896
Ethnicity	SCs	322	348	127	233	482	112	8188
	STs	95	239	439	320	609	15	3986
	OBCs	210	974	212	536	1288	643	20558
	Others	1118	529	1208	614	777	1051	20165
	Total	1745	2090	1987	1704	3156	1822	52896
Wealth	Poor	117	750	244	873	1719	65	16476
	Middle	363	437	586	306	428	158	10082
	Rich	1265	903	1158	526	1009	1598	26338
	Total	1745	2090	1987	1704	3156	1822	52896
Occupation	Not working	1182	895	636	1077	1352	1237	29340
	prof., tech, manager	80	62	160	44	100	147	2014
	Clerical	25	12	23	7	14	71	562
	sales	20	20	220	31	42	65	989
	Agric-employee	350	856	474	385	1072	69	13444
	Service	8	46	34	40	61	55	1572
	Skilled	76	199	439	118	516	174	4931
	total	1742	2090	1985	1702	3156	1818	52852
Alcohol Use	no	1743	2082	1947	1584	3070	1809	51679
	yes	2	8	39	119	86	13	1210
	Total	1745	2090	1986	1703	3156	1822	52889
Tobacco Use	no	1720	1905	1130	1099	2610	1797	46638
	yes	25	185	857	605	546	25	6258
	Total	1745	2090	1987	1704	3156	1822	52896
Diabetes	No	1714	2073	1949	1623	3110	1764	51732
	Yes	20	8	20	14	30	51	602
	DK	12	9	17	67	16	7	563
	Total	1745	2090	1987	1704	3156	1822	52897
Body Mass Index	Underweight	423	675	251	661	1204	273	16257
	Normal	1060	1181	1381	900	1673	963	27848
	Overweight	262	234	355	143	280	586	8792
	Total	1745	2090	1987	1704	3156	1822	52896

Appendix 9: Basal Metabolic Rate over ages across states														
Age	Himachal Pradesh		Rajasthan		Manipur		Orissa		Madhya Pradesh		Kerala		INDIA	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
21	1514.79	1297.27	1493.83	1313.15	1493.03	1324.94	1443.85	1294.18	1501.61	1292.22	1566.70	1334.84	1501.59	1304.63
22	1510.27	1298.72	1506.97	1297.29	1502.62	1314.06	1453.60	1289.40	1471.76	1288.95	1599.15	1336.07	1486.29	1300.70
23	1519.79	1312.85	1472.88	1299.16	1506.18	1316.61	1456.64	1280.84	1466.33	1288.72	1545.19	1338.50	1493.48	1301.58
24	1525.27	1315.06	1490.36	1291.24	1489.92	1314.17	1450.71	1270.45	1449.01	1284.32	1561.34	1336.82	1492.08	1303.03
25	1461.35	1289.44	1495.79	1294.08	1489.66	1314.57	1422.13	1278.45	1452.31	1270.28	1573.10	1341.12	1473.20	1298.01
26	1457.05	1299.80	1492.45	1303.80	1478.90	1311.62	1412.93	1274.07	1438.68	1268.14	1577.17	1378.73	1481.90	1298.54
27	1492.24	1280.12	1504.54	1307.73	1463.10	1306.16	1454.86	1267.55	1468.62	1279.56	1630.67	1359.68	1486.51	1296.65
28	1519.85	1299.81	1468.72	1281.14	1474.57	1309.74	1433.40	1256.57	1466.31	1270.96	1597.47	1367.97	1478.45	1295.51
29	1505.76	1292.71	1458.13	1300.22	1490.82	1316.35	1431.02	1252.49	1473.75	1268.77	1521.25	1344.61	1493.40	1292.29
30	1483.73	1300.68	1470.01	1279.21	1456.93	1305.98	1418.37	1253.72	1429.04	1249.41	1544.73	1345.46	1451.71	1281.95
31	1509.48	1277.28	1502.53	1289.14	1481.52	1301.37	1402.96	1277.01	1453.69	1269.61	1635.52	1347.32	1481.08	1290.52
32	1525.23	1283.74	1492.61	1262.16	1445.36	1313.76	1395.97	1255.58	1432.12	1253.91	1588.57	1354.19	1465.36	1286.87
33	1518.49	1288.77	1482.19	1280.24	1454.18	1301.21	1431.38	1247.99	1468.48	1254.98	1580.58	1350.99	1470.40	1282.94
34	1456.11	1291.51	1464.47	1274.31	1431.38	1302.13	1412.45	1265.47	1473.43	1243.35	1563.17	1329.75	1465.73	1286.43
35	1427.99	1286.27	1467.55	1275.01	1440.22	1313.80	1376.32	1230.86	1400.11	1235.69	1513.55	1321.45	1419.97	1276.58
36	1538.73	1308.30	1485.40	1266.12	1436.18	1297.85	1346.50	1249.11	1423.64	1264.72	1514.77	1332.74	1449.58	1280.63
37	1439.69	1291.80	1479.82	1275.34	1439.07	1286.21	1349.67	1234.81	1413.09	1252.72	1528.27	1331.91	1456.98	1275.46
38	1393.54	1280.70	1439.66	1258.55	1437.31	1286.06	1338.01	1224.88	1412.46	1236.91	1461.82	1300.69	1419.24	1263.37
39	1406.64	1284.67	1501.99	1277.51	1420.65	1284.45	1384.80	1219.95	1387.63	1229.62	1494.27	1313.55	1444.47	1275.09
40	1371.11	1291.43	1403.67	1237.68	1430.62	1287.62	1342.97	1222.29	1370.50	1235.89	1481.57	1293.64	1380.79	1260.23
41	1450.68	1269.23	1437.62	1249.72	1386.75	1293.32	1362.15	1208.19	1395.64	1235.41	1483.29	1297.64	1424.94	1263.93
42	1468.15	1265.58	1379.54	1260.10	1432.01	1280.16	1346.76	1216.80	1442.43	1249.17	1489.13	1311.36	1405.18	1264.44
43	1407.03	1316.53	1471.34	1246.31	1413.45	1270.18	1441.10	1235.67	1373.05	1232.75	1411.99	1308.28	1404.42	1254.15
44	1413.28	1273.08	1434.08	1223.51	1402.53	1250.03	1289.53	1193.62	1420.94	1209.95	1559.78	1314.20	1403.69	1256.78
45	1376.32	1250.10	1379.26	1247.01	1389.09	1233.09	1309.90	1207.85	1343.20	1223.58	1385.40	1289.53	1350.73	1246.85
46	1443.54	1244.02	1425.55	1244.20	1376.42	1270.46	1364.31	1189.77	1325.00	1220.37	1455.74	1245.22	1379.48	1245.21
47	1430.22	1207.32	1411.88	1290.97	1350.13	1263.65	1390.82	1212.38	1402.85	1229.68	1428.04	1288.13	1384.91	1244.69
48	1439.42	1268.47	1336.82	1226.76	1347.01	1238.38	1263.65	1165.08	1324.50	1201.51	1414.46	1301.82	1357.78	1233.15
49	1323.25	1249.44	1324.75	1220.18	1376.44	1217.21	1345.77	1208.66	1332.39	1200.03	1351.81	1289.90	1362.66	1243.21