# *Chapter – 6*

## *Human Health in the Neighbourhood of Chemical and Petrochemical Industries*

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## 6.1 INTRODUCTION

The processes of industrialisation provide better job opportunities and leads to regional and economic development of a region. On the contrary, industrialisation affects the demographic pattern by inviting the skilled persons from outside, income inequality, traditional local economic pattern and causes health hazards by polluting the environment. The hazardous waste released from the industries pollutes the soil, water and air which adversely affects the human health. Related to this, the chemical and petrochemical industries on one hand, may help in regional development but on the other hand it may cause contamination of soil, groundwater and surface water by industrial waste. Groundwater, surface water and soil are important compounds that affect human body and health directly or indirectly. The results from chapters 2, 3, 4 and 5 revealed the presence of different elements in water and soil and the disposal of industrial waste and its impact on sub-surface water. The presence of the elements above desirable limit can create health issues ranging from mild to severe. Thus, the present chapter focuses upon the health conditions in the neighbourhood of chemical and petro-chemical industrial complex considering the industrial waste, contamination of water and soil and the socio economic factors.

### 6.1.1 Industrialisation and Human Health

Human health and industrialisation are positively related. Different studies (Ruston, 2003; Hamer, 2003; Vrijheid, 2000; Su G, 2005; Lee et al., 2010; Porta et al., 2009) state that many diseases are directly a result of polluted environment which may be a result of the industrialisation. Injudicious disposal of solid and liquid waste and release of pollutant gases adversely affect the water, soil and atmosphere. The pollution of water, soil and gases directly or indirectly affects human health. Even a single pollutant may cause a wide range of health effects and the occurrence of ailment is related with the different level of exposure to the polluted environment. Briggs (2005) stated that about 8 - 9% of the different types of diseases of the world are because of this factor. Improper waste management, unsafe water and polluted environment in the industrial regions possess a great challenge to the people living adjacent to the dumpsites.

### 6.1.2 Role of Socio-Economic Status on Human Health

Household analysis of the different issues like age, gender, marital status, body mass index, income, education and occupation is useful to understand the role of socio economic status on the health of the people. Further, it would be helpful in understanding the contribution of socio-economic status on the health condition. This chapter also discusses the possible impact of chemical and petro-chemical industries on human health.

The health pattern in the present study was based on the analysis of house hold survey conducted at 22 places using structured schedule. These were randomly selected from the neighbourhood of the chemical and petro-chemical industrial areas. Fifteen (15) surveyed places were villages, while *Bajwa, Karachiya Nandesari* and *Ranoli* are the census towns and three (*Chhani, Karodiya* and *Undera*) are urban outgrowths (Census, 2011). The incidence of diseases such as dental, nervous system

disorders, eye and ear, hair, skin, abdominal, respiratory and general (skeletal and dullness/dizziness) problems were observed in the study area.

**Table 6.1: Basic Information of the Surveyed Places**

| Sample Code | Places | Types | Area sq.km. | Total Population | Surveyed Population | Affected Population |
|---|---|---|---|---|---|---|
| 1 | Ajod | V | 4.05 | 2661 | 937 | 650 |
| 2 | Anagadh | V | 11.36 | 14780 | 848 | 253 |
| 3 | Ankodiya | V | 5.21 | 4608 | 939 | 236 |
| 4 | Bajwa | CT | 1.91 | 9611 | 929 | 614 |
| 5 | Chhani | OG | 8.74 | 23933 | 862 | 552 |
| 6 | Dasharath | OG | 9.26 | 11438 | 956 | 789 |
| 7 | Dhanora | V | 3.74 | 4006 | 877 | 214 |
| 8 | Dodka | V | 7.69 | 3724 | 963 | 520 |
| 9 | Fajalpur | V | 6.13 | 4740 | 925 | 418 |
| 10 | Gorva | OG | 7.77 | 9337 | 960 | 582 |
| 11 | Karachiya | CT | 0.96 | 7103 | 860 | 424 |
| 12 | Karodiya | OG | 2.55 | 9256 | 897 | 435 |
| 13 | Koyli | OG | 11.8 | 10691 | 892 | 355 |
| 14 | Nandesari | CT | 7.85 | 8290 | 740 | 399 |
| 15 | Padmala | V | 6.95 | 5446 | 874 | 431 |
| 16 | Ranoli | CT | 6.92 | 11726 | 880 | 435 |
| 17 | Rayka | V | 5.95 | 1981 | 911 | 194 |
| 18 | Sankarda | V | 7.34 | 7460 | 806 | 477 |
| 19 | Sisva | V | 4.18 | 2799 | 1033 | 731 |
| 20 | Sokhda | V | 11.8 | 12610 | 817 | 581 |
| 21 | Undera | CT | 4.39 | 16902 | 822 | 449 |
| 22 | Vasna-Kotariya | V | 4.96 | 3974 | 917 | 549 |
| | Total | | 141.51 | 187076 | 19645 | 10288 |
| | V - Village | | CT- Census Town | | OG – Out Growth | |

*Source: District Census Handbook – Vadodara 2001 & www.censusindia.gov.in/census_data_2001/village_directory/population data*

## 6.2 OVERALL PREVALENCE RATE

>50% of the total surveyed population was affected by one or the other disease. The prevalence rate of diseases varied from >80% in *Dasharath* which is adjacent to GSFC to 20% in *Rayaka* which is far from the industrial estate. (Table: 6.2) The villages of *Anagadh, Ankodiya* and *Dhanora* had registered lower incidence rates and all three of them are on the west of the Golden Corridor.

The incidence of diseases was higher (60%) in females than in their counterparts (40%). The difference of prevalence rate was higher in *Chhani, Bajwa, Undera, Ajod, Sokhda, Nandesari, Dasharath* and *Koyli* while in *Dodka, Rayaka, Gorwa,* and *Dhanora* the difference was less (Table:6.2). All the females (100%) of *Dasharath* village were suffering from one or the other disease. The percentage was also high (90%) in *Ajod, Bajwa, Sokhda* and *Chhani*. The occurrence of diseases among women in *Dodka, Padmala* and *Karodiya* was less than the average incidence rate (60%). The incidence of diseases among males was less (39%) than the females. Highest incidence of males was observed in *Dashrath* (65%) followed by *Sisva, Gorwa, Dodka, Sokhda* and *Vasna-Kotariy*a (>50%) while lowest was in *Ankodiya, Rayaka* and *Dhanora*. Male prevalence rate at *Chhani*, *Undera*, *Nandesari, Karachiya* and *Fajalpur* was less than the male average prevalence rate.

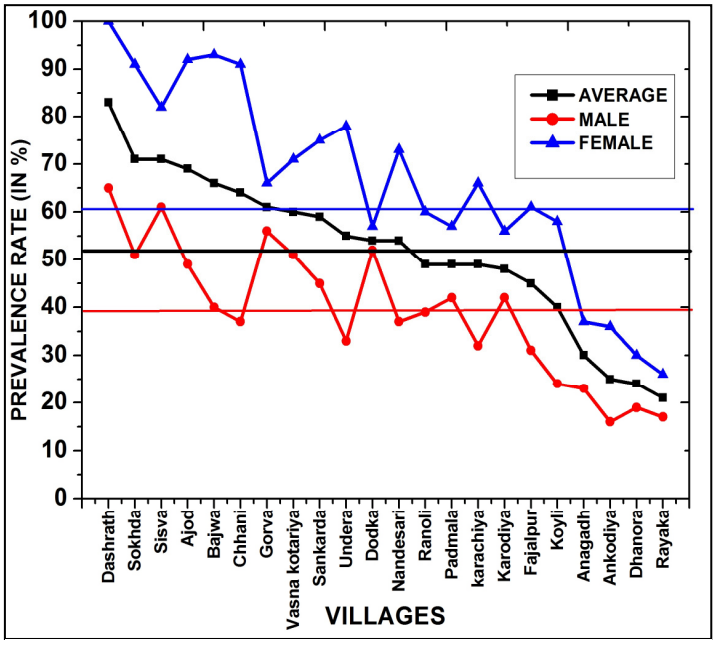


**Fig.6.1: Overall Prevalence Rate of Diseases**

**Table 6.2: Prevalence Rate of Diseases**

| Places | Total | Male | Female |
|---|---|---|---|
| Ajod | 69.37 | 48.98 | 91.72 |
| Anagadh | 29.83 | 23.48 | 36.79 |
| Ankodiya | 25.13 | 15.54 | 35.56 |
| Bajwa | 66.09 | 40.42 | 92.95 |
| Chhani | 64.04 | 36.98 | 90.97 |
| Dasharath | 82.53 | 65.06 | 100.00 |
| Dhanora | 24.40 | 19.30 | 29.93 |
| Dodka | 54.00 | 51.73 | 56.66 |
| Fajalpur | 45.19 | 30.66 | 61.28 |
| Gorva | 60.63 | 55.93 | 65.86 |
| Karachiya | 49.30 | 32.49 | 66.43 |
| Karodiya | 48.49 | 42.01 | 56.23 |
| Koyli | 39.80 | 24.01 | 58.11 |
| Nandesari | 53.92 | 37.02 | 72.65 |
| Padmala | 49.31 | 41.89 | 57.42 |
| Ranoli | 49.43 | 39.34 | 60.24 |
| Rayka | 21.30 | 17.31 | 25.51 |
| Sankarda | 59.18 | 45.22 | 75.07 |
| Sisva | 70.76 | 60.93 | 81.54 |
| Sokhda | 71.11 | 51.21 | 91.36 |
| Undera | 54.62 | 32.94 | 77.83 |
| Vasna-Kotariya | 59.87 | 50.51 | 70.66 |
| **Total** | **52.37** | **39.00** | **66.33** |

*Source: Computed*

## 6.3 AGE AND GENDER WISE PREVALENCE RATE

### 6.3.1 Ajod

The overall prevalence rate of diseases in this village was 69.37%. Dental problems were highest (30%) followed by hair, eye and ear problems. Other ailments like skin, respiratory and abdominal had the least occurrence of around 5%. In terms of age wise pattern, a general increase in dental problems with advancing age was observed. The prevalence of this disease among children (<14 years) was low (10%). The rise of this ailment and general symptoms was noticed from the age of thirty years. A vice versa situation prevailed in problems related to hair where 35% of children and 3% of elderly were reported to suffer. Similarly, the percentage of

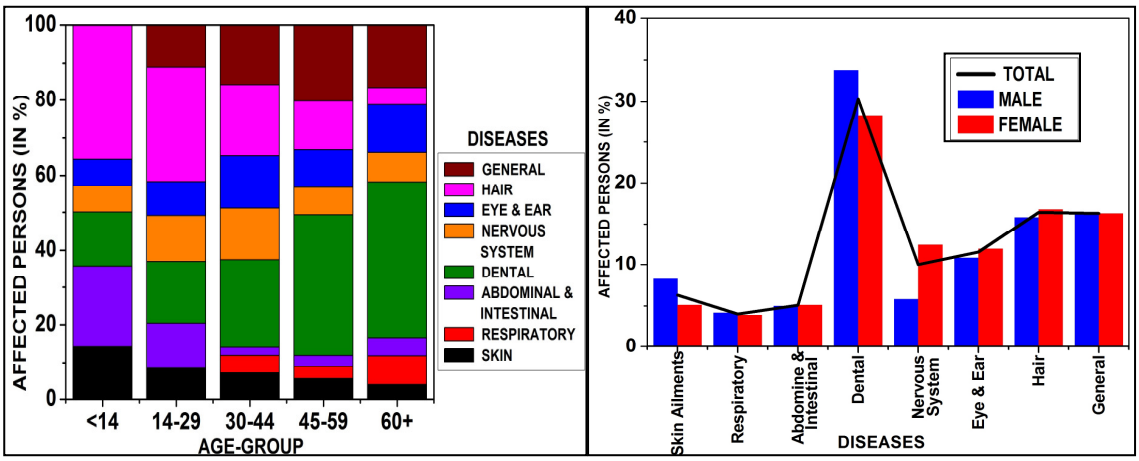


**Fig.6.2: Age and Gender Wise Prevalence Rate in *Ajod***

people suffering from abdominal and intestinal diseases also decreased with age in Ajod village.

Not much gender wise difference was noted in the prevalence of various diseases. One conspicuous observation perceived was the higher percentage of men with dental issues. The level of *fluoride* was below the desired limits in the entire area and *Ajod* was one of the villages where this level was Below Detectable Limit (BDL). Further, the problems in males enhanced because of the habits like chewing of tobacco and gutka.

### 6.3.2 Ankodiya

The occurrence of diseases (25.13% prevalence rate) was low in this village. The percentage of patients suffering from various diseases was <25%. Noticeable

clustering of diseases in various age groups in *Ankodiya* were apparent. 58% of the children suffered from skin diseases. 40% people between 14 and 29 years had hair problems, 30% between 30 to 44 years showed signs of general symptoms and 20% in the same age group had ailments related to hair. 45% persons between 45 to 59 years showed signs of dullness, dizziness and skeletal problems. Symptoms of breathlessness, chest pain, dizziness, dullness and skeletal disorders were seen in the 25% of the elderly.

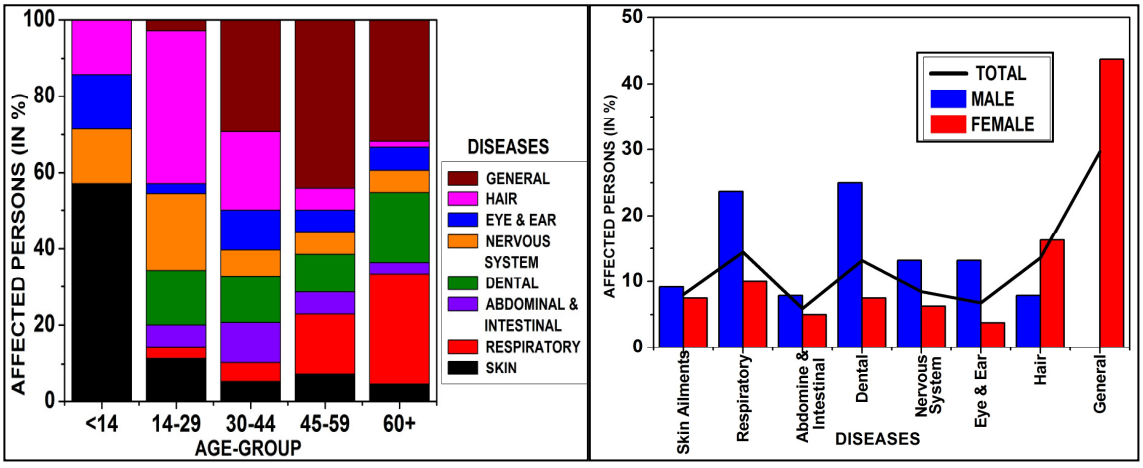


**Fig.6.3: Age and Gender Wise Prevalence Rate in *Ankodiya***

General symptoms were higher amongst women, 40% of them had general problems (fever, dizziness, dullness and skeletal disorders). Contrarily, there were no noted general symptoms in men. The number of females suffering from hair problems was <10% and it was less than their counterparts (16.25%). Remarkable genderwise differences in respiratory and dental problems were observed and the percentage of females suffering from these two diseases was higher. Hair problems depicted a reversed trend with number of females suffering was more than the males.

### 6.3.3 Anagadh

35% was the overall prevalence rate in the village, which was much below the area's average. The incidence of dental problems (30%) and general symptoms (25%) was higher. The occurrence of diseases increased with age is a common phenomena and Anagadh village was no exception. Respiratory, abdominal, intestinal and hair problems were less in elderly but dental problems were more widespread amongst all.

General problems were more conspicuous from the age of thirty years. The prevalence rate was higher among females (35%) than males (23%).The percentage of females suffering was more in skin, respiratory, dental, hair and general symptoms, while in abdominal eye and ear problems the occurrence was higher in males.

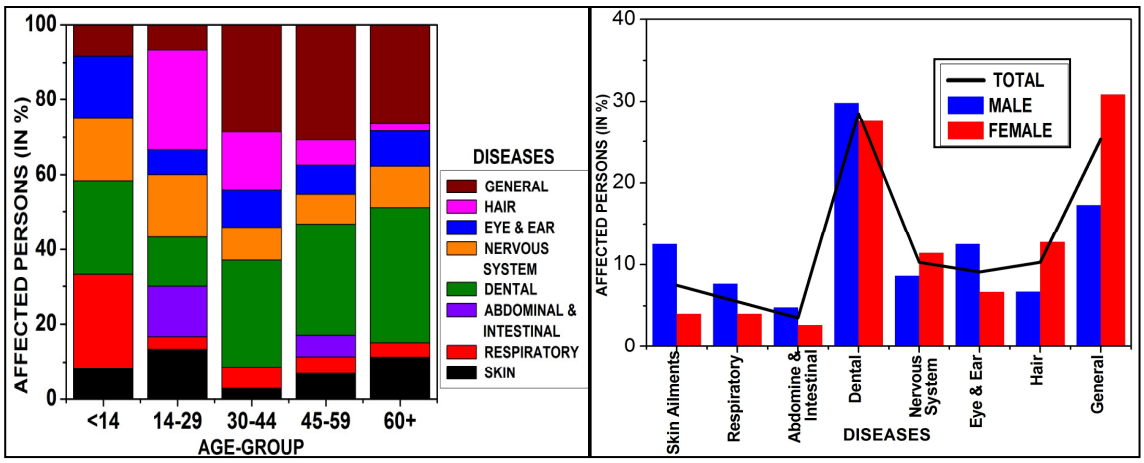


**Fig.6.4: Age and Gender Wise Prevalence Rate in *Anagadh***

### 6.3.4 Bajwa

*Bajwa* is located between the IPCL and GSFC and nearness to industrial area affecting the human health can best be the example by perceiving the case of this village. The incidence of dental, nervous, eye and ear, hair and general symptoms was

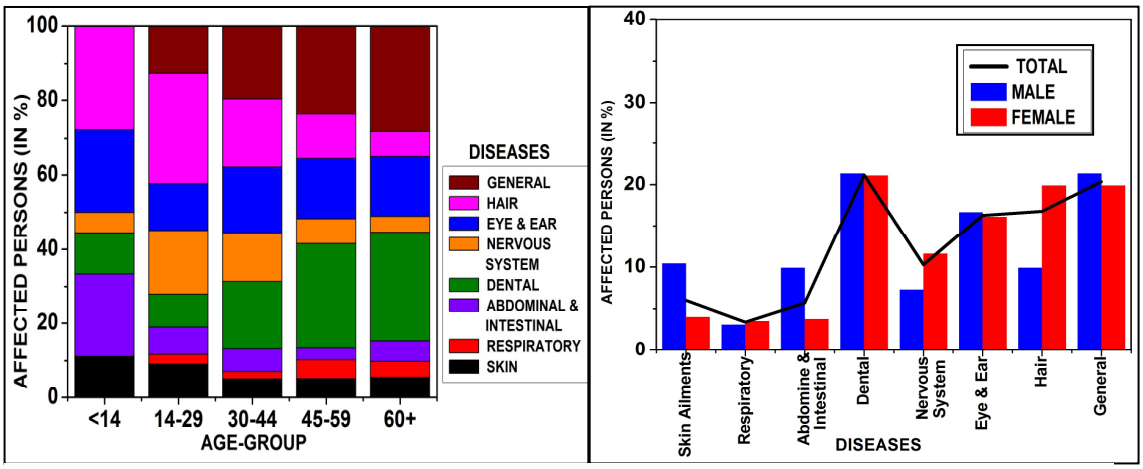


**Fig.6.5: Age and Gender Wise Prevalence Rate in *Bajwa***

20%. Low incidences rates were noted in skin, respiratory and abdominal ailments. A gradual increase in the incidence rates was observed with the advancing age. Ailments related with nervous system was highest (10%) in people of 14-29 years and negligible

both in children and elderly. General symptoms were absent in children but the incidence rate increased with age [(7% in 14-29 years), (20% in 30-44 years), (25% in 45-59 years) and (30% in >60 years)]. Reversal of this trend viz. decline of occurrence of disease with age was visible only in skin diseases. As far as gender wise pattern is concerned, nervous and hair problems were higher amongst women. The gap of occurrence between the two genders was less in dental, eye and ear, respiratory and general symptoms.

### 6.3.5 Chhani

The overall prevalence rate was 65% which was much above the average. Age wise pattern revealed the lower incidence in the problems related to nervous system, eye and ear ailments. Higher occurrence was noted in hair problems followed by abdominal and intestinal diseases, general symptoms and skin diseases in children. Dental problems were more which increased with age (22% in 45-59 years and 35% in 60+ population). There was absence of respiratory problems upto 30 years of age.

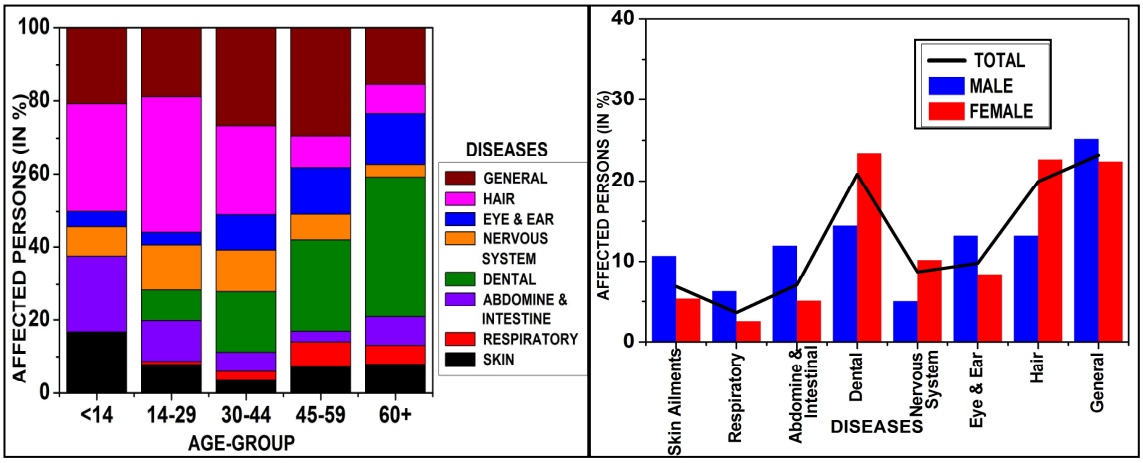


**Fig.6.6: Age and Gender Wise Prevalence Rate in *Chhani***

General symptoms were higher with >20% in all ages. The incidence of eye and ear rose after 30 years. Gender wise variation was observed (35% for males and 90% for females respectively). Dental, hair and general symptoms affected >20% people while lower proportion (<10%) was noted in skin ailments, respiratory, nervous system, eye and ear problems. *Chhani* is adjacent to GSFC industrial area which manufactures a variety of chemicals. Women were more exposed to the open environment while

washing clothes and utensils in open, working in fields, going out to fetch household items and even cooking food in open enhances the chances of dust getting settled on head and further intensifying the risk of hair ailments.

### 6.3.6 Dasharath

In the study area the prevalence of diseases was highest (85%) in this village. Disturbing conditions were observed in hair problems when 60% of the population till the age of 30 years was adversely affected. Later, a decline in the percentage of affected people was observed. Incidences of dental problems increased after 30 years. Prolonged use of water with high concentration of *TDS* was one of the reasons for the

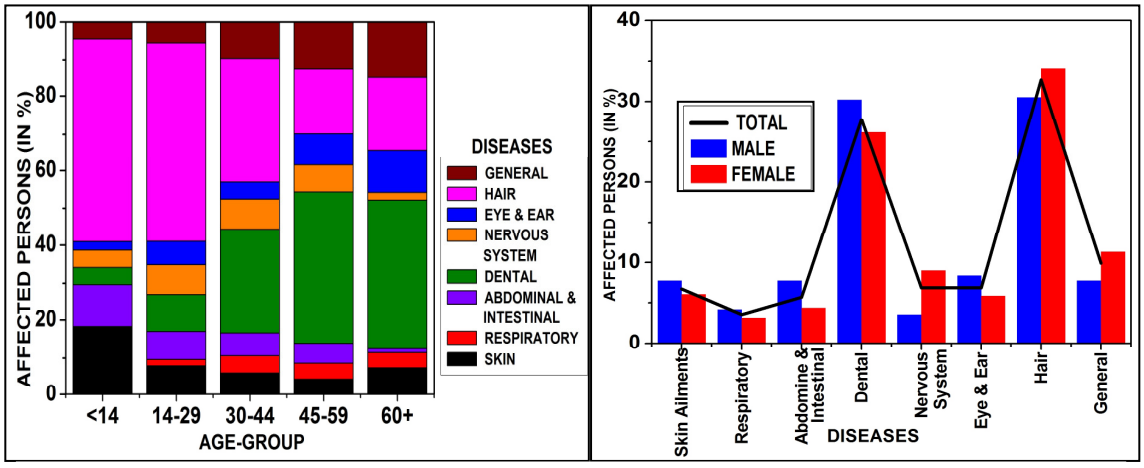


**Fig.6.7: Age and Gender Wise Prevalence Rate in *Dasharath***

occurrence of this phenomenon. All the females of the village and 65% of the males suffered from one or the other disease. The village is situated in the neighbourhood of two big industries IPCL and GSFC. 30% of the surveyed population suffered from dental and hair problems. The other diseases were not so rampant in the village.

### 6.3.7 Dhanora

The overall prevalence rate in the village was very low (25%) and was second lowest (only next to *Rayaka*). 30% of children and people <45 years of age were affected by dental ailments. One-third of the people of 30-44 years suffered from dullness and dizziness. One-third people between 14-29 years suffered from hair problems. Abdominal and intestinal diseases were either absent or negligible in all age groups with <1% females and 5% males were affected from the disease. 30% of

females and 20% males complained of one or the other ailment. Dental problems were conspicuous in both the genders (25%). The occurrence of other diseases varied between 10% - 15%.

### 6.3.8 Dodka

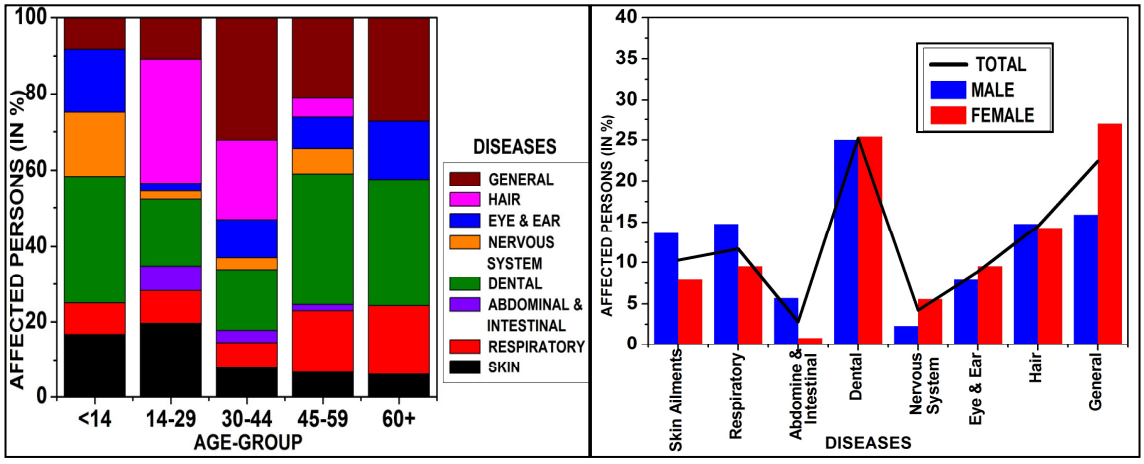


**Fig.6.8: Age and Gender Wise Prevalence Rate in *Dhanora***

The overall prevalence rate in *Dodka* was 50% and not much difference was noted neither in the disease wise incidence nor between the two genders. Dental ailments were highest (25%). The occurrence of other diseases varied between 8%-18%. Problems related to nervous system were negligible in children and diseases related to skin, hair and abdomen declined after 30 years. Contrarily, the incidences of dental problems increased after this age. The incidence of dental, nervous system, abdomen and intestine was higher in females. The number of males was more with

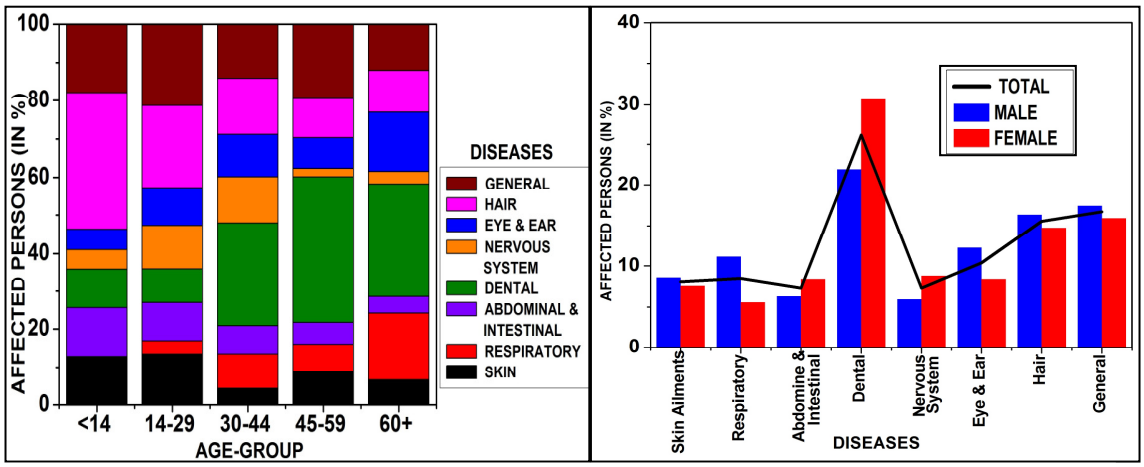


**Fig.6.9: Age and Gender Wise Prevalence Rate in *Dodka***

respiratory, hair, eye and ear problems. In skin ailments the affected percentage of two genders was more or less same.

### 6.3.9 Fajalpur

The overall incidence was lower in the males and also in the incidence of skin, respiratory, abdominal and intestinal diseases. Increase in the incidence of general symptoms and dental problems with advancing age was noticed. Contrarily, a decline

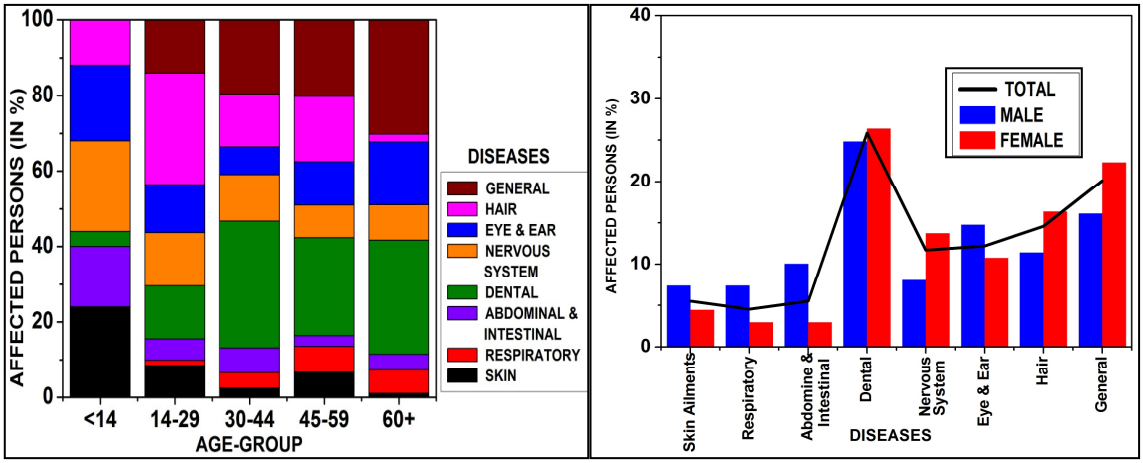


**Fig.6.10: Age and Gender Wise Prevalence Rate in *Fajalpur***

in prevalence rates was observed in ailments related to hair, skin, abdomen and intestine. Problems related to nervous system was a cause of concern in this village with 5%-10% of population affected with this problem. The issue was grave in children with almost one-fourth of them were sufferers. Higher rates of occurrence of dental, hair, general symptoms and nervous diseases was observed among females. Higher incidence of dental problems was observed in both the gender (25%).

### 6.3.10 Gorva

The incidence of diseases in *Gorwa* village was more or less near to the area's average. The overall average was 60% while that of females it was 65% and males 55%. Dental (28%) and hair problems (23%) were the most prevalent diseases. Skin, respiratory and abdominal problems had a lower percentage of occurrences. The prevalence of other diseases was <10%. The influence of the urban area was observed in the age wise pattern, where skin diseases were almost absent in children and also not much fluctuation in the incidence of various diseases was observed. The incidence rate was between 20%-30% for dental problems and general symptoms. The highest

cases (40%) were detected with hair problems in children while in other age groups the variation was between 15%-20%. Low occurrence of respiratory problems (<10%) and ailments related to nervous system (<5%) was also observed. The rate of occurrence was identical in both males and females. Problems related to nervous system, eye and ear were higher in females.

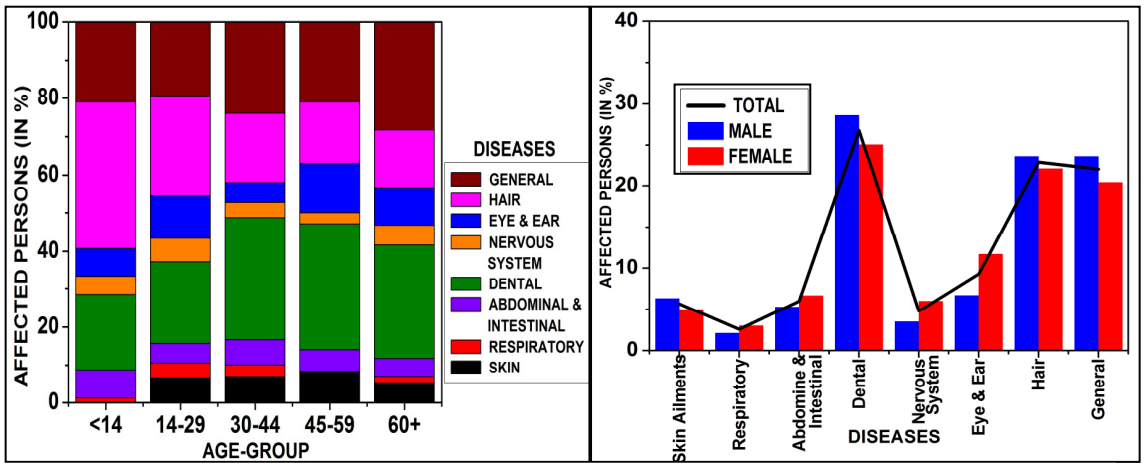


**Fig.6.11: Age and Gender Wise Prevalence Rate in *Gorva***

### 6.3.11 Karachiya

Prevalence rate of *Karachiya* village was close to the area's average (50%). Increase in the incidence of dental problems and decline of skin and hair ailments was evident in this village. The occurrence of disorders of skin ailment, respiratory, abdominal and intestinal problems >14 years of age was <10%. The problems related to respiratory and nervous system were absent in children while hair, abdominal and

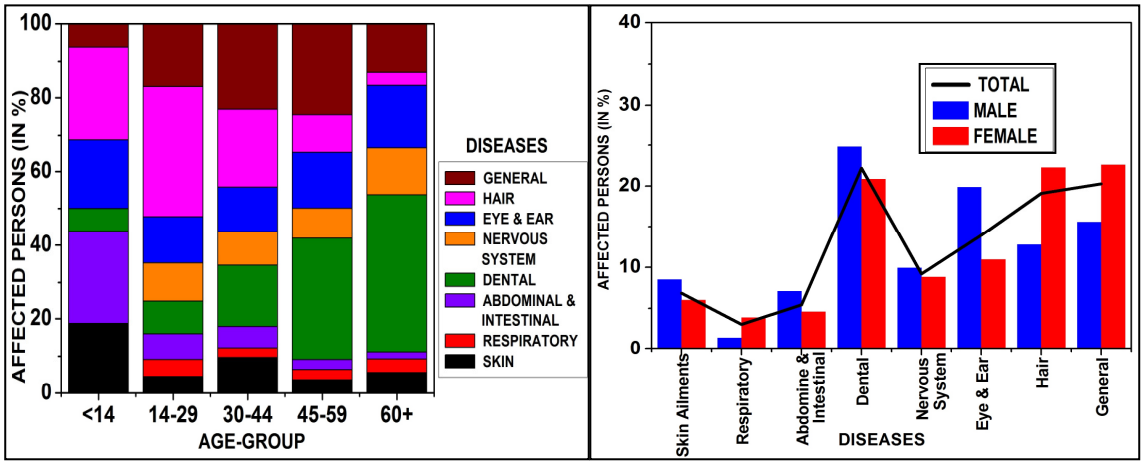


**Fig.6.12: Age and Gender Wise Prevalence Rate in *Karachiya***

intestinal diseases were most dominant among them (25%). A remarkable difference in male and female prevalence rates was observed where <35% males and >65% females were affected. General symptoms, dental, eye and ear problems were more prominent among males. This pattern is largely because of high temperatures, continuous noise, smoke and dust are the common environmental conditions under which they work.

### 6.3.12 Karodiya

The overall prevalence rate in *Karodiya* village was slightly below the area's average. However, the incidence rates were lower in women than the area's average and higher among men. General symptoms, dental and hair problems were most dominant diseases. The occurrence of other diseases like nervous system, eye and ear problems, skin ailments, respiratory, abdominal and intestinal issues was <10%. Few conclusions observed at *Karodiya* varied from many other villages of the area. Decline

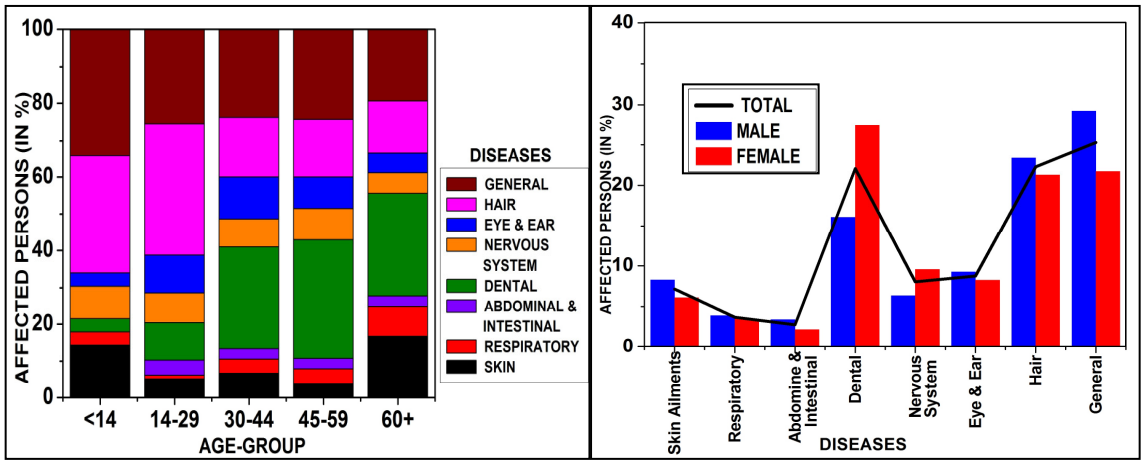


**Fig.6.13: Age and Gender Wise Prevalence Rate in *Karodiya***

in the percentage of affected persons with general symptoms was one of them. Another was the high occurrence (15%) of skin diseases in elderly while 30% children showed signs of hair ailments. Few similarities which were noticed was the increase in the incidence of dental problems with age and lower rates of respiratory, abdominal and intestinal problems. The percentage of women suffering from dental problems was almost double than the males (27% &16% respectively). It should be noted here that the amount of *fluoride* in this village was just 0.15 mg/l in groundwater which

was the major source of drinking water. The percentage of males suffering by hair as well as general ailments was higher.

### 6.3.13 Koyli

Prevalence rate in *Koyli* village was 40% and it ranked fifth from the bottom. High incidence of diseases among females (60%) was the only alarming situation. Dental, hair and general symptoms were more prevalent in the entire study area and same was observed in the Koyli village too. There was an increase in the percentage of

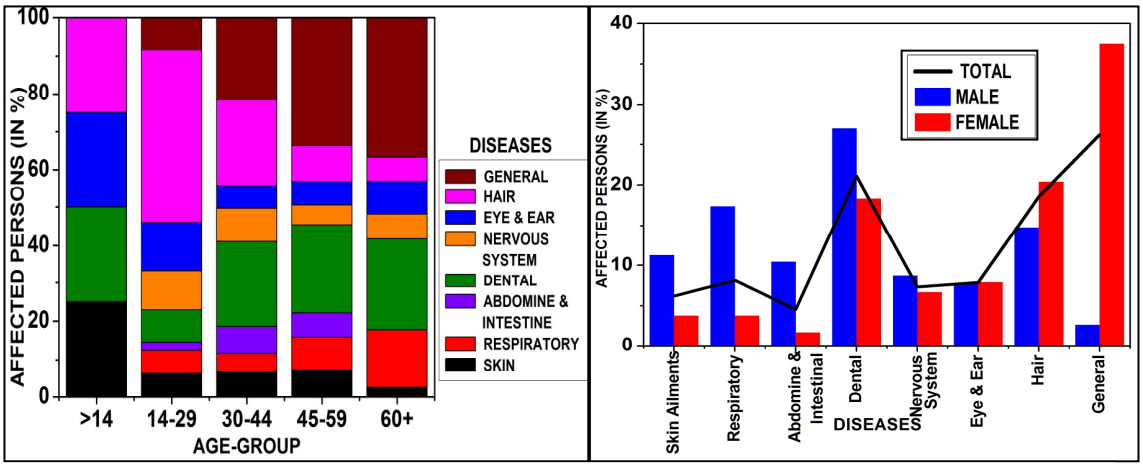


**Fig.6.14: Age and Gender Wise Prevalence Rate in *Koyli***

persons affected by general symptoms. The occurrence of hair problems declined with age and high prevalence (25%-30%) of dental problems were the two most common features. Half of the people in age of 14-29 years suffered from hair problems. Respiratory, abdominal and intestinal, nervous system and skeletal problems were absent in children. The number of males suffering by dental ailments was more while females outnumbered males in hair ailments, dullness and dizziness. A broad gap was observed in skin ailments, respiratory, abdominal and intestinal problems.

### 6.3.14 Nandesari

Prevalence rate in *Nandesari* taken as a whole was close to the average of the area (51%) but the occurrence of diseases amongst females was very high (75%). Prevalence rate of dental, eye, ear, hair and general symptoms was high. The incidence of dental problems, skin ailments and general symptoms increased with age. However, 10% of the children had this disorder. Playing in water was the major

factor responsible for high incidence of skin diseases in children. Hair problems was more prevalent in 14-29 years of age. Dental problems were higher in males (>25%) than females (<15%). Skin disorders abdominal and intestinal, eye and ear problems were the other diseases where the prevalence rate was between 10% and 20%. The number of men suffering from these diseases was more than the females. Hair issues and general symptoms were the other two conspicuous ailments and women were larger sufferers then men. Respiratory problems in both males and females and nervous system problems among men were insignificant.

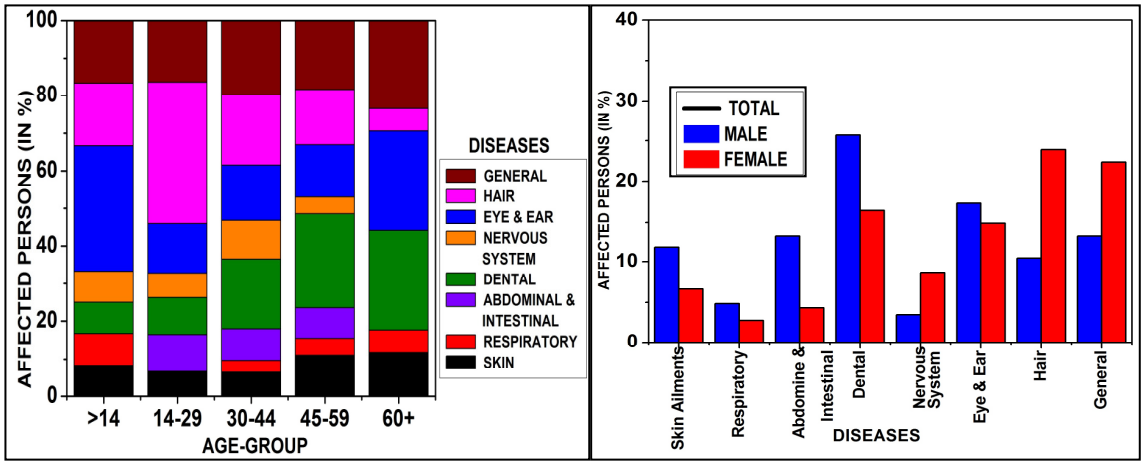


**Fig.6.15: Age and Gender Wise Prevalence Rate in *Nandesari***

## 6.3.15 Padmala

The prevalence rate in *Padmala* village was close to the average of the area. The pattern of ailments in this village was quite similar to that at Nandesari with dental,

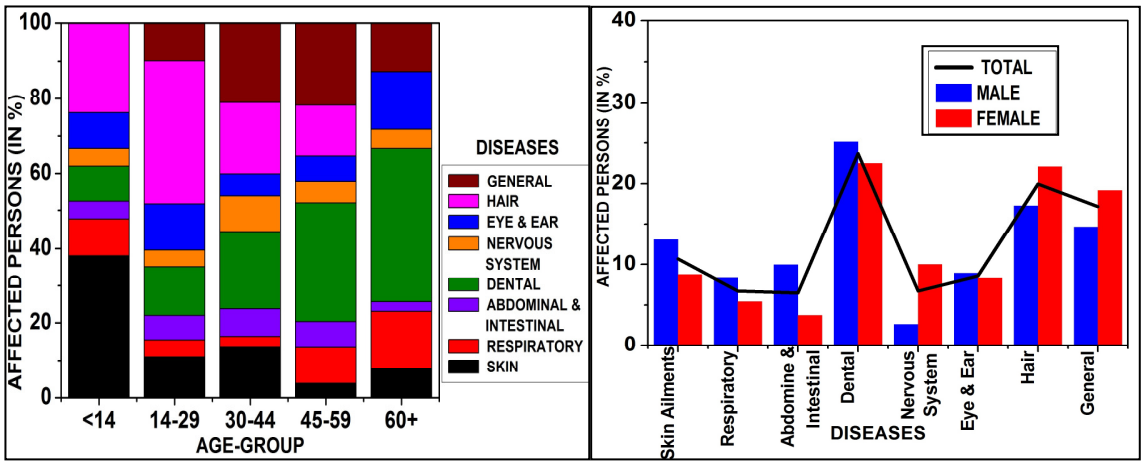


**Fig.6.16: Age and Gender Wise Prevalence Rate in *Padmala***

hair and general symptoms more prevalent (20%-25%). The prevalence rates of other

ailments – skin, respiratory, abdomine and intestine, nervous system, eye and ear were <10%. 35% of the children (>14 years) were suffering from skin diseases. Adults of 14-29 years had the dominance of hair problems. 35% to 40% people of this age group suffered from hair loss and its change of colour. The percentage of people suffering from dental ailments increased with age. A total absence of abdominal and intestinal problems was observed in children.

### 6.3.16 Rayaka

*Rayaka* depicted the best picture in the entire area in terms of health conditions. The incidence rate of diseases was lowest (25%) and much variation in the incidence of various diseases was not observed in this village. The total prevalence rate of skin, dental, abdominal, intestinal ailments was >10% and respiratory problems were rampant (15%). Dental problems were also high (>15%). The high occurrence (12%) of the ailments related to nervous system was another highlighting phenomena which was observed. In *Rayaka*, 50% of the children population suffered from skin

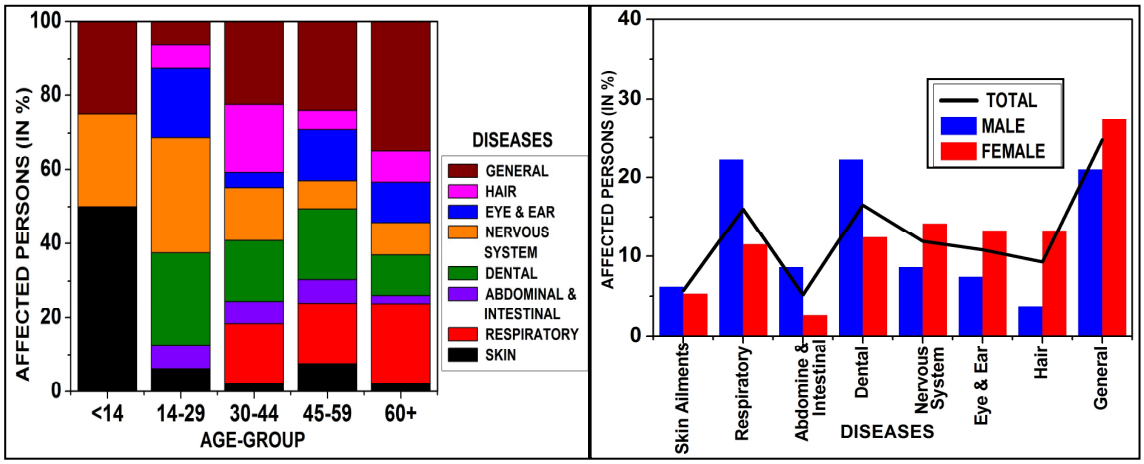


**Fig.6.17: Age and Gender Wise Prevalence Rate in *Rayaka***

diseases and this problem decreased with age. A high incidence of trembling, shaking and nervous impairment in people upto the age of 30 years was observed and after that, the incidence of nervous system problems decreased. General symptoms were high both in elderly and children. A considerable difference between the two genders was observed in hair problems that is <5% amongst males and >13% in females. >20% of the males were suffering from respiratory problem while <12% females had the

problem of same disease. The percentage of males suffering from abdominal intestinal was almost 9% while only 3% of the females were affected.

### 6.3.17 Ranoli

The incidence pattern of this village was same as that noticed in *Nandesari* village. Overall prevalence rate was close to the area's average (52%). One-third of the total surveyed population was suffering from dental problems. The incidence of general symptoms was 20%. High incidence of skin ailments and problems associated with hair were observed in *Ranoli* village. The incidence of these two ailments declined with age. Reversal of trend was observed in dental problems where the percentage of affected persons increased with age. Continuous use of water with very

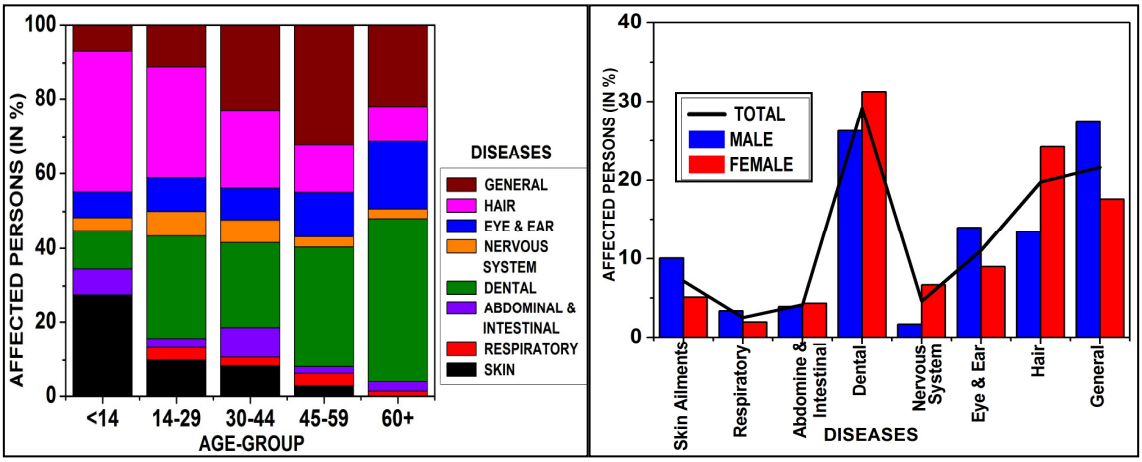


**Fig.6.18: Age and Gender Wise Prevalence Rate in *Ranoli***

low level of *fluoride* was the main cause for it. Similarly, general symptoms too showed an increasing trend with age. A gap in the incidence rates between the females (75%) and males (40%) was visible. 25% females had hair problems while, this problem was not so grave in men (13%). As pointed out earlier, direct exposure with polluted air physically damages the hair. Women were more exposed while completing the household chores in open, working in fields or going out to nearby distances to fetch household items. The next in order, with more males was eye and ear (13%), skin ailments (10%) and respiratory diseases (<5%). Even though, the total incidence of problems related with nervous system was low but the number of females suffering was higher than the male counterparts (7%).

### 6.3.18 Sankarda

The prevalence rate of this village was higher (60%) than the area's average. The general observation of the whole area was the dominance of skin diseases in children. As per the trend, 60% of the children were suffering from skin ailments. The occurrence decreased with age and a negligible percentage of elderly were suffering from this ailment. Contrarily, dental problems were most prevalent amongst aged

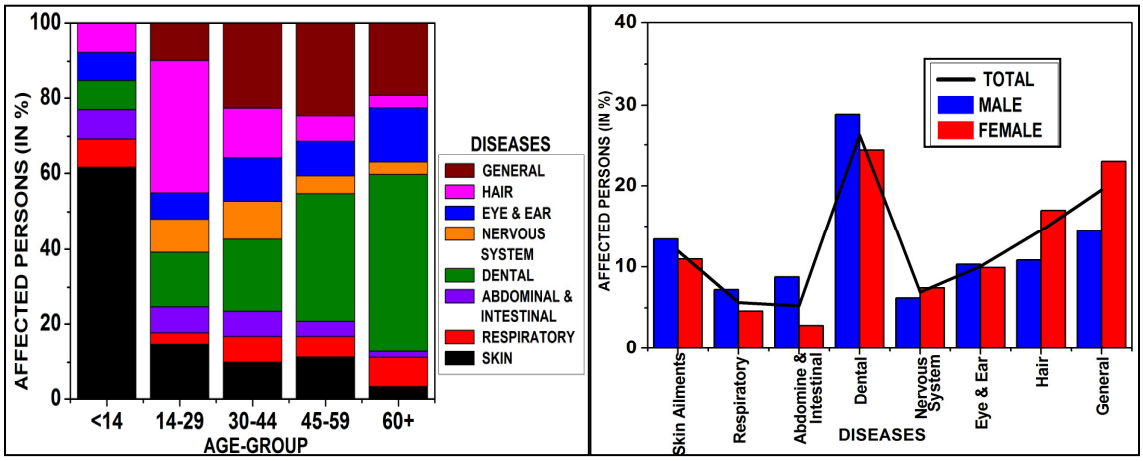


**Fig.6.19: Age and Gender Wise Prevalence Rate in *Sankarda***

(50%). Problems associated with hair were maximum between 14 to 29 years. The prevalence rate of diseases in females and males was 75% and 45% respectively. 30% of the males of *Sankarda* village suffered from dental problems. This proportion was definitely more than females. The problems related to hair and general symptoms were between 15% to 20%. The least amount of cases in females were observed in abdomen and respiratory diseases.

### 6.3.19 Sisva

The incidence rate in *Sisva* village was the third highest in the study area. This percentage was 70 in total population, 80 in women and 60 amongst men. Dental problems were high (30%) in the village. More than half of the total adult population (60+ years) was suffering from dental diseases. A decline of hair and nervous system related problems was evident. The prevalence rate of various diseases in children varied between 10% to 20%. There was a dominance of hair problems in people between 14-29 years and dental in all other ages. The proportion of males suffering

was more than their counterparts. The prevalence of hair ailments come next (17%). The percentage of females was >20% while 15% of males were affected. Except for the general symptoms the incidence of all the diseases – skin ailments, respiratory, nervous system, abdomen and intestine and eye and ear was <10%. The prevalence

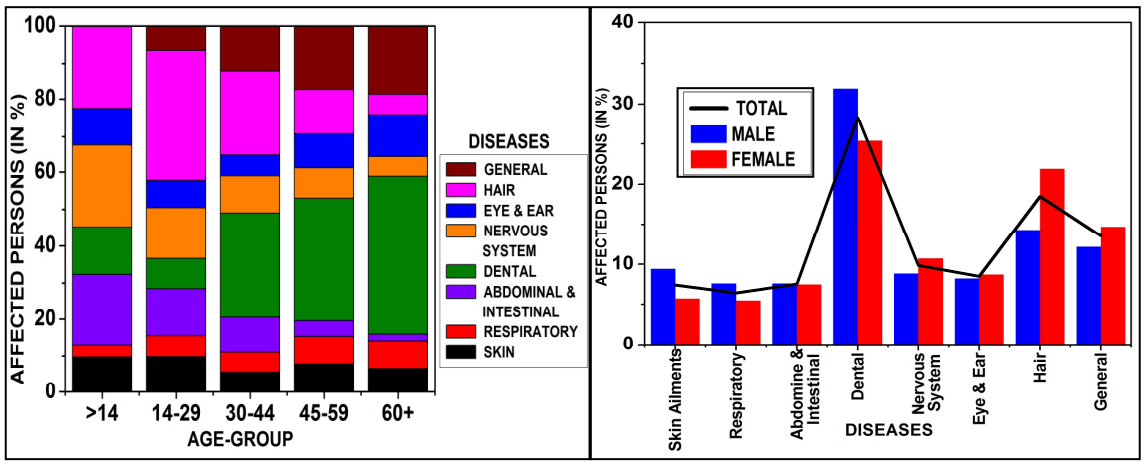


**Fig.6.20: Age and Gender Wise Prevalence Rate in *Sisva***

was higher in men in the former two disorders while in the last two, the proportion of men and women was same. The percentage of females was high only in the ailments related to nervous system.

### 6.3.20 Sokhda

Health conditions of *Sokhda* village were not good. Incidence rates was high (70%) being only next to *Dasharath* village. High prevalence of dental problems (30%)

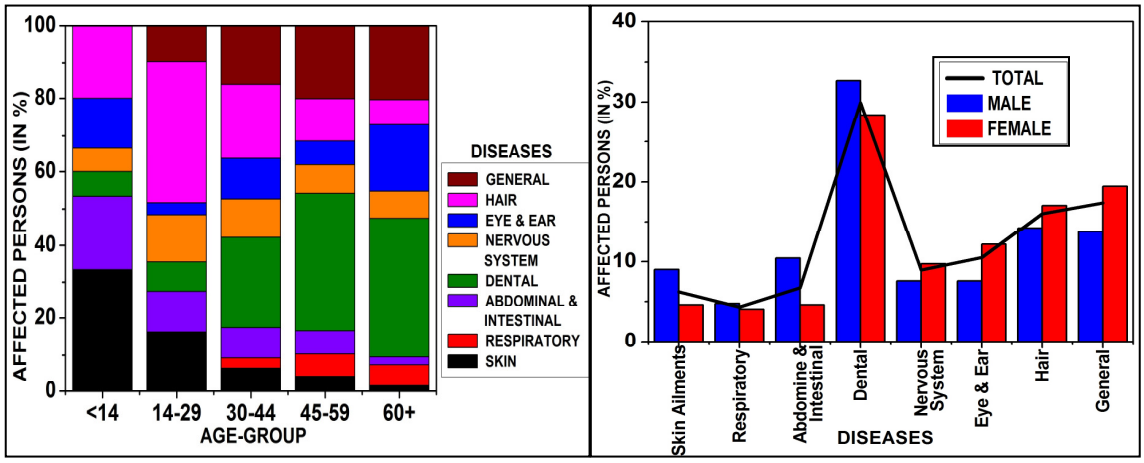


**Fig.6.21: Age and Gender Wise Prevalence Rate in *Sokhda***

was a common phenomena in all the villages adjoining Golden Corridor. The

prevalence rate in rest of the diseases was between 10 to 15 per cent. Respiratory diseases was the only exception with <5% of occurrence. The age wise pattern in Sokhda village revealed a decrease in the incidence of skin diseases with 30% of children and negligible percentage of elderly suffering. A decrease in prevalence of abdominal, intestinal and hair problems with age was also observed. Increase in the percentage of people suffering from dental ailments with no children and >one-third of the elderly suffering by it. The percentage of females suffering was higher with general symptoms, hair, eye and ear and nervous system problems. Reversal of cases with more men suffering was observed in dental, skin, abdomen and intestine ailments.

### 6.3.21 Undera

The overall prevalence rate of this village was near to the average of the total area. The highest prevalence (30%) was noticed in dental as well as in hair problems. Skin and hair ailments were most dominant in children (>14 years). High hair problems were noticed between 14-29 years of age. In people of 30-44 years dental, hair and general symptoms contributed to >50% of the diseases. Dental problems increased with age, hence it was standing out in >45 years of age. 40% in 45-59 years and >50% in 60 + years. Problems related to eye and ear were also high in elderly. A wide gap was also observed between the two genders (females 80% and males 35%). Men outnumber females in dental ailments while females had more of hair problems. Gender wise wide gap existed in general symptoms. >20% females and <10% males

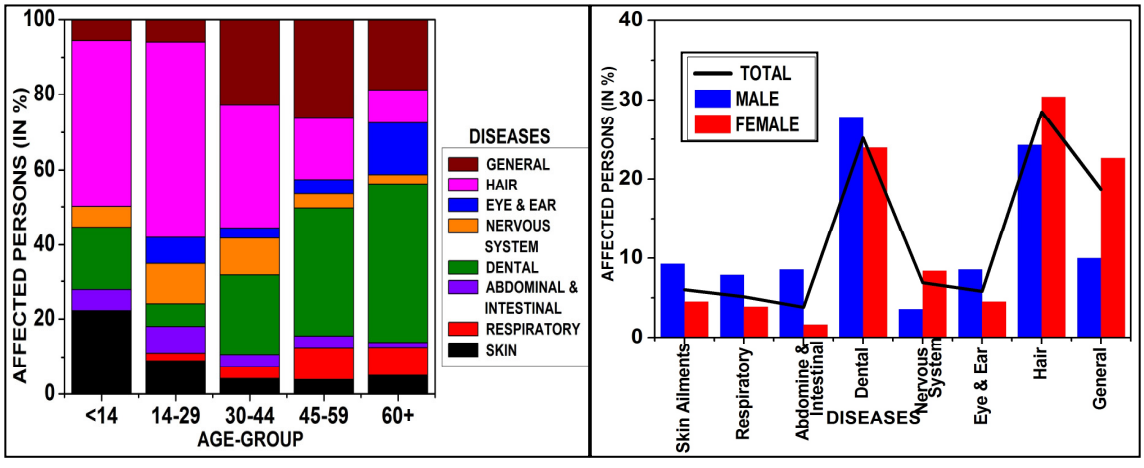


**Fig.6.22: Age and Gender Wise Prevalence Rate in *Undera***

illustrated the symptoms of dizziness, dullness and skeletal disorders. Other diseases like skin, respiratory, abdomen and intestine, nervous system, eye and ear ailments were not conspicuous (<10%).

### 6.3.22 Vasna-Kotariya

Prevalence rate in *Vasna-Kotariya* was 60%. Dental problems once again had highest prevalence (28%) followed by general symptoms (20%). High prevalence of the skin diseases was a general pattern which had emerged in the villages adjoining Golden Corridor. The same trend was noticed here with 40% of the children suffering from these ailments. Dental problems was another remarkable feature. 10% of adults (14-24 years), 15% of middle aged (30-44 years) and 50% of elderly (60+) were suffering from dental problems. Dizziness, dullness and skeletal disorders were absent

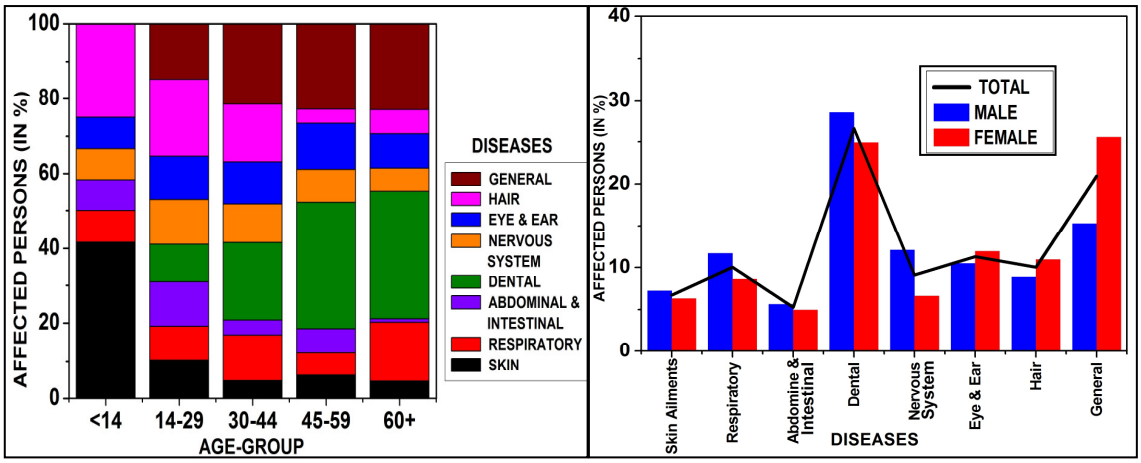


**Fig.6.23: Age and Gender Wise Prevalence Rate in *Vasna-Kotariya***

in children. The percentage of sufferers with general symptoms were also seen increasing with age with one-fourth of the elderly suffering from one or the other problem. The prevalence rate in females and males was 60% and 40% respectively. Females showed higher signs (almost double) of dizziness, dullness and skeletal problems. One feature which was different from other villages was the higher incidence of problems related to nervous system among men. In most of the villages it was the females who were larger sufferers. More females had hair, eye and ear problems. Men display more signs of skin, abdominal, intestinal and respiratory problems. Eating out habits was the major factor responsible for the higher

occurrence of the former and exposure to polluted air was responsible for respiratory problems.

## 6.4 PREVALENCE RATE AND SOURCES OF DRINKING WATER

The information of different sources of drinking water for the sample households in the study area indicated that the ground water and river water were the major sources for drinking while pond or lake water were largely used for domestic purpose. In terms of contamination of water due to industrial waste both the surface and sub-surface water were much polluted near the industrial zone (Chapters 2, 3, 4 and 5). In most of the places under investigation, groundwater was the main

**Table 6.3: Population Using Different Sources of Drinking Water**

| | UGW | TGW | TRW | OS | Prevalence Rate (%) |
|---|---|---|---|---|---|
| Ajod | 0.43 | 99.57 | NA | NA | 69.37 |
| Anagadh | NA | 2.36 | 97.64 | NA | 29.83 |
| Ankodiya | NA | 78.38 | NA | 21.62 | 25.13 |
| Bajwa | NA | 23.68 | 0.97 | 75.35 | 66.09 |
| Chhani | 2.32 | 46.87 | 50.81 | NA | 64.04 |
| Dasharath | 0.63 | 99.37 | NA | NA | 82.53 |
| Dhanora | 6.96 | 13.80 | 79.25 | NA | 24.40 |
| Dodka | 32.71 | 67.29 | NA | NA | 54.00 |
| Fajalpur | 0.22 | 6.70 | 93.08 | NA | 45.19 |
| Gorva | NA | NA | 100.00 | NA | 60.63 |
| Karachiya | NA | NA | 100.00 | NA | 49.30 |
| Karodiya | NA | 100.00 | NA | NA | 48.49 |
| Koyli | NA | 100.00 | NA | NA | 39.80 |
| Nandesari | NA | NA | 100.00 | NA | 53.92 |
| Padmala | 100.00 | NA | NA | NA | 49.31 |
| Ranoli | NA | 100.00 | NA | NA | 49.43 |
| Rayka | NA | 100.00 | NA | NA | 21.30 |
| Sankarda | 0.99 | 60.30 | 38.71 | NA | 59.18 |
| Sisva | 100.00 | NA | NA | NA | 70.76 |
| Sokhda | NA | 100.00 | NA | NA | 71.11 |
| Undera | NA | 100.00 | NA | NA | 54.62 |
| Vasna-Kotariya | 9.60 | 90.40 | NA | NA | 59.87 |

UGW= Untreared Ground water | TGW=Treated Ground Water

TRW= Treated River Water | OS= Other Sources

*Source: Computed*

source of drinking water, to the extent that the people of ten (10) sites (*Ajod, Ankodiya*, *Dashrath, Karodiya, Koyli, Rayka, Sisva, Sokhda, Undera* and *Vasna-*

*Kotariya*) were solely dependent on sub-surface water as given in Table:6.3. In *Dodka* and *Sankarda*, source of drinking water for >60% of population was groundwater, while in *Bajwa* both underground as well as river water was used for drinking. In *Nandesari, Karachiya, Padmala, Anagadh, Gorwa*, and *Ranoli*, groundwater had high *TDS* and was used only for domestic purposes. High amount of *TDS* in water affects the hair and digestive system. The hairs get sticky after bath and fell while the digestive system was affected by gastrointestinal problems.

### 6.4.1 Overall

In the study area 54.10% of the total population were drinking treated ground water, 29.03% the treated river water, and 12.27% consumed untreated ground water. 4.59% of the people drank water from other sources like Riverse Osmosis (RO) or treated river water as well as ground water (Table:6.4). The highest 64.83% prevalence rate was observed among the population drinking the untreated ground water. Maximum people of the *Sisva, Vasna-Kotariya, Padmala, Dodka* and *Dhanora* were using the untreated ground water. 54.64% was the prevalence of diseases of those who are consuming treated ground water which was used for drinking in *Ajod, Ankodiya, Dasrath, Dodka, Karodiya, Koyli, Ranoli, Rayaka, Sokhda* and *Undera*. The population consuming treated river water depicted lowest prevalence rate of diseases (45.47%). Population at *Anagadh, Dhanora, Gorwa, Karachiya, Nandesari* and *Sankarda* were using treated river water. In *Ankodiya* and *Bajwa,* people used reverse osmosis water or treated river water as well as treated ground water.

**Table 6.4: Overall Prevalence Rate among the Population Using Different Sources of Drinking Water**

| Sources of Drinking water | Population | | Prevalence Rate |
|---|---|---|---|
| | Surveyed Number (%) | Affected Number (%) | |
| Untreated Ground water | 12.27 | 15.19 | 64.83 |
| Treated ground water | 54.1 | 54.64 | 52.9 |
| Treated River water | 29.03 | 25.2 | 45.47 |
| Other sources | 4.596 | 4.95 | 56.48 |
| Total | 100 | 100 | 52.37 |

*Source: Computed*

### 6.4.2 Diseases Wise

Dental problems were the most common ailment in all the categories. Those who were using the ground water were more affected by dental and respiratory problems. Higher prevalence of hair and general problem were also noted (Fig.6.24). The eye and ear problems were greater among the people drinking treated river water and other sources. In all the categories of different sources of drinking water, nearly 8% of the population suffered from the problems related to nervous system. Respiratory, abdominal and intestinal problems were highest among those who are using the untreated ground water.

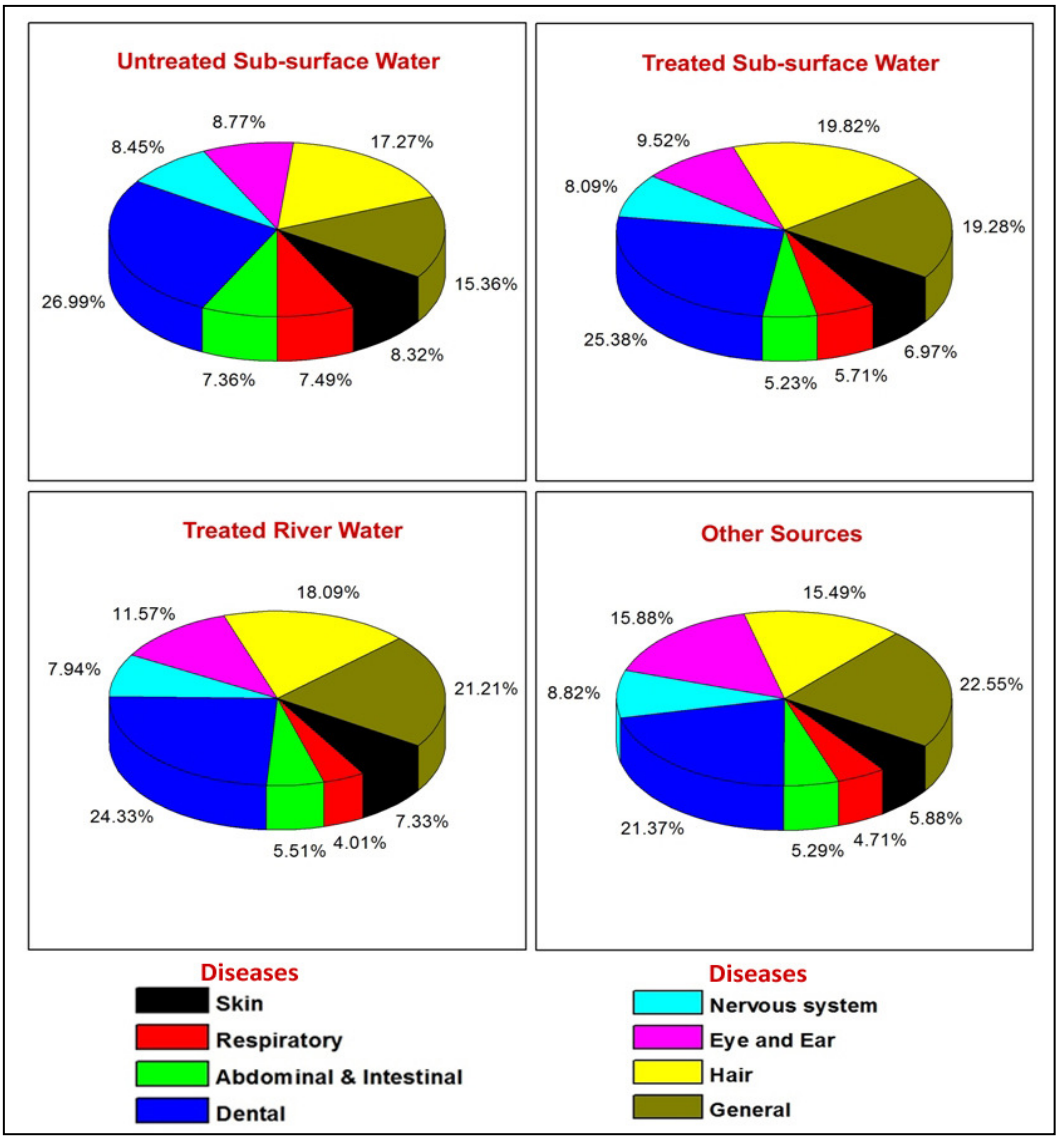


**Fig.6.24: Prevalence of Diseases among Using Different Sources of Drinking Water**

| Table 6.5: Distribution of Diseases among Using Different Sources of Drinking Water | | | | |
|---|---|---|---|---|
| **Diseases** | **UGW** | **TGW** | **TRW** | **OS** |
| Skin | 8.32 | 6.97 | 7.33 | 5.88 |
| Respiratory | 7.49 | 5.71 | 4.01 | 4.71 |
| Abdominal & Intestinal | 7.36 | 5.23 | 5.51 | 5.29 |
| Dental | 27.00 | 25.38 | 24.33 | 21.37 |
| Nervous system | 8.45 | 8.09 | 7.94 | 8.82 |
| Eye and Ear | 8.77 | 9.52 | 11.57 | 15.88 |
| Hair | 17.27 | 19.82 | 18.09 | 15.49 |
| General | 15.36 | 19.28 | 21.21 | 22.55 |
| Total | 100 | 100 | 100 | 100 |
| *Source: Computed* | | | | |

### 6.4.3 Location Wise

The prevalence of diseases among those who drank the drinking of untreated ground water varied between 35.00% (*Chhani*) to 187.50% (*Sankarda*). 78.62% was the average with the standard deviation of 46.70. *Dashrath, Dodka* and *Vasna-Kotariya* had >80% of prevalence of diseases. *Dhanora* and *Padmala* depicted comparatively lower prevalence rate i.e 40.98% and 49.31% respectively. The highest prevalence rate of population using treated ground water was observed at *Dashrath* (82.42%) while the lowest was noted at *Anagadh* (10.00%). >60% of the prevalence rate was observed at *Ajod, Bajwa, Channi* and *Sankarda* while <30% was recorded at

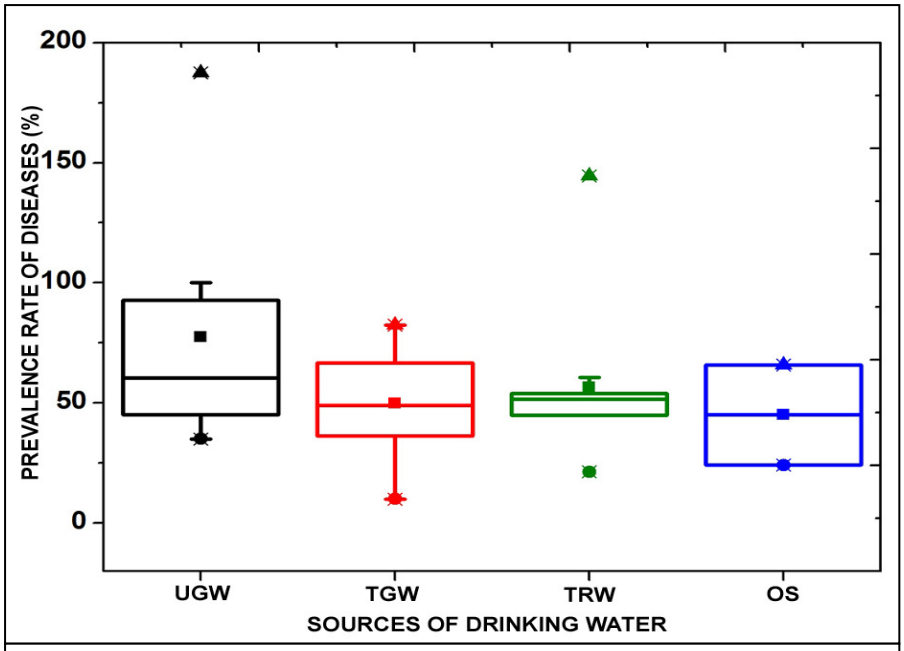


**Fig.6.25: Prevalence of Diseases**

*Ankodiya* (25.41%) and *Rayaka* (21.30%). 50.25% and 20.36 were the value of mean and standard deviation. Among the drinking of treated river water the prevalence rate ranged from 21.29 % (*Dhanora*) to 144.44% (*Bajwa*). *Gorwa* also had high prevalence of diseases i.e 60.63%. The mean value was 56.52% and 35.20 was the deviation from the mean.The other sources of drinking water were only observed at *Ankodiya* (24.14%) and *Bajwa* (65.86). The average value of the prevalence of diseases was 45.00% with the deviation of 29.50.

Table 6.6: Location Wise Prevalence Rate of Diseases

| Places | UGW | TGW | TRW | OS |
|---|---|---|---|---|
| Ajod | NA | 69.67 | NA | NA |
| Anagadh | NA | 10.00 | 30.31 | NA |
| Ankodiya | NA | 25.41 | NA | 24.14 |
| Bajwa | NA | 63.64 | 144.44 | 65.86 |
| Chhani | 35.00 | 78.96 | 51.60 | NA |
| Dasharath | 100.00 | 82.42 | NA | NA |
| Dhanora | 40.98 | 33.88 | 21.29 | NA |
| Dodka | 85.40 | 38.73 | NA | NA |
| Fajalpur | 50.00 | 48.39 | 44.95 | NA |
| Gorva | NA | NA | 60.63 | NA |
| Karachiya | NA | NA | 49.30 | NA |
| Karodia | NA | 48.49 | NA | NA |
| Koyali | NA | 39.80 | NA | NA |
| Nandesari | NA | NA | 53.92 | NA |
| Padamla | 49.31 | NA | NA | NA |
| Ranoli | NA | 49.43 | NA | NA |
| Rayaka | NA | 21.30 | NA | NA |
| Sankarda | 187.50 | 61.52 | 52.24 | NA |
| Sisva | 70.76 | NA | NA | NA |
| Sohkda | NA | 71.11 | NA | NA |
| Undera | NA | 54.62 | NA | NA |
| Vasna-Kotariya | 88.64 | 56.82 | NA | NA |
| Total | 64.83 | 52.90 | 45.47 | 56.48 |

*Source: Computed*

### 6.4.4 Relationship between Prevalence Rate and Sources of Drinking Water

A significant positive correlation existed between sources of drinking water and affected population. Between the untreated ground water and affected population the correlation value was +0.98. Similar value was observed between other sources of

drinking water and occurrence of diseases. Treated river water and prevalence of diseases depicted the correlation of +0.94 and 0.87 was the correlation value between treated ground water and incidence of diseases.

Table 6.7: Correlation between Affected Population and Drinking Water

| | Population Using Different Sources of Drinking Water | | | |
|---|---|---|---|---|
| | Untreated Ground Water | Treated Ground Water | Treated River Water | Other Sources |
| Affected population | 0.98 | 0.87 | 0.95 | 0.98 |

*Source: Computed*

## 6.5 PREVALENCE RATE AND INCOME

### 6.5.1 Overall

It has been proposed that individual behaviour, environment as well as other factors such as income, diet, medical care, occupation and education etc. were associated with health and diseases. The relationship between health and per capita income had been analysed (Tables: 6.8). The maximum population (>60%) had the lower per capita income. 66.75% of the population was earning <Rs.1000/-per capita, 24.54% population had <Rs.500/- while 42.21% person were getting Rs.501/- to 1000/- per capita. Only 7.66% population earned Rs. 1501/- to 2000/-. The highest income was earned by 10.86 % of people. The 0.71 % of the total affected had not responded regarding the income. The highest per capita income group >Rs.2000/- depicted the lowest prevalence rate of diseases (Table: 6.8). While the prevalence of diseases was

Table 6.8: Overall Prevalence Rate among Different Income Group

| Per Capita Income (in Rupees) | Population (%) | | Prevalence Rate (%) |
|---|---|---|---|
| | Surveyed Number | Affected Number | |
| <500 | 24.54 | 23.79 | 50.91 |
| 501-1000 | 42.21 | 42.45 | 52.82 |
| 1001-1500 | 14.02 | 15.15 | 56.75 |
| 1501-2000 | 7.66 | 7.71 | 52.86 |
| >2001 | 10.86 | 10.25 | 49.6 |
| No response | 2.05 | 1.67 | 42.71 |
| Total | 101.34 | 101.021 | 52.356 |

*Source: Computed*

highest (56.75%) amongst the income group of Rs.1000/- to Rs.1500/-. The maximum number of affected population (66.24%) had lower per capita income (<Rs 1000/-). While the minimum total affected population (7.71%) were getting the income of Rs.1500/- to Rs.2000/- per month (Table: 6.8).

### 6.5.2 Disease Wise

Dental, respiratory, eye and ear problem were highest in lowest income group (<Rs.500/-). While the lowest prevalence rate of nervous system, dental and eye and ear existed in the highest income group (Table: 6.9). On the other hand, the problem

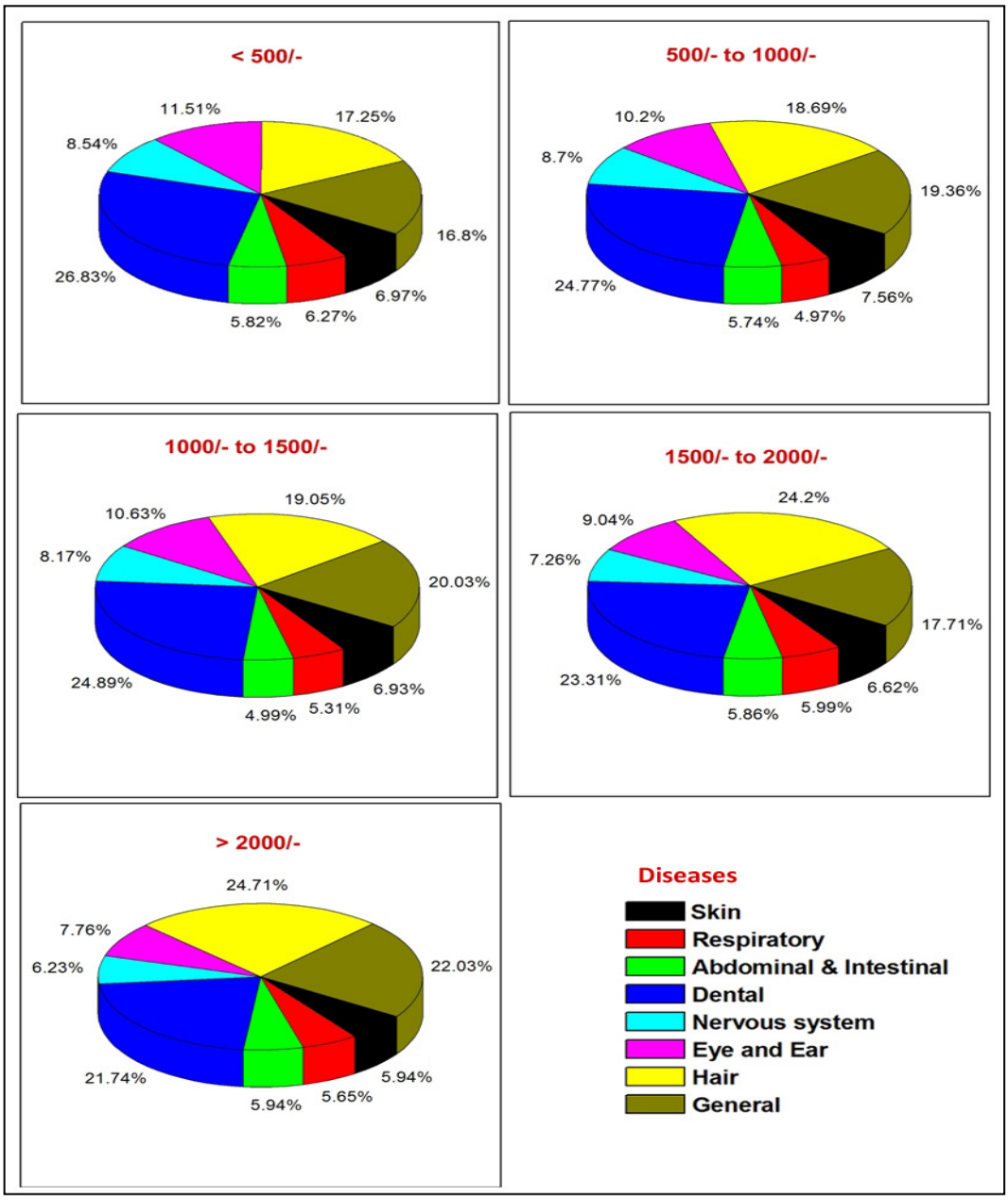


**Fig.6.26: Prevalence of Diseases among Using Different Income Group**

of hair and general (skeletal and dullness) was maximum in highest income group (>Rs.2000/). The problem of hair gradually increased from lower income to higher income group. Dental problem gradually decreased with the increase of income. In all the income groups the problem of dental, hair and general symptoms depicted the higher incidence whereas abdominal, skin ailments, respiratory problems were relatively low.

**Table 6.9: Prevalence of Diseases among Different Per Capita Income Group (in Rupees)**

| Diseases | > 500 | 501-1000 | 1001-1500 | 1501-2000 | >2000 |
|---|---|---|---|---|---|
| Skin | 6.97 | 7.56 | 6.93 | 6.62 | 5.94 |
| Respiratory | 6.27 | 4.97 | 5.31 | 5.99 | 5.65 |
| Abdominal & Intestinal | 5.82 | 5.74 | 4.99 | 5.86 | 5.94 |
| Dental | 26.83 | 24.77 | 24.89 | 23.31 | 21.74 |
| Nervous system | 8.54 | 8.70 | 8.17 | 7.26 | 6.23 |
| Eye and Ear | 11.51 | 10.20 | 10.63 | 9.04 | 7.76 |
| Hair | 17.25 | 18.69 | 19.05 | 24.20 | 24.71 |
| General | 16.80 | 19.36 | 20.03 | 17.71 | 22.03 |
| Total | 100 | 100 | 100 | 100 | 100 |

*Source: Computed*

### 6.5.3 Location Wise

The high prevalence rate (>70%) was observed amongst those who are earning <Rs.500/- per capita income at *Dasharath*, *Dodka* and *Sisva*. Whlie the lower occurrence of diseases was noted at *Anagadh, Chhani* and *Dhanora*. In the income group of Rs.500/- to Rs.1000/- the occurrence of diseases was high at *Ajod, Chhani* and *Dashrath* (>70%). >60% was noted *at Bajwa, Sankarda, Sokhda* and *Vasna-Kotariya* whereas >30% was recorded at *Dhanora* and *Rayaka*. The maximum incidence of Rs.1000/- to Rs.1500/- was observed at *Sokhda* (125.00%), *Bajwa, Dashrath, Dodka* and *Sankarda* also indicated high cases of diseases. *Anagadh* and *Rayaka* depicted the <30% prevalence of diseases. Unfortunately, 300.00% prevalence was noted at *Anagadh* among the income group of Rs.1500/- to Rs.2000/-. >100% of prevalence rate of this income group was noticed at *Sokhda* and *Vasna-Kotariya*. On the contrary, only 8.04% of were noted at *Rayaka*. In the highest income group

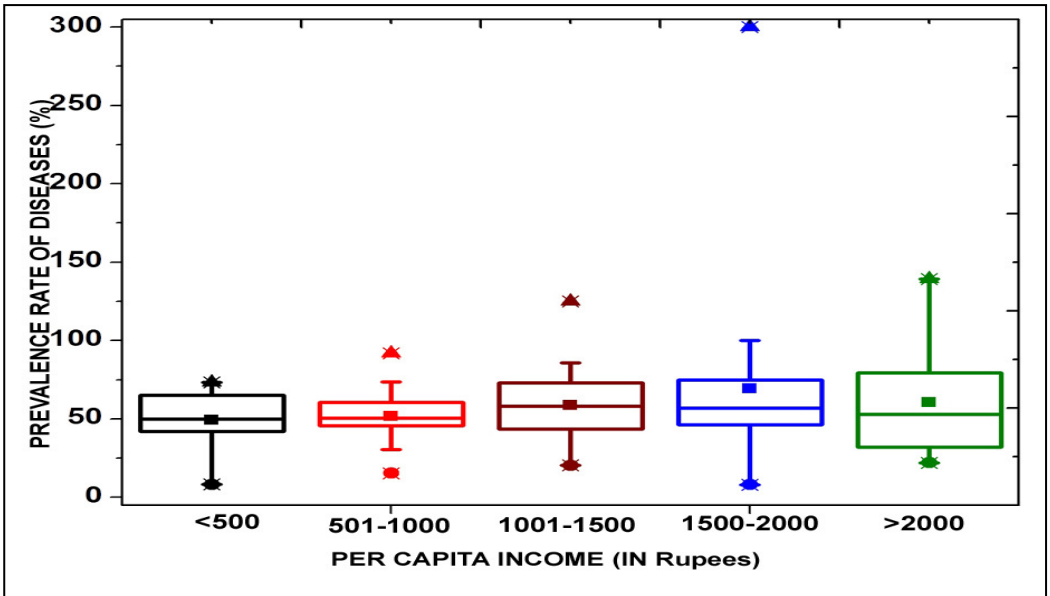


**Fig.6.27: Prevalence of Diseases**

(>Rs.2000/-), *Chhani* indicated the highest incidence of diseases (139.33%). *Ankodiya, Dhanora, Koyli* and *Rayaka* had <30% prevalence rate.

**Table 6.10: Prevalence Rate of Diseases among Different Income Group (in Rupees)**

| Places | <500) | 501-1000 | 1001-1500 | 1501-2000 | >2001 |
|---|---|---|---|---|---|
| Ajod | 66.03 | 71.11 | 68.66 | 52.54 | 93.33 |
| Anagadh | 27.14 | 30.38 | 33.83 | 300.00 | 37.50 |
| Ankodiya | 20.00 | 30.96 | 26.09 | 28.13 | 22.07 |
| Bajwa | 67.57 | 66.86 | 72.91 | 48.98 | 79.23 |
| Chhani | 8.19 | 73.71 | 45.96 | 76.39 | 139.33 |
| Dasharath | 71.43 | 91.82 | 85.71 | 62.50 | 89.41 |
| Dhanora | 26.42 | 22.28 | 20.45 | 29.55 | 23.46 |
| Dodka | 73.37 | 47.57 | 74.55 | 59.02 | 47.56 |
| Fajalpur | 42.04 | 45.60 | 57.85 | 60.00 | 32.14 |
| Gorva | 65.06 | 58.62 | 66.13 | 75.00 | 32.10 |
| Karachiya | 47.92 | 51.17 | 45.93 | 52.17 | 41.03 |
| Karodiya | 45.05 | 50.41 | 41.67 | 44.83 | 78.13 |
| Koyali | 50.92 | 46.03 | 43.56 | 31.65 | 22.22 |
| Nandesari | 49.00 | 47.88 | 58.13 | 71.43 | 63.21 |
| Padamla | 45.83 | 47.78 | 82.98 | 46.30 | 66.67 |
| ranoli | 54.67 | 44.88 | 62.73 | 54.64 | 54.19 |
| Rayaka | 29.59 | 15.38 | 20.61 | 8.04 | 29.20 |
| Sankarada | 62.13 | 60.17 | 70.65 | 66.67 | 39.58 |
| Sisva | 72.36 | 61.68 | 82.81 | 80.43 | 103.13 |
| Sokhda | 52.31 | 60.05 | 125.00 | 121.88 | 108.82 |
| Undera | 63.04 | 50.63 | 47.26 | 54.32 | 79.49 |
| Vasna-Kotariya | 46.96 | 60.58 | 57.69 | 100.00 | 51.72 |
| Total | 50.91 | 52.82 | 56.75 | 52.86 | 49.60 |

*Source: Computed*

### 6.5.4 Relationship between Prevalence Rate and Income:

The occurrence of diseases and income had positive relationship. It was more prominent in the lower income groups. The correlation value was +0.81 in <Rs.500/- per capita income population and +0.68 in Rs.500/- to Rs.1000/-. Among the higher income groups i.e. Rs.1000/- to Rs.1500 and >Rs.2000/- the value was same (+0.52). +0.44 was the correlation value of Rs.1500/- to Rs.2000/- between per capita income and affected population.

Table 6.11: Correlation between Affected Population and Different Per Capita Income Group

| | Population having different income (in Rupees) | | | | |
|---|---|---|---|---|---|
| | <500 | 501-1000 | 1001-1500 | 1501-2000 | >2000 |
| Affected population | **+0.816** | **+0.682** | **+0.525** | **+0.442** | **+0.525** |

*Source: Computed*

## 6.6 PREVALENCE RATE AND OCCUPATION:

### 6.6.1 Overall Prevalence Rate and Occupation:

In the study area 45.27% of the total population were unemployed. Students comprised of 21.86% and 2.21% were retired. Self and government employed together constituted 20.69%. The population working in industries and labourer were 5.27% and 5.10% respectively.

Table 6.12: Overall Prevalence Rate among Different Occupational Group

| Occupation | Population (in %) | | Prevalence Rate (%) |
|---|---|---|---|
| | Surveyed Number | Affected Number | |
| Working in Industries | 5.27 | 5.08 | 50.48 |
| Labourer | 5.11 | 8.4 | 86.14 |
| Self employed/Govt.employed | 20.27 | 19.98 | 51.63 |
| Unemployed | 45.27 | 52.02 | 60.19 |
| Student | 21.86 | 8.51 | 20.4 |
| Retired | 2.21 | 6 | 141.84 |
| Total | 100 | 100 | 52.37 |

*Source: Computed*

### 6.6.2 Disease Wise

The maximum population in all the occupational groups were suffering from dental problems (>23%) except for the students (13.13%). Hair problems was most

prevalent among students (32.19%). General (skeletal and dullness) and hair problems were the most occurring in the different occupational groups. Nearly 10% of the population in all ages was facing the problem of eye and ear. 5.5% to 9.30% of the population in different occupational groups had nervous system problems. Skin

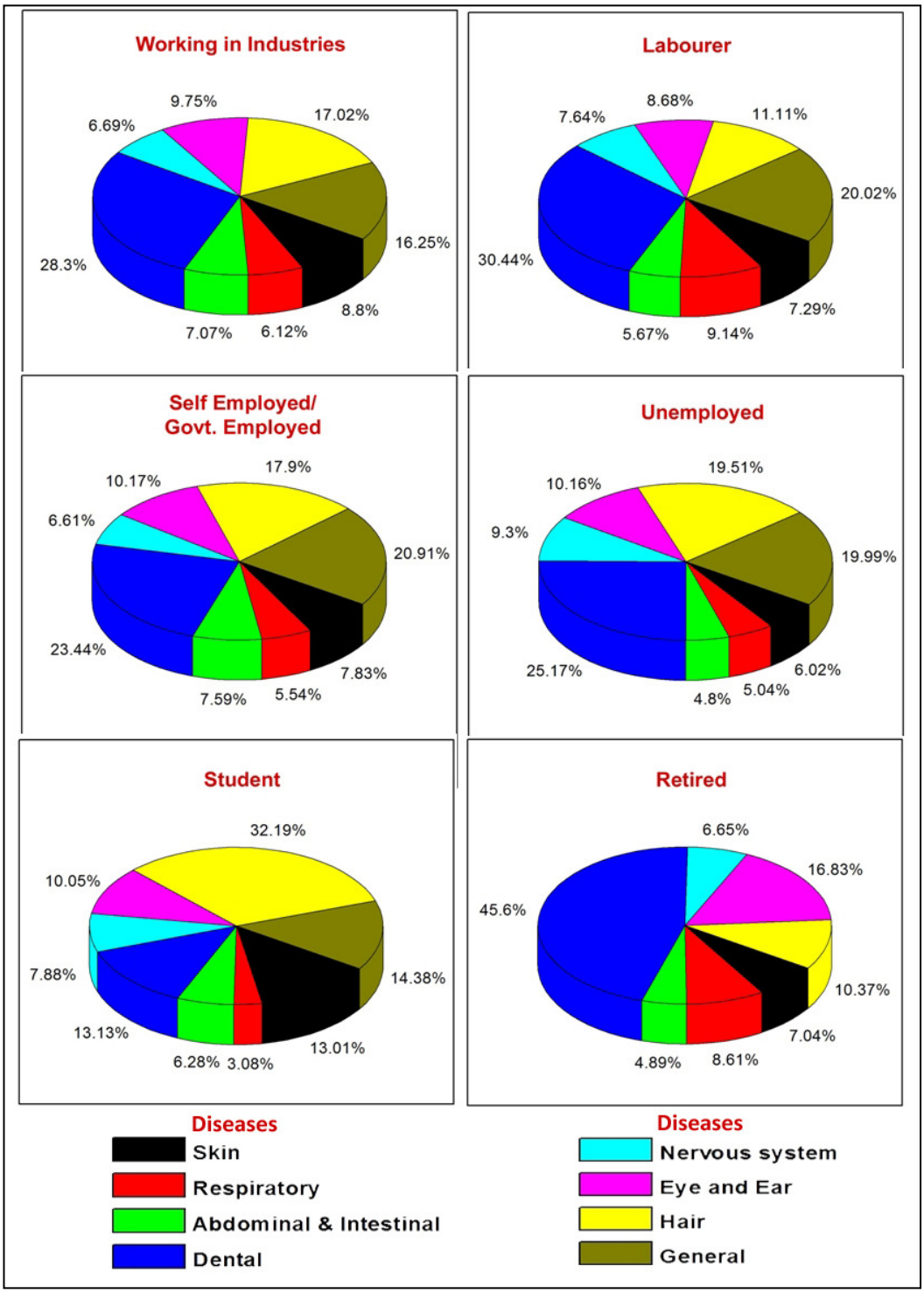


**Fig.6.28: Prevalence of Diseases among Different Occupational Group**

problems varied between 5.83% to 13.01% in different occupational groups. The percentage of population suffering from respiratory problem was lowest among those working in industries, self employed and students. While among the labourer, unemployed and retired persons the lowest occurrence was of abdominal and intestinal problems.

Table 6.13: Prevalence of Diseases among Different Occupational Group (in %)

| Diseases | Working in Industries | Labourer | Self employed /Govt.employee | Unemployee | Student | Retired |
|---|---|---|---|---|---|---|
| Skin | 8.80 | 7.29 | 7.83 | 6.02 | 13.01 | 5.83 |
| Respiratory | 6.12 | 9.14 | 5.54 | 5.04 | 3.08 | 7.13 |
| Abdominal & Intestinal | 7.07 | 5.67 | 7.59 | 4.80 | 6.28 | 4.05 |
| Dental | 28.30 | 30.44 | 23.44 | 25.17 | 13.13 | 37.76 |
| Nervous system | 6.69 | 7.64 | 6.61 | 9.30 | 7.88 | 5.51 |
| Eye and Ear | 9.75 | 8.68 | 10.17 | 10.16 | 10.05 | 13.94 |
| Hair | 17.02 | 11.11 | 17.90 | 19.51 | 32.19 | 8.59 |
| General | 16.25 | 20.02 | 20.91 | 19.99 | 14.38 | 17.18 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |

*Source: Computed*

### 6.6.3 Location Wise

The high prevalence of diseases amongst whose working in industries was observed at *Dashrath* (103.37%). *Nandesari*, *Padmala, Sankarda, Sisva* and *Vasna-Kotariya* also had high occurrence of diseases (>60%). 46.18 % was the average prevalence rate of diseases for those who were working in industries and standard deviation was 27.92.(Table:6.14) Lower prevalence rate in people working in industries was observed at *Rayaka* (8.25%), *Koyli* (8.47%) and *Ankodiya* (12.16%). The prevalence of diseases among labourer ranged from 0.00 to 300.00% with an average of 84.12% and standard deviation of 69.58. The labourers living at *Bajwa, Chhani, Dashrath, Fajalpur, Gorva, Nandesari* and *Sisva* had high prevalence rate (>100%). No labourer in *Anagadh, Karachiya* and *Undera* suffered from diseases. Lower prevalence rate was noted at *Ranoli* (14.29%) and *Ankodiya* (24.00%). The maximum prevalence rate (80.14%) among self-employed population was noted at *Dashrath* and minimum (23.16%) was observed at *Anagadh*. High prevalence rate of

diseases was also observed at *Sankarda* and *Sisva*. 52.58% and 16.80 were the values of mean and deviation from the mean respectively. 91.38% was the highest prevalence rate of diseases among unemployed population which was observed at *Dashrath*. The unemployed masses of *Ajod, Bajwa, Chhani, Ranoli* and *Sokhda* also depicted high prevalence rate (>70%). The lowest prevalence rate was noted at *Rayaka* (27.38%). 60.61% was the average and 16.58 was the standard deviation. The students were the least affected population. >50% was noted only in *Bajwa* and *Gorva*. The prevalence rate of various diseases ranged between 3.66% and 61.02% with the average of 19.30% and standard deviation of 15.91.The retired men and women were the most affected. The prevalence rate varied from 0.00 to 244.44% with the average of 106.79% and standard deviation 66.65. *Chhani, Dodka, Nandesari, Sisva, Sokhda* and *Vasna-Kotariya* had >150% of prevalence rate. Lower prevalence rate was observed at *Rayaka* (33.33%), *Ankodiya* (33.33%) and *Bajwa* (30.77%).

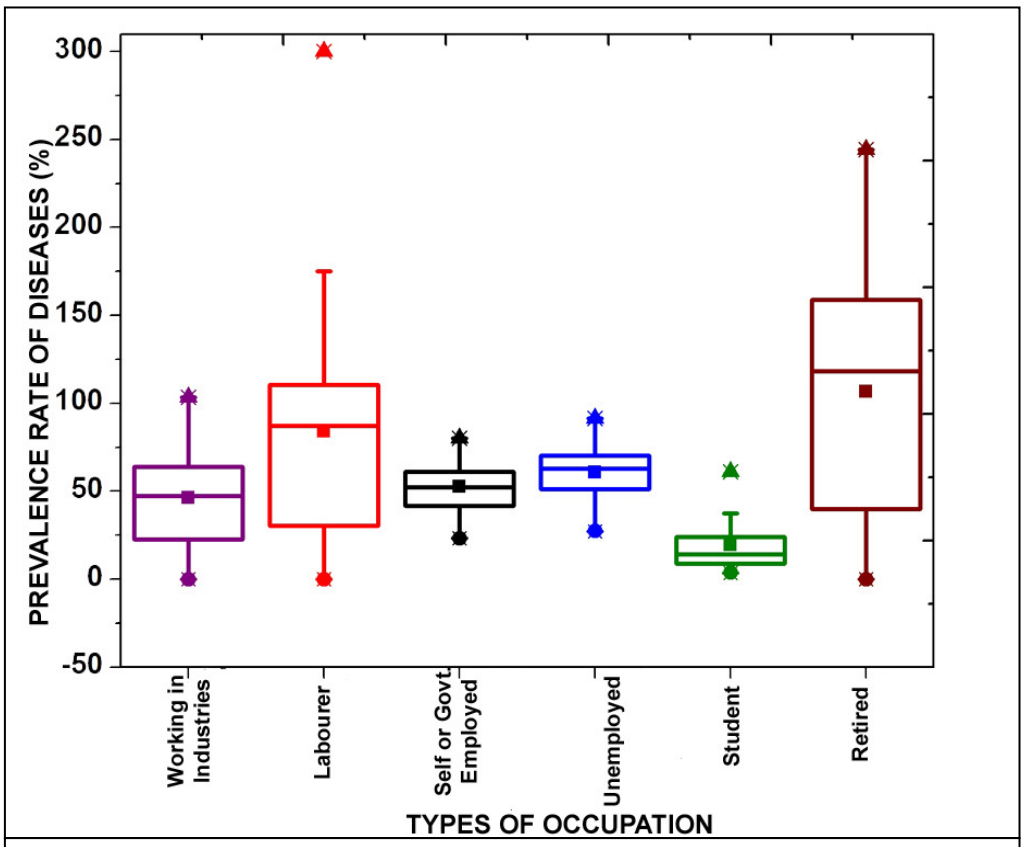


**Fig.6.29: Prevalence of Diseases**

Table 6.14: Location Wise Prevalence Rate of Diseases among Different Occupational Group

| Places | Working in Industries | Labourer | Self employed/ Govt.employee | Unemployed | Student | Retired |
|---|---|---|---|---|---|---|
| Ajod | 58.33 | 111.94 | 51.05 | 77.86 | 10.17 | 156.25 |
| Anagadh | 22.73 | 0.00 | 23.16 | 41.79 | 3.75 | 40.00 |
| Ankodiya | 12.16 | 24.00 | 28.77 | 33.71 | 4.55 | 33.33 |
| Bajwa | 56.82 | 300.00 | 58.00 | 74.02 | 61.02 | 30.77 |
| Chhani | 56.76 | 133.33 | 55.41 | 85.53 | 19.68 | 165.00 |
| Dasharath | 103.57 | 110.42 | 80.14 | 91.38 | 37.31 | 135.42 |
| Dhanora | 15.79 | 36.36 | 26.06 | 32.73 | 6.48 | 0.00 |
| Dodka | 43.75 | 91.55 | 61.01 | 54.26 | 24.19 | 244.44 |
| Fajalpur | 47.54 | 100.00 | 37.02 | 61.71 | 13.79 | 125.00 |
| Gorva | 33.33 | 175.00 | 66.41 | 62.67 | 50.44 | 0.00 |
| Karachiya | 46.34 | 0.00 | 53.65 | 66.34 | 13.27 | 50.00 |
| Korodia | 0.00 | 89.66 | 45.09 | 59.80 | 24.20 | 137.50 |
| Koyali | 8.47 | 47.17 | 48.52 | 52.36 | 7.87 | 77.78 |
| Nandesari | 94.52 | 160.00 | 57.61 | 63.16 | 10.00 | 175.00 |
| Padamla | 63.74 | 76.79 | 50.42 | 51.23 | 14.46 | 111.76 |
| Ranoli | 31.03 | 14.29 | 50.93 | 70.42 | 14.35 | 86.67 |
| Rayka | 8.25 | 30.51 | 31.58 | 27.38 | 3.66 | 33.33 |
| Sankarda | 75.90 | 71.05 | 78.87 | 68.40 | 8.90 | 134.62 |
| Sisva | 68.52 | 100.60 | 75.19 | 69.21 | 19.35 | 170.83 |
| Sokhda | 50.00 | 93.40 | 76.36 | 73.68 | 13.16 | 182.98 |
| Undera | 47.06 | 0.00 | 41.59 | 65.30 | 47.47 | 100.00 |
| Vasna Kotariya | 71.43 | 84.57 | 59.84 | 50.55 | 16.47 | 158.73 |
| Total | 50.48 | 86.14 | 51.63 | 60.18 | 20.39 | 141.8 |

*Source: Computed*

### 6.6.4 Relationship between Prevalence Rate and Occupation:

Positive correlation existed between the occupation and diseases. Strong positive relationship was observed between labourers and occurrence of diseases (+0.97) and also between retired population and the incidence of diseases. +0.65 was the correlation value of population working in industries and prevalence of diseases. Low positive relationship existed between unemployed and occurrence of diseases.

Table 6.15: Correlation between Affected Population and Different Occupational Group

| | Occupation | | | | | |
|---|---|---|---|---|---|---|
| | *Working in Industries* | *Labourer* | *Self employed/ Govt.employee* | *Unemployed* | *Student* | *Retired* |
| Affected population | +0.65 | +0.97 | +0.43 | +0.15 | +0.62 | +0.97 |

*Source: Computed*

## 6.7 PREVALENCE RATE AND EDUCATION:

### 6.7.1 Overall Prevalence

In the study area 77.96% of the people were literates while 14.03% were illiterates and 8.01% were of <5 years of age. The prevalence rates of literates and illiterate population was 48.89% and 93.40% respectively. Population <5years comprised of 14.63% of diseases (Table: 6.16).

**Table 6.16: Overall Prevalence Rate among Different Educational Status**

| Per Capita Income | Population (in %) | | Prevalence Rate (%) |
|---|---|---|---|
| | Surveyed Number | Affected Number | |
| Literate | 77.96 | 72.78 | 48.89 |
| Illiterate | 14.03 | 25.02 | 93.4 |
| < 5yrs | 8.01 | 2.2 | 14.36 |
| Total | 100 | 100 | 52.37 |

*Source: Computed*

### 6.7.2 Disease Wise

In both literates and illiterates the dental problems were most prominent. Among the former, 21.77% persons were suffering from hair problems. The general problem (skeletal and dullness) constituted 17.87% of the total, while ear problems were noted in <10% of the population. The population suffering from respiratory ailments were low. Among the illiterate, 22.11% of the population suffered from general problems. 12.08% of the illiterate suffered from eye and ear. People having

**Table 6.17: Distribution of Diseases among Different Educational Status**

| Diseases | Literate | Illiterate | <5yrs |
|---|---|---|---|
| Skin | 7.73 | 4.74 | 11.50 |
| Respiratory | 5.45 | 6.45 | 4.87 |
| Abdominal & Intestinal | 6.40 | 3.11 | 7.52 |
| Dental | 23.57 | 29.76 | 18.58 |
| Nervous system | 7.72 | 9.71 | 9.29 |
| Eye and Ear | 9.50 | 12.08 | 11.50 |
| Hair | 21.77 | 12.04 | 20.80 |
| General | 17.87 | 22.11 | 15.93 |
| Total | 100 | 100 | 100 |

*Source: Computed*

abdominal and intestinal problems were lowest (3.11%). children <5years were mainly suffered from hair (20.80%) and dental problem (18.58%). 15.93% was the occurrence of skeletal and dullness problems. Respiratory problems were less among the children.

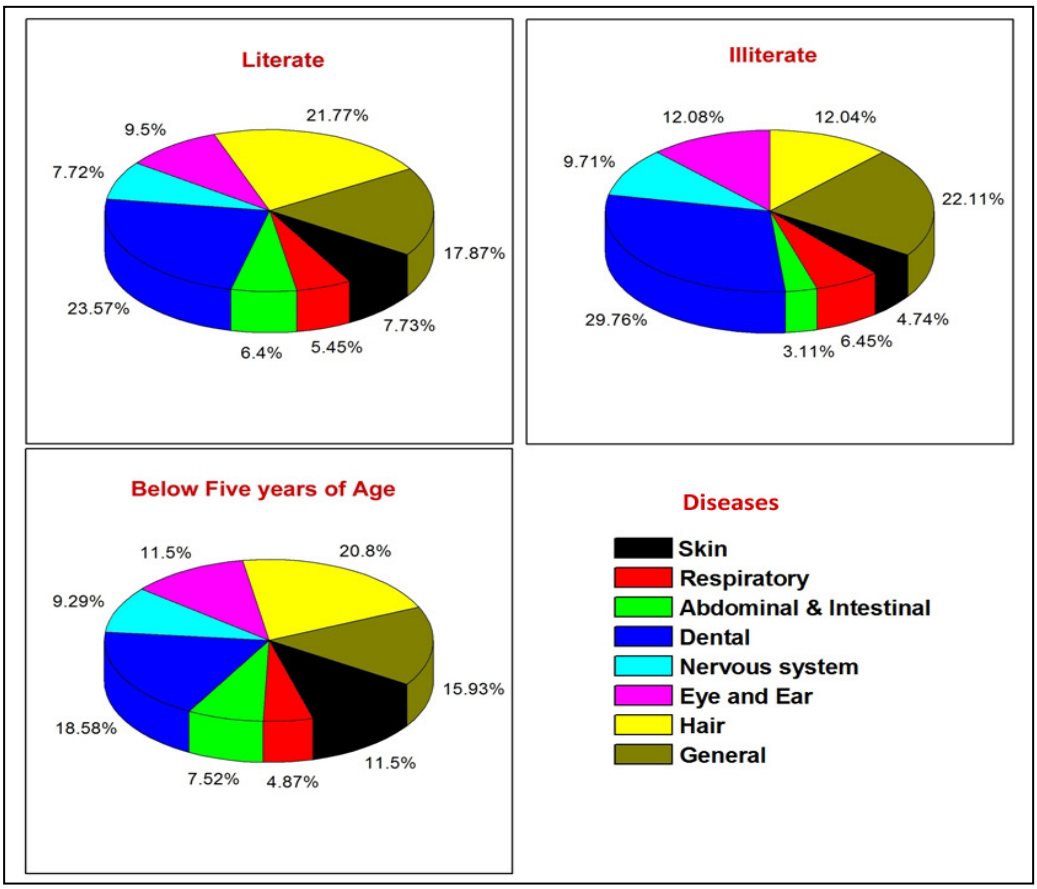


**Fig.6.30: Prevalence of Diseases among Different Educational Status**

### 6.7.3 Location Wise

The prevalence rate of literate population varied between 15.71% to 79.74%. The mean value was 48.79% and standard deviation was 17.46. The high prevalence rates were observed at *Chhani* (73.17%), *Dasharath* (79.74%) and *Sisva* (70.36%). *Ajod, Bajwa, Gorwa, Nandesari, Ranoli, Sankarda, Sokhda* and *Vasna-Kotariya* had >50% of prevalence rate. The lower prevalence rates were noted at *Rayaka* (15.71%), *Anagadh* (23.68%) and *Ankodiya* (25.03%). High prevalence rate of diseases was observed in illiterates ranging from 46.48% to 148.94%. 92.19% was the average and standard deviation was 29.77. *Ajod, Dasharath, Fajalpur, Karachiya*, *Nandesari*,

*Sankarda*, *Sisva, Sokhda* and *Vasna-Kotariya* depicted >100%. Children depicted relatively less prevalence rate of diseases. High prevalence rate was observed only in some selected sites i.e *Undera* (117.07%), *Bajwa* (96.55%) and *Gorva* (42.37%). No children in *Sokhda* and *Rayaka* suffered from any diseases.

Table 6.18: Prevalence Rate of Diseases among Different Educational Status

| Places | Literate | Illiterate | < 5yrs |
|---|---|---|---|
| Ajod | 61.20 | 148.94 | 3.66 |
| Anagadh | 23.68 | 75.69 | 1.00 |
| Ankodiya | 25.03 | 46.48 | 3.08 |
| Bajwa | 65.41 | 56.25 | 96.55 |
| Chhani | 73.17 | 53.55 | 10.39 |
| Dasharath | 79.74 | 140.94 | 10.81 |
| Dhanora | 19.88 | 64.75 | 3.30 |
| Dodka | 48.32 | 95.06 | 12.07 |
| Fajalpur | 38.46 | 101.53 | 12.66 |
| Gorva | 60.97 | 67.52 | 42.37 |
| Karachiya | 42.68 | 106.40 | 11.11 |
| karodiya | 42.30 | 93.79 | 19.28 |
| koyali | 37.42 | 87.01 | 2.08 |
| Nandesari | 52.76 | 107.94 | 9.84 |
| Padamla | 45.35 | 87.72 | 3.33 |
| Ranoli | 50.87 | 69.57 | 8.33 |
| Rayaka | 15.71 | 56.55 | 0.00 |
| Sankarda | 53.13 | 126.42 | 5.00 |
| Sisva | 70.36 | 115.66 | 10.17 |
| Sokhda | 65.40 | 134.68 | 0.00 |
| Undera | 47.12 | 78.85 | 117.07 |
| Vasna Kotariya | 54.41 | 112.88 | 1.18 |
| Total | 48.89 | 93.40 | 14.36 |

*Source: Computed*

### 6.7.4 Relationship between Prevalence Rate and Education:

The educational status and problem of diseases had positive correlation. +0.67 was the correlation of illiterate population and incidence of diseases while literate population and the diseases was +0.29. Significant positive relation existed between children population (>5years) and the prevalence of diseases.

Table 6.19: Correlation between Affected Population and Educational Status

| | Educational Status | | |
|---|---|---|---|
| | Literate | Illiterate | < 5yrs |
| Affected population | +0.29 | +0.67 | +0.95 |

*Source: Computed*

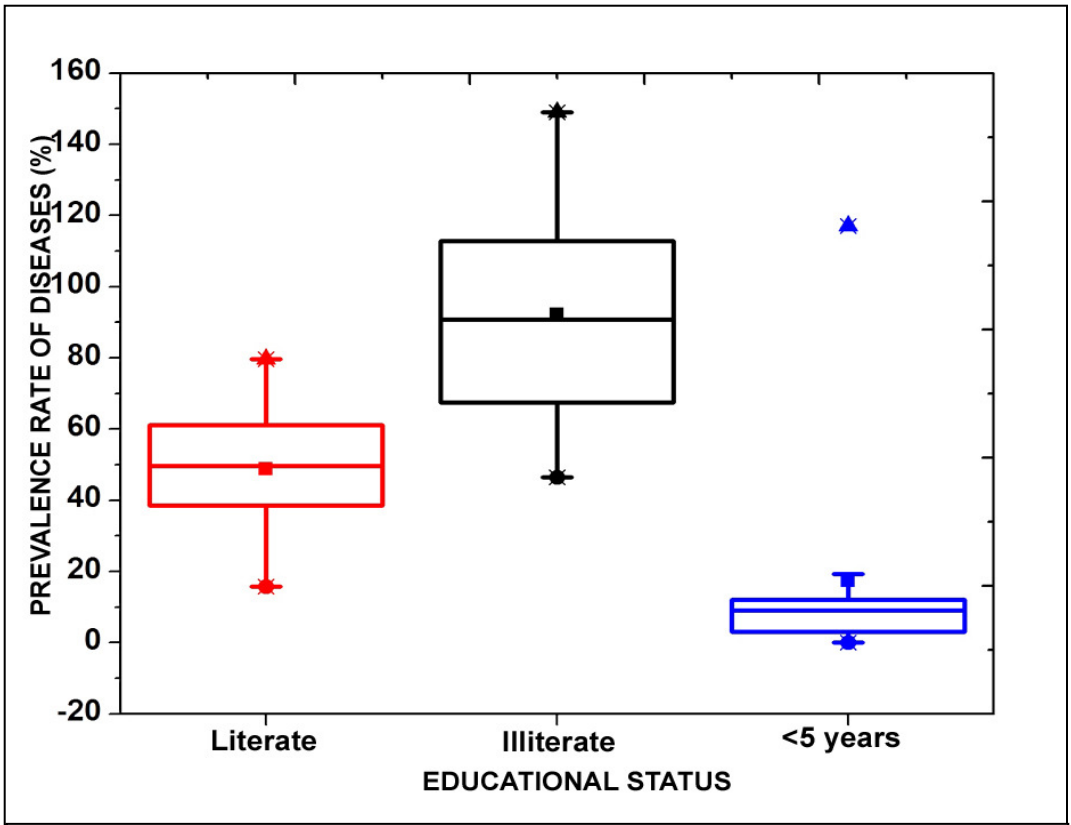


Fig.6.31: Prevalence of Diseases in Different Educational Status

## 6.8 PREVALENCE RATE AND BODY MASS INDEX:

### 6.8.1 Overall

The maximum population (51.67%) was underweight while 5.17% was overweight. 41% of the people had normal weight, obese population constituted the lowest percentage (1.53%) of the total population. Overweight population showed the highest prevalence rate of diseases (97.15%) followed by obese population (86.38%). normal (40.21%) and underweight 60.73%.

Table 6.20: Overall Prevalence Rate among Different Income Group

| Weight Status | Population (in %) | | Prevalence Rate (%) |
|---|---|---|---|
| | Surveyed Number | Affected Number | |
| Underweight | 51.68 | 39.68 | 40.21 |
| Normal | 41.56 | 48.2 | 60.73 |
| Overweight | 5.17 | 9.59 | 97.15 |
| Obese | 1.53 | 2.53 | 86.38 |
| No data | 0.06 | 0 | 0 |
| Total | 100 | 100 | 52.37 |

*Source: Computed*

### 6.8.2 Diseases wise

In all, the dental and general problems were maximum followed by hair problems. Nearly 10% of the population in each category suffered from eye and ear

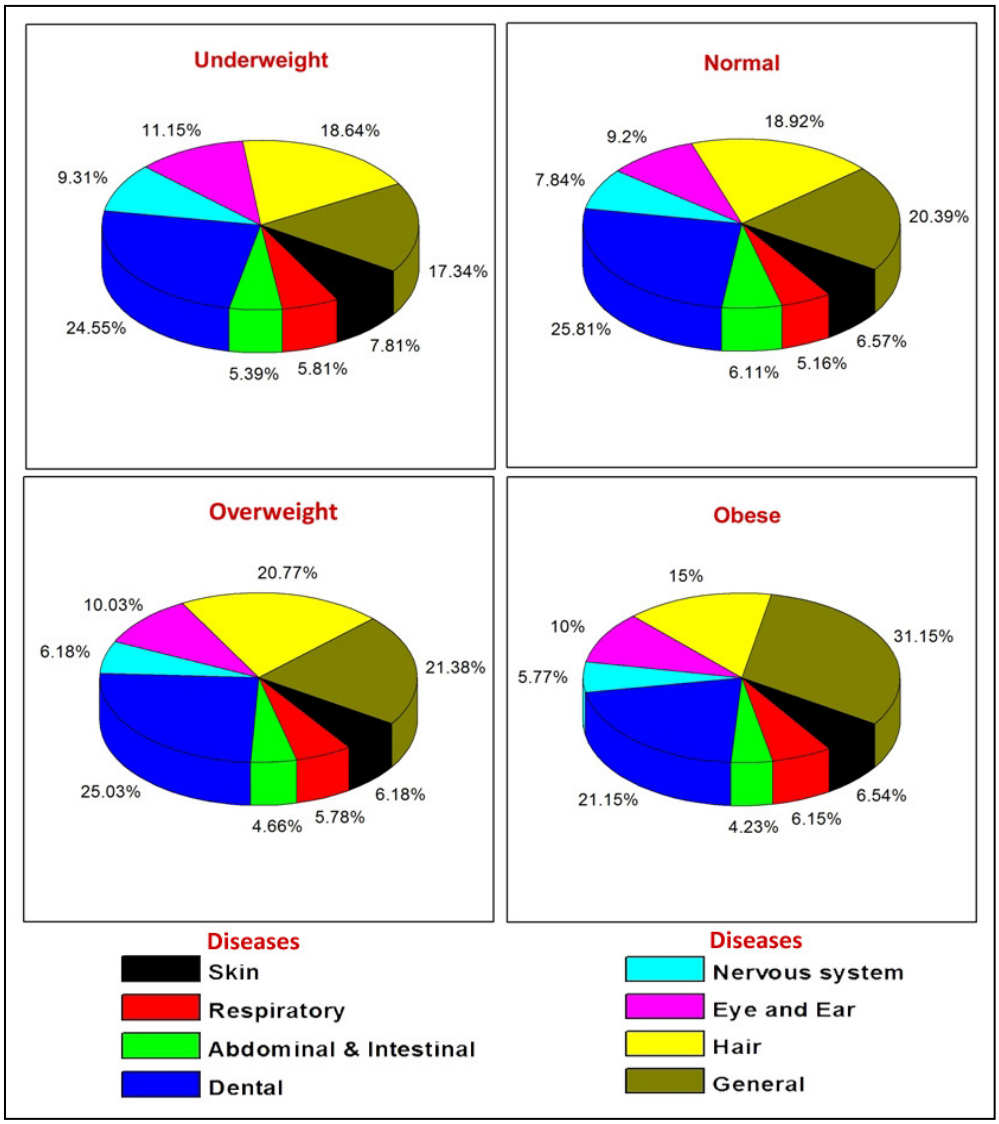


**Fig.6.32: Prevalence of Diseases among Different Weight Status**

problem. Abdominal and intestinal problems were lowest among the underweight, overweight and obese. In case of normal weight people respiratory problem was the lowest.

Table 6.21: Prevalence of Diseases among Different Weight Status

| Diseases | Underweight | Normal | Overweight | Obese |
|---|---|---|---|---|
| Skin | 7.81 | 6.57 | 6.18 | 6.54 |
| Respiratory | 5.81 | 5.16 | 5.78 | 6.15 |
| Abdominal & Intestinal | 5.39 | 6.11 | 4.66 | 4.23 |
| Dental | 24.55 | 25.81 | 25.03 | 21.15 |
| Nervous system | 9.31 | 7.84 | 6.18 | 5.77 |
| Eye and Ear | 11.15 | 9.20 | 10.03 | 10.00 |
| Hair | 18.64 | 18.92 | 20.77 | 15.00 |
| General | 17.34 | 20.39 | 21.38 | 31.15 |
| Total | 100 | 100 | 100 | 100 |

*Source: Computed*

### 6.8.3 Location Wise

The prevalence rate of underweight population ranged from 16.03% to 76.46%. The mean value was 39.88% and the standard deviation was 14.07. The highest prevalence rate of underweight population was noted at *Dasharath*. While the lowest was recorded at *Rayaka*. The prevalence rates in normal weighted population varied between 26.20% to 85.96%. At *Bajwa*, *Chhani, Dasharath* and *Sisva* it was >80%. The lowest prevalence rate in normal weight people was at *Ankodiya*. The mean and standard deviation values were 60.76% and 18.60 respectively. The low prevalence rate was observed at *Rayaka* (26.35%) and *Dhanora* (28.90%). The minimum and maximum prevalence rates of overweight population were 11.76% and 170.59%. 90.50% was the average with standard deviation of 45.64. *Bajwa* (165.52%), *Nandesari* (150.85%) and *Sokhda* (170.59%) had >150% of prevalence rate of diseases. *Gorva, Ranoli, Sankarda, Sisva* and *Undera* also denoted high incidence of diseases. The lower prevalence rate of overweight population was noted at *Dhanora* (11.76%), *Rayaka* (18.37%) and *Anagadh* (25.00%). The maximum prevalence rate of diseases in obese was observed at *Undera* (300.00%). High prevalence rate was also found at *Ajod*

(160.00%), *Bajwa* (142.11%), *Karodiya* 157.14% and *Sokhda* 143.75. The obese population of Anagadh were not suffering from any of the diseases. 86.20% was the average of prevalence rate of diseases amongst obese with 67.70 standard deviation.

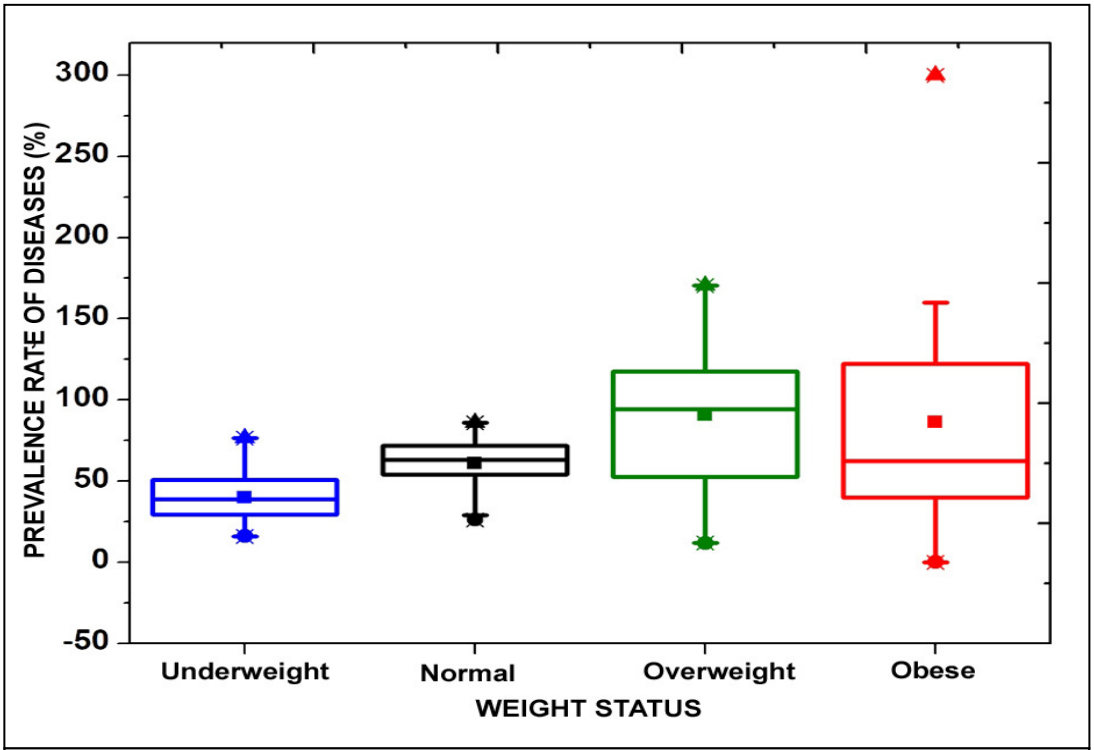


**Fig.6.33: Prevalence of Diseases in Different Weight Status**

### 6.8.4 Relationship between Prevalence Rate and Body Mass Index (BMI):

Positive relation existed between underweight population and prevalence of diseases (+0.41). Very low positive correlation existed between people with normal BMI and occurrence of diseases (+0.03) as well as obese population and incidence of diseases. Negative relation (-0.25) was noted between population with overweight BMI population and diseases.

**Table 6.22: Correlation between Affected Population and Different Weight Status**

| | Weight Status | | | |
|---|---|---|---|---|
| | Underweight | Normal | Overweight | Obese |
| Affected population | +0.415 | +0.037 | -0.25 | +0.004 |

*Source: Computed*

Table 6.23: Location Wise Prevalence Rate of Diseases among Different Weight Status

| Places | Underweight | Normal | Overweight | Obese |
|---|---|---|---|---|
| Ajod | 59.15 | 71.63 | 112.28 | 160.00 |
| Anagadh | 27.26 | 35.29 | 25.00 | 0.00 |
| Ankodiya | 20.28 | 26.20 | 37.50 | 31.82 |
| Bajwa | 41.54 | 81.40 | 165.52 | 142.11 |
| Chhani | 46.45 | 85.96 | 65.12 | 116.67 |
| Dasharath | 76.46 | 85.19 | 111.43 | 78.57 |
| Dhanora | 22.60 | 28.90 | 11.76 | 50.00 |
| Dodka | 43.33 | 59.90 | 91.49 | 120.00 |
| Fajalpur | 34.08 | 69.86 | 50.00 | 50.00 |
| Gorva | 36.97 | 70.08 | 120.90 | 66.67 |
| Karachiya | 45.98 | 53.96 | 52.63 | 44.44 |
| Karodiya | 29.52 | 58.87 | 89.29 | 157.14 |
| Koyli | 33.24 | 41.98 | 61.54 | 54.55 |
| Nandesari | 32.08 | 60.27 | 150.85 | 83.33 |
| Padamla | 35.76 | 63.82 | 94.44 | 16.67 |
| Ranoli | 28.19 | 63.38 | 117.65 | 40.00 |
| Rayaka | 16.03 | 26.35 | 18.37 | 31.58 |
| Sankarda | 51.20 | 63.02 | 113.16 | 58.33 |
| Sisva | 50.82 | 85.22 | 106.90 | 122.22 |
| Sokhda | 53.64 | 73.96 | 170.59 | 143.75 |
| Undera | 40.40 | 61.64 | 130.77 | 300.00 |
| Vasna Kotariya | 52.43 | 69.88 | 93.94 | 28.57 |
| Total | 40.21 | 60.73 | 97.15 | 86.38 |

*Sources: Computed*

## 6.9. COMORBIDITY

Comorbidity is the occurrence of more than one disease in an individual. (Valderas et al. 2009). Chronic diseases rarely happen alone but rather in combination (Meghani et al., 2013). Similarly, according to Buck et al. (2013) cardiovascular diseases (CVD) also rarely occur in isolation. Thus, it is common to find multiple comorbid conditions among those who suffer from CVD. This phenomenon is particularly observed in the older adult population (Edwards et al. 2002). Successful management of comorbidity with any diseases is associated with proper care by the patient, complex treatment routine and better understanding of the complexities of comorbidity (Meghani et al., 2013).

## 6.10 GENDERWISE COMORBIDITY

### 6.10.1 Ajod

The total female population with multiple diseases was 24.81% which was double of the males (12.04%). Among the females, the maximum percentage (8.95%) of comorbidity population was with three diseases while minimum females suffered from four diseases (2.91%). The highest male population (8.16%) were affected with two diseases whereas the lowest population depicted the occurrence of 5 or >5 diseases.

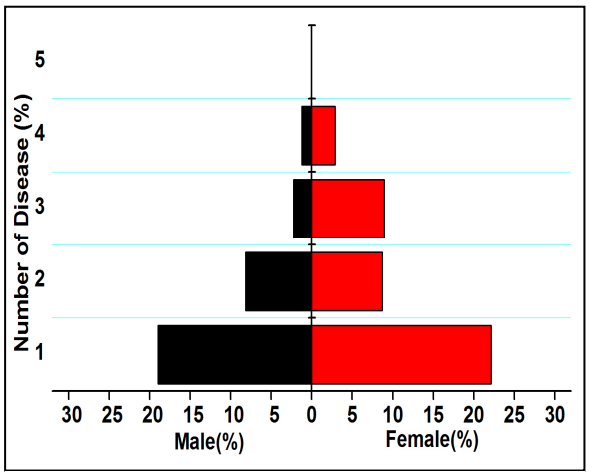


**Fig. 6.34: Gender Wise Comorbidity, *Ajod***

### 6.10.2 Anagadh

In this village 6.32% of the total male population suffered from two diseases while total comorbidity of females was 8.64%. Between the two genders, there was not much difference of comorbidity with two diseases. The least percentage of multiple diseases in males (0.23%) and females (0.99%) was observed with 5 or >5 diseases.

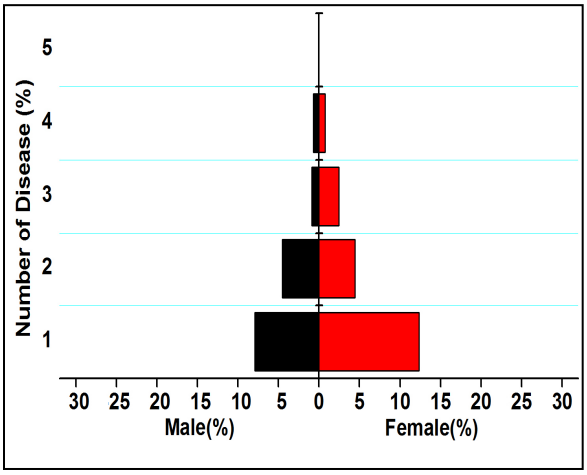


**Fig.6.35: Gender Wise Comorbidity, *Anagadh***

### 6.10.3 Ankodiya

The total male comorbidity was 3.89% in the village while 6.44% of the females suffered from more than a single disease. 3.48% male and 5.33% females were affected with two diseases. In the village no person suffered from >3 diseases.

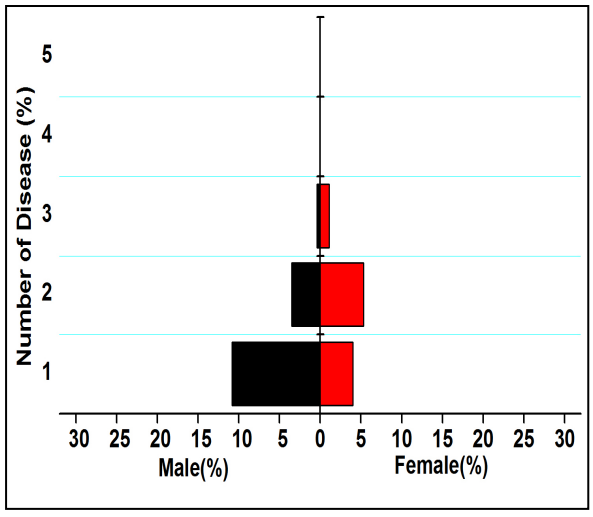


**Fig.6.36: Gender Wise Comorbidity, *Ankodiya***

### 6.10.4 Bajwa

25.55% females in Bajwa had the problems of multiple diseases while 9.05% males had the prevalence of more than one disease. 9.91% females suffered from two diseases and 8.81%% from three. Some of the females (3.52%) even had 5 or >5. The occurrence of comorbidity among males was lower than their counterpart. 5.05% males suffered from two diseases. 1.89%, 1.05% and 1.05% males suffered from 3, 4 and 5 or >5 diseases.

### 6.10.5 Chhani

The total male and female comorbidity was 10.47% and 25.00% respectively which was similar to Bajwa. The proportion of occurrence of number of diseases among male and females was also similar to Bajwa. The incidence of two diseases depicted highest percentage in both the genders (6.28% males and 13.66% females). The prevalence of 5 or >5 diseases among males comprised the lowest percentage (1.40%).While the minimum number of females had four diseases.

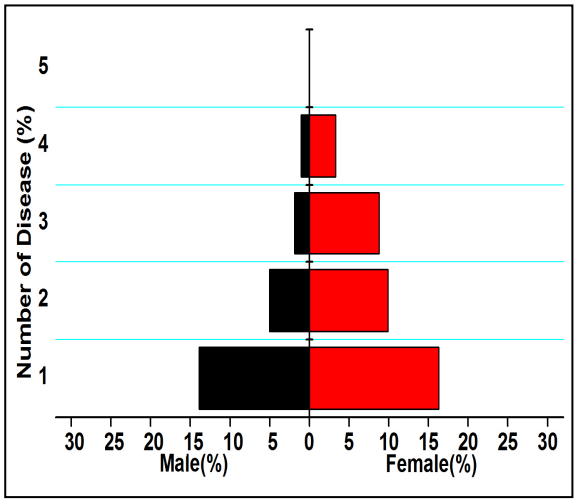


Fig.6.37: Gender Wise Comorbidity, *Bajwa*

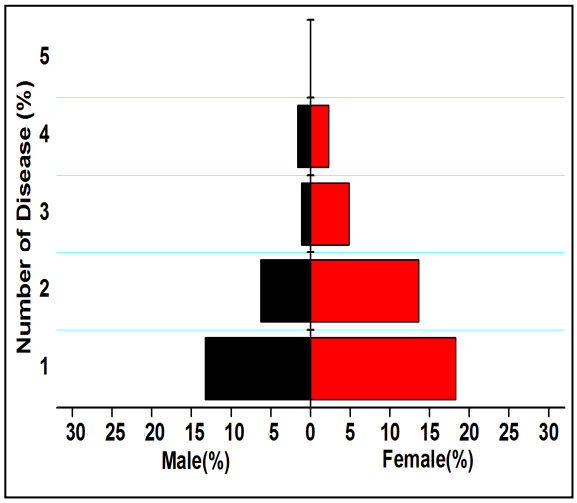


Fig.6.38: Gender Wise Comorbidity,*Chhani*

### 6.10.6 Dasharath

High female comorbidity (36.82%) was observed in this village whereas 16.32% was the prevalence of >1 disease among males. The percentage of females suffering from three diseases was 19.46% which was highest. 2.51% females had the diseases of 5 or >5. The highest percentage of male comorbidity was 10.25% with two diseases and lowest (0.84%) with 5 or >5 diseases

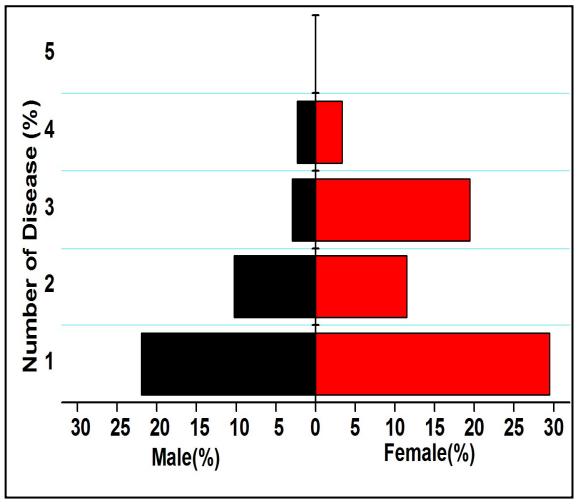


Fig.6.39: Gender Wise Comorbidity, *Dasharath*

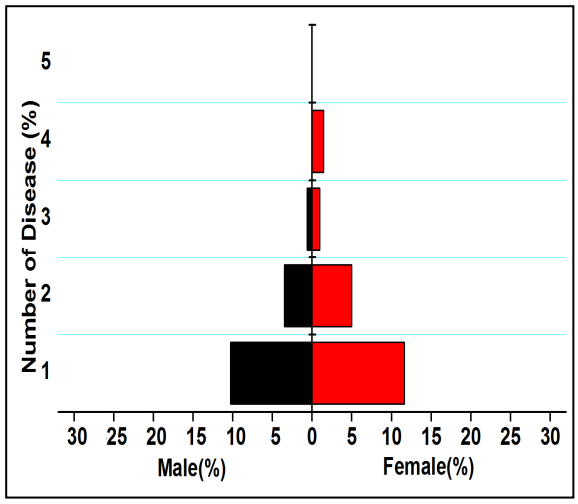


Fig. 6.40: Gender Wise Comorbidity, *Dhanora*

### 6.10.7 Dhanora

4.17% males suffered from multiple diseases and 7.36% of females had more than one disease. Two to three diseases were common among men while females suffered from even 4 diseases. Maximum percentage of the comorbidity population was affected by two diseases.

### 6.10.8 Dodka

In this village there was not much of comorbidity variation between the two genders (12.88% males and 13.77% females). 8.58% female population suffered from two diseases and 7.12% males population. Among the females, incidence of four diseases was observed in minimum population (1.13%) whereas the least population of males were affected from 5 or >5 diseases (1.15%).

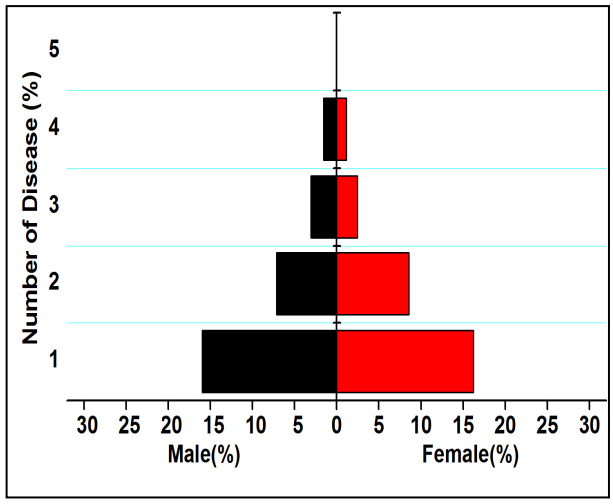


Fig.6.41: Gender Wise Comorbidity, *Dodka*

### 6.10.9 Fajalpur

The wide gap of comorbidity was observed (5.97% males and 17.54% females) in this village. 10.48% females had more than one disease and 3.64% suffered from three diseases. Female comorbidity was least with 5 or >5 diseases. The lowest comorbidity among males was affected with four diseases (0.41%).

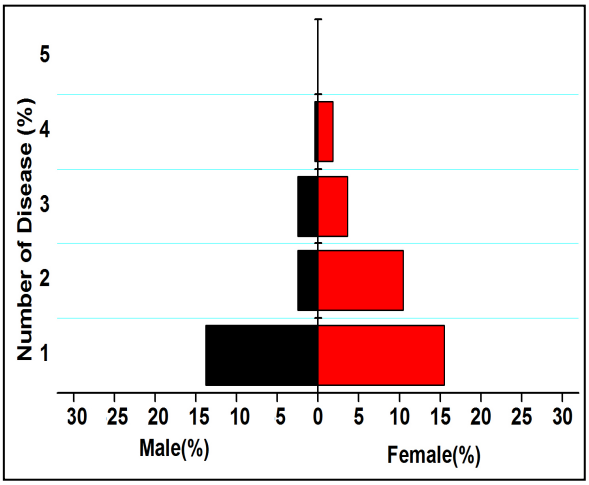


Fig.6.42: Gender Wise Comorbidity, *Fajalpur*

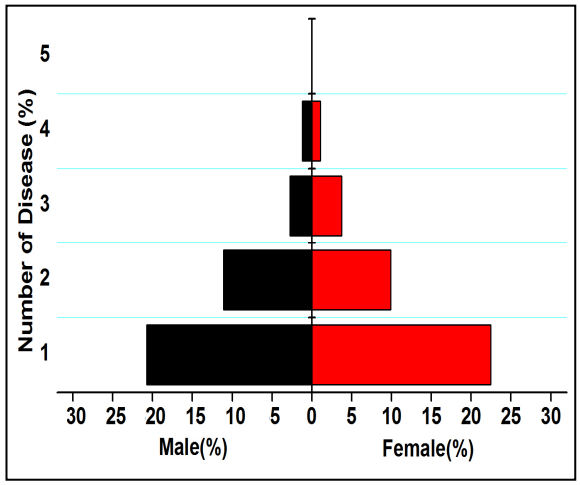


Fig.6.43: Gender Wise Comorbidity, *Gorva*

### 6.10.10 Gorva

The comorbidity was 15.61% males and 15.64% in females respectively. The highest comorbidity in both the genders was with the two diseases (11.047% males and 9.91% females). Unlike other places, the men with two diseases exceeded women with same number of diseases. The number of people who suffered from 5 or >5 diseases was least.

### 6.10.11 Karachiya

Total female comorbidity was much higher (22.77%) than males (6.91%). 3.64% males and 11.03% females were affected from two diseases. The number of males who suffered from 4 diseases and 5 or >5 diseases was same. The percentage of females decreased with the increase in number of diseases.

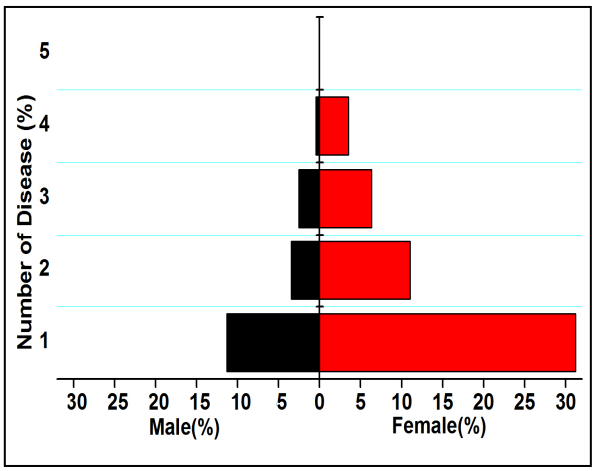


Fig.6.44: Gender Wise Comorbidity, *Karachiya*

### 6.10.12 Karodiya

The male and female total comorbidity was 10.04% and 14.67% respectively. The maximum population of multiple diseases was observed with two diseases (6.56% males and 7.58% females). While the minimum population was with the occurrence

of 5 or >5 diseases. The minimum female comorbidity was lower than the male minimum comorbidity.

### 6.10.13 Koyli

The total female population of multiple diseases was 14.04% and that of males was 6.89%. 7.51% females and 4.80% males were affected from two diseases. In every

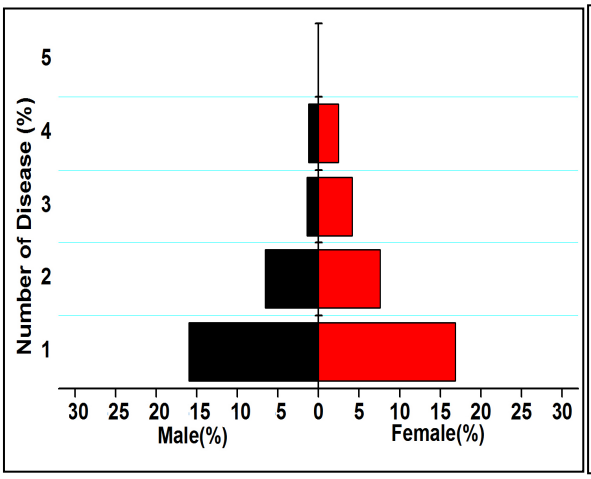


Fig. 6.45: Gender Wise Comorbidity, *Karodiya*

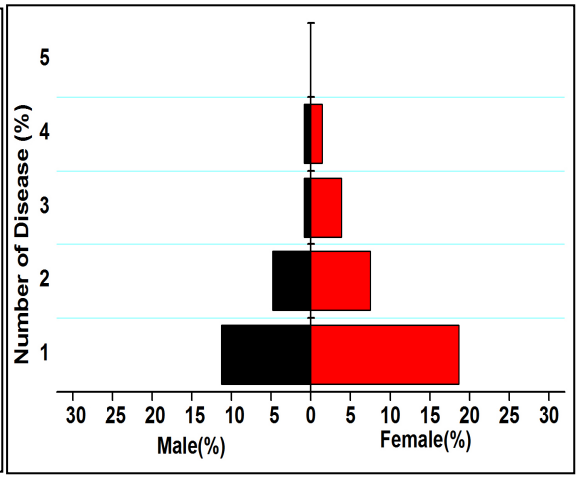


Fig. 6.46: Gender Wise Comorbidity, *Koyli*

category of comorbidity of diseases female population exceeded the males.

### 6.10.14 Nandesari

19.09% female had the problem of multiple diseases. The total male population was lower than their counterparts (8.74%). The maximum females (7.12%) suffered by three diseases while the percentage of males was with two diseases. The least population suffered from 5 or >5 diseases.

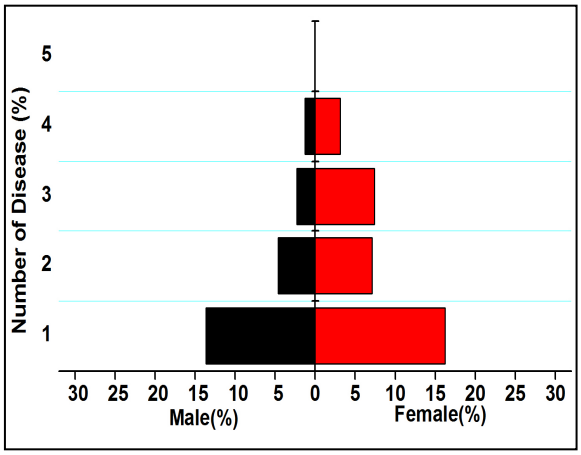


Fig.6.47: Gender Wise Comorbidity, *Nandesari*

### 6.10.15 Padmala

The male and female population with multiple diseases was 9.65% and 16.27% respectively. The highest

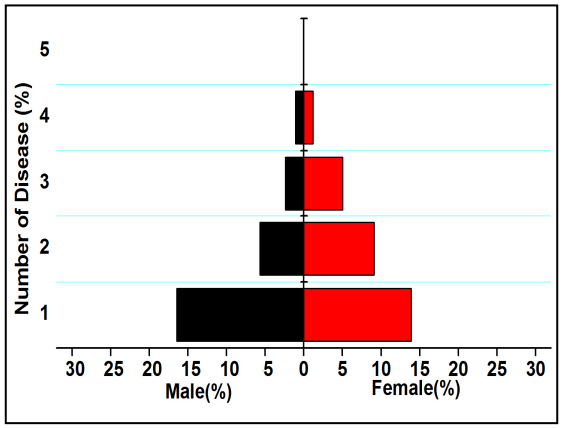


Fig.6.48: Gender Wise Comorbidity, *Padmala*

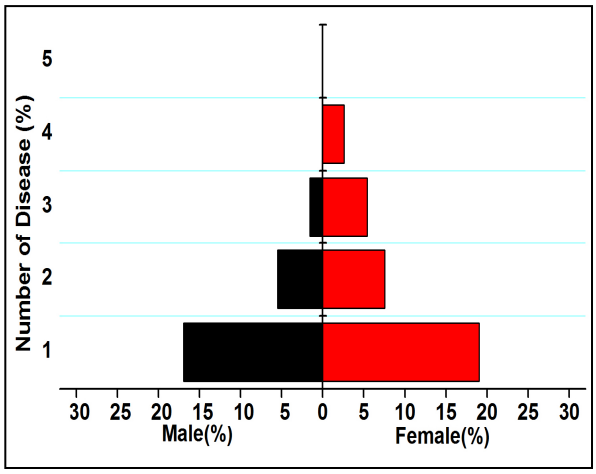


**Fig.6.49: Gender Wise Comorbidity, *Ranoli***

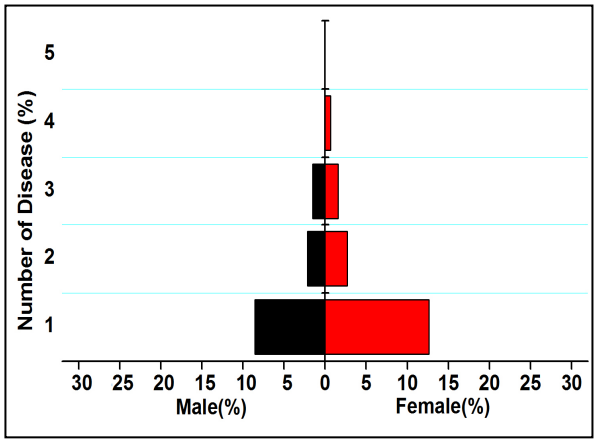


**Fig.6.50: Gender Wise Comorbidity, *Rayaka***

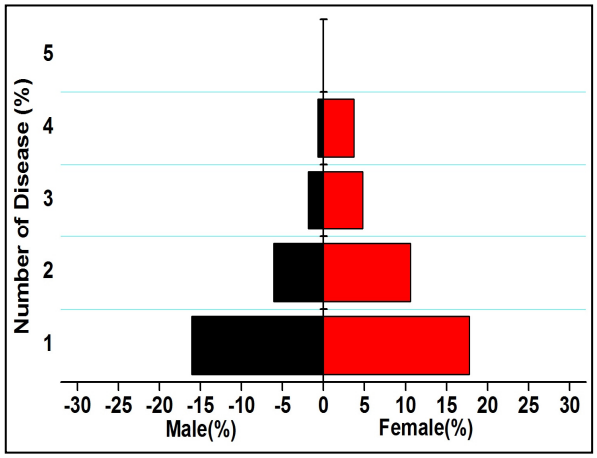


**Fig. 6.51: Genderwise Comorbidity, *Sankarda***

percentage of the comorbidity was in people affected by two diseases (5.70% males and 9.09% females). The minimum had 5 or >5 diseases.

### 6.10.16 Ranoli

Female comorbidity was 17.41% in Ranoli. In every category of affected population with different number of diseases, the females outnumbered the males. The number of affected population was least (0.22% males and females) with maximum number of diseases (5 or >5 diseases).

### 6.10.17 Rayaka

Only 3.63% males and 4.97% females had more than one disease. None of the males had >3 diseases whereas females were noted upto four diseases but the percentage was least 0.68%.

### 6.10.18 Sankarda

21.49% female suffered from 2 or >2 diseases. Male comorbidity (9.56%) was lower than female. For both the genders maximum population suffered from two diseases. In all the cases of number of diseases, females outnumbered males. The least percentage of males suffered from four diseases while minimum females were affected by 5 or >5 diseases.

### 6.10.19 Sisva

In *Sisva,* wide variation between male and female comorbidity was observed (37.73% females and 15.74% males). 20.49% of the females suffered from two diseases. Three diseases occurred in 8.72% of females and 3.65% women had 5 or >5 diseases. 9.81% males suffered with two diseases. The occurrence of more diseases was observed among lowest male population.

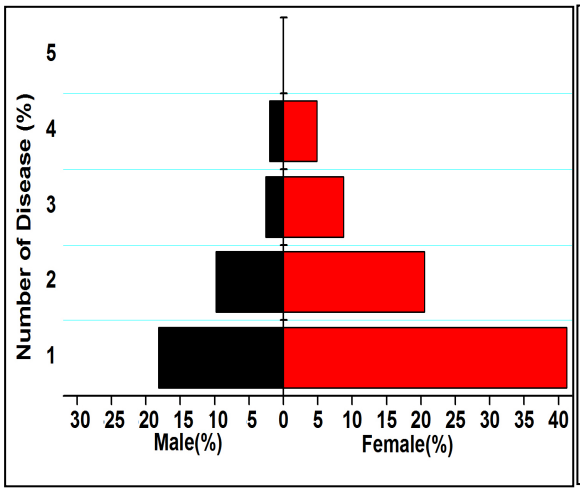


Fig.6.52: Gender Wise Comorbidity, *Sisva*

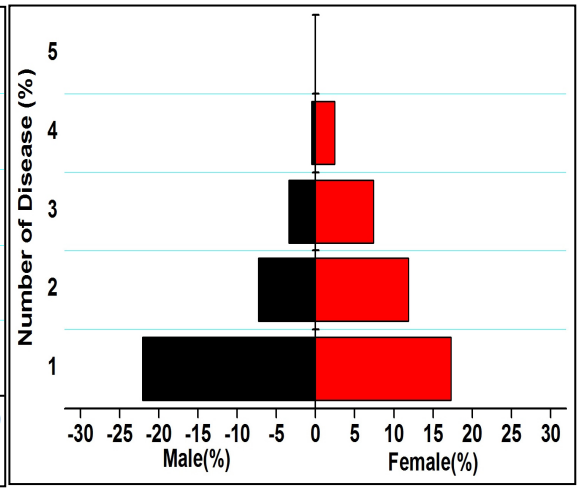


Fig.6.53: Gender Wise Comorbidity, *Sokhda*

### 6.10.20 Sokhda

22.71% females had multiple diseases in and 11.65% males were affected by >2 diseases. The percentage of male and female comorbidity with two diseases was 7.28% and 11.85% respectively. Same number (0.49%) of population were effected by both 4 and 5 or >5 diseases.

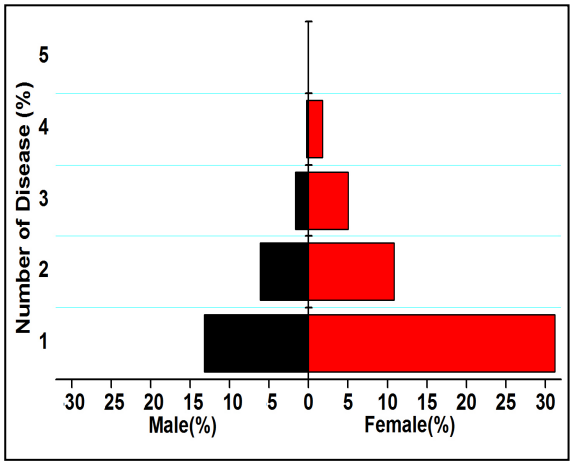


Fig. 6.54: Gender Wise Comorbidity, *Undera*

### 6.10.21 Undera

8.24% males and 18.14% females had the problem of more than one disease. For the two genders the occurrence of two diseases was most common phenomena (6.12% males and 10.83% females).

### 6.10.22 Vasna-Kotariya

The male and female comorbidity were 11.41% and 19.62% respectively. Among the females 9.62% and 7.33% males suffered with two diseases. The minimum male population (0.20%) had the prevalence of 5 or >5 diseases. 4.23% of the females suffered with 5 or >5 diseases.

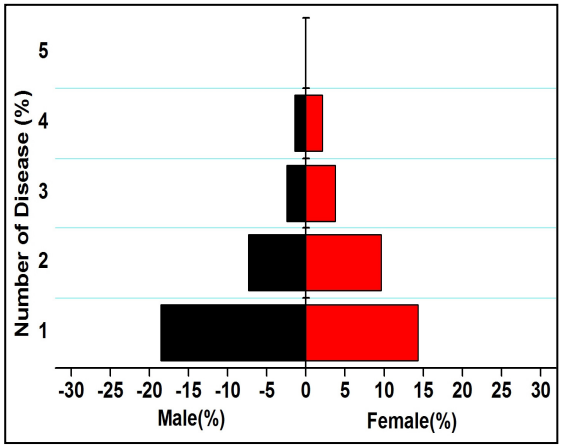


**Fig. 6.55: Gender Wise Comorbidity, *Vasna-Kotariya***

**Table 6.24: Population Suffered from Multiple Diseases**

| Places | Male | Female | Total |
|---|---|---|---|
| Ajod | 12.04 | 24.38 | 17.93 |
| Anagadh | 6.32 | 8.64 | 7.43 |
| Ankodiya | 3.89 | 6.44 | 5.11 |
| Bajwa | 9.05 | 25.55 | 17.12 |
| Chhani | 10.47 | 25.00 | 17.75 |
| Dasharath | 16.32 | 36.82 | 26.57 |
| Dhanora | 4.17 | 7.36 | 5.70 |
| Dodka | 12.88 | 13.77 | 13.29 |
| Fajalpur | 5.97 | 17.54 | 11.46 |
| Gorva | 15.61 | 15.64 | 15.63 |
| Karachiya | 6.91 | 22.77 | 14.77 |
| Karodiya | 10.04 | 14.67 | 12.15 |
| Koyli | 6.89 | 14.04 | 10.20 |
| Nandesari | 8.74 | 19.09 | 13.65 |
| Padmala | 9.65 | 16.27 | 12.81 |
| Ranoli | 7.25 | 17.41 | 12.16 |
| Rayka | 3.63 | 4.97 | 4.28 |
| Sankarda | 9.56 | 21.49 | 15.14 |
| Sisva | 15.74 | 37.73 | 26.23 |
| Sokhda | 11.65 | 47.16 | 29.25 |
| Undera | 8.24 | 18.14 | 13.02 |
| Vasna-Kotariya | 11.41 | 19.72 | 15.27 |

*Source: Computed*

## 6.11 DISEASEWISE COMORBIDITY

### 6.11.1 Skin Diseases

The maximum skin affected population were associated with the respiratory problem (14.49%) and the minimum (8.07%) skin affected population suffered with hair problems. The eye and ear (11.02%) and nervous system (11.59%) problems occurred in >10% of skin affected population.

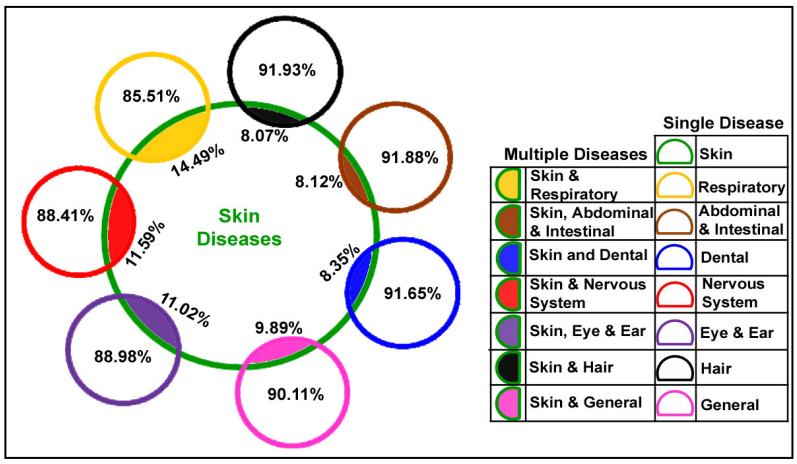


**Fig.6.56: Occurrence of Different Diseases in Skin Affected Person**

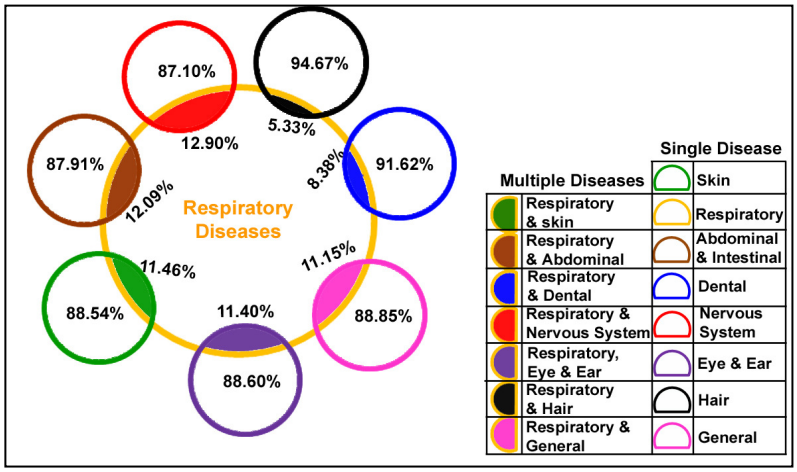


**Fig.6.57: Occurrence of Different Diseases in Respiratory Diseases Affected Person**

### 6.11.2 Respiratory Diseases

Among respiratory affected population, higher prevalence of abdominal (12.09%) and nervous problems (12.90%) was observed. Only 5.33% of respiratory affected population had hair problems. Eye and ear (11.40%) and skin (11.46%) depicted similar percentage of prevalence rate.

### 6.11.3 Abdominal and Intestinal

>10% of people suffered from abdominal disease and also from dental (10.59%) and nervous system problem. The comorbidity of abdominal and intestinal diseases with skin ailments showed the least percentage (6.47%). The occurrence of hair and abdominal and intestinal diseases (8.33%) as well as eye, ear and abdominal and intestinal diseases (8.36%) depicted similar percentage.

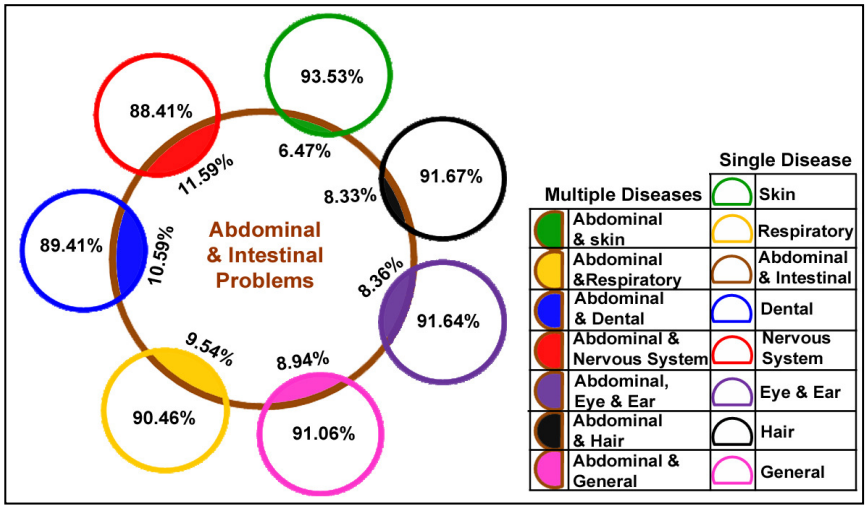


**Fig.6.58: Occurrence of Different Diseases in Abdominal and Intestinal Affected Person**

### 6.11.4 Dental Problems

High prevalence of multiple diseases with dental problem was observed. 43.21% population with dental problem were also affected with eye and ear diseases. >40% of the general problem (skeletal problem and dullness) and nervous system diseases were also observed in the total dental affected population. Relatively, the comorbidity of abdominal with dental problem affected population was lowest (25.91%).

### 6.11.5 Nervous System Problems

23.46% people with nervous system problems also suffered from eye and ear ailments. Higher occurrence of general, respiratory and dental problems among the patients of nervous system problem was also observed. The prevalence of multiple diseases of skin with nervous system problem was lower 10.78%. 15.20% of nervous system affected population also suffered from abdominal and intestinal problems.

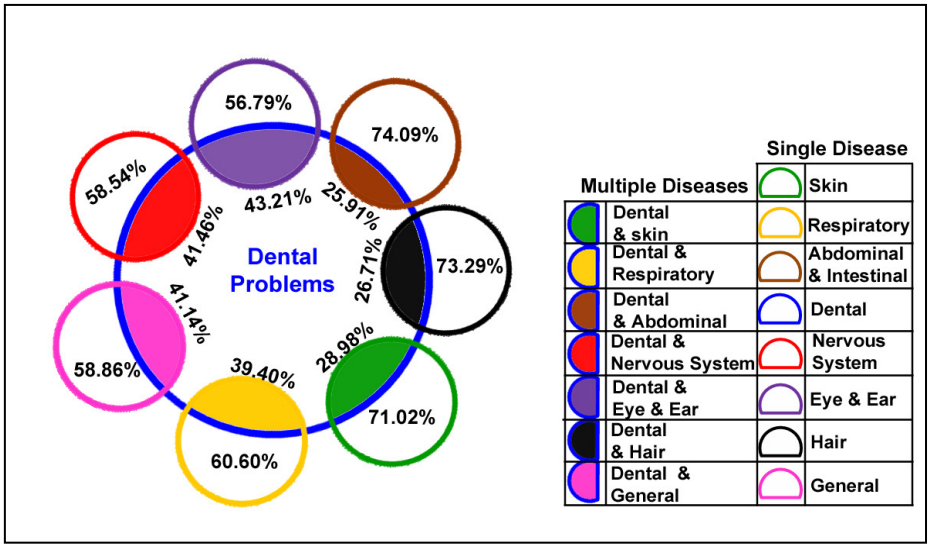


Fig.6.59: Occurrence of Different Diseases in Dental Affected Person

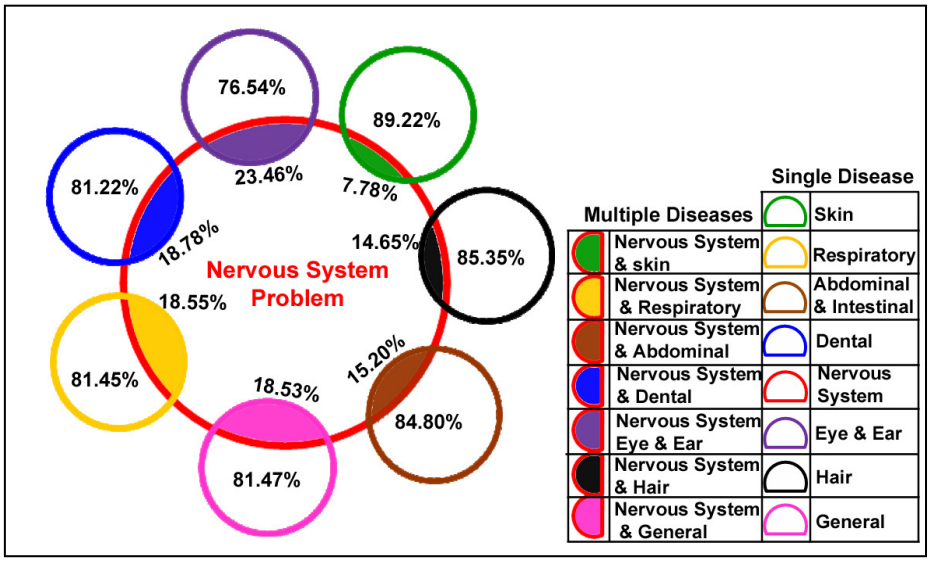


Fig.6.60: Occurrence of Different Diseases in Nervous System Affected

## 6.11.6 Eye and Ear problem

26.52% of eye infected population suffered from nervous system problems. Dullness and skeletal problems was noted in 22.60% of eye and ear infected population. 12.78% with eye and ear diseases suffered from abdominal and intestinal problems. The occurrence of hair problems and skin diseases was also low among the eye and ear infected population.

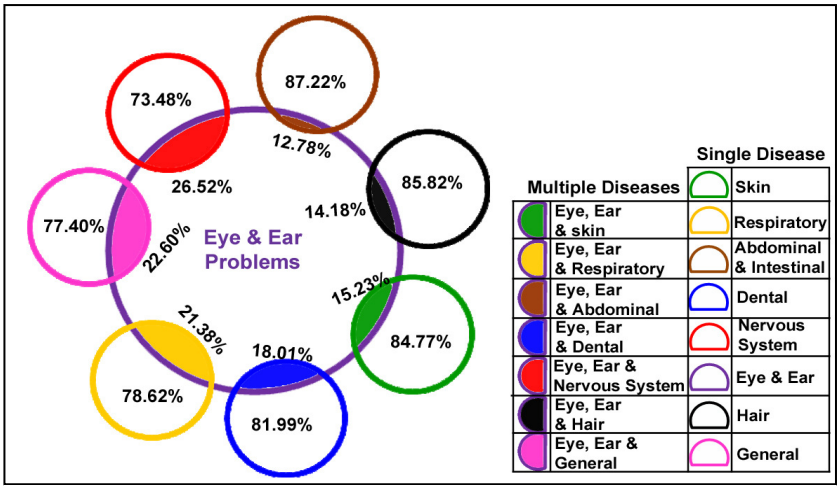


**Fig.6.61: Occurrence of Different Diseases in Eye and Ear Affected Person**

### 6.11.7 Hair

The maximum population with hair problems was associated with the nervous system problem 32.74%. >25% people with hair issues suffered from abdominal (26.25%) and general (27.47%) problems. The population having multiple diseases with hair and respiratory problems showed lowest percentage (17.31%).

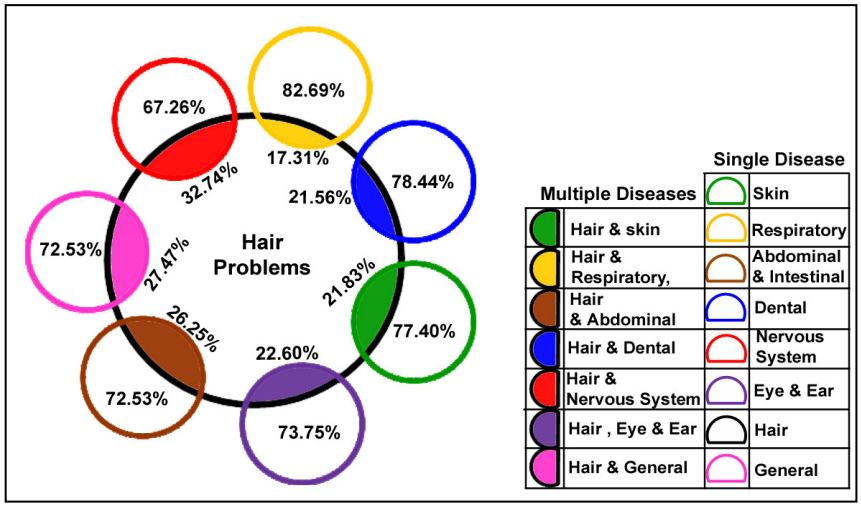


**Fig.6.62: Occurrence of Different Diseases with Hair Problem**

### 6.11.8 General

High percentage of comorbidity was observed with general problem. 43.40% of population with general problem also faced the problem eye and ear problem. 40.50% and 40.11% of the general (dullness and skeletal) problems affected population also

suffered from nervous system and respiratory problem respectively. The abdominal and intestinal problems occurred in general affected population.

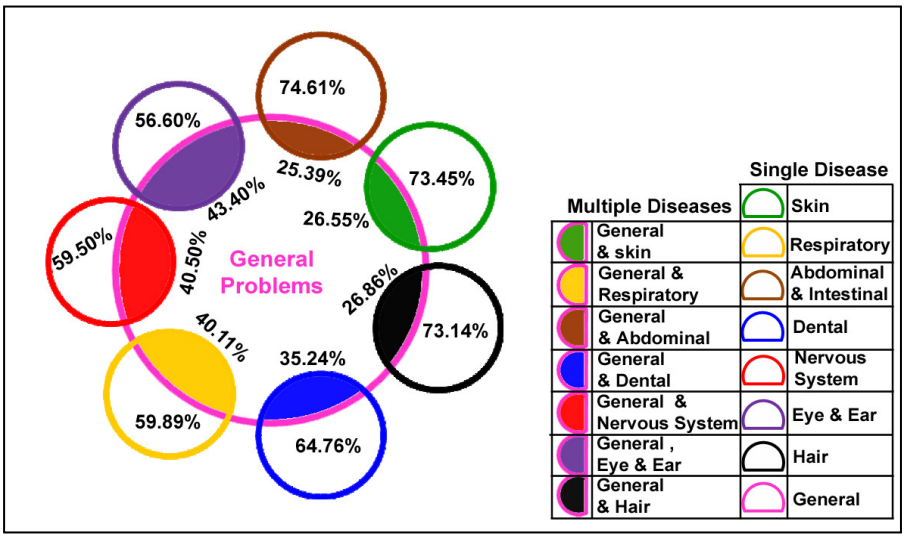


**Fig.6.63: Occurrence of Different Diseases in General (Skeletal and Dullness) Affected Person**

## 6.12 CORRELATION BETWEEN DIFFERENT PARAMETERS AND PREVALENCE RATE

The scatter plot defined the relationship between *TDS* in subsurface water and prevalence rate, the larger the value of *TDS* higher was the value of prevalence rate. The *pH* value in subsurface water and the prevalence rate appeared to be having lower negative correlation (-0.28). From the scatter diagram, it can be observed that there was almost a negligible relationship between the level of *iron* in subsurface water and prevalence rate (0.001). It indicated that the change in concentration of *iron* in subsurface water did not had an impact on prevalence rate. Lower positive correlation (+0.12) was observed between *nitrite* concentration and prevalence rate.

The correlation value (+)0.41 (Fig.6.64) which was apparent from the graph confirmed that moderate positive correlation existed between *TDS* in surface water and prevalence rate. Moderate negative relationship (-0.41) existed between *pH* level in surface water and prevalence rate. The calculation of correlation between *iron* in surface water and prevalence rate depicted low positive relationship (+0.11) which means that the concentration of *iron* in surface water does not very much influence

## Sub-surface Water

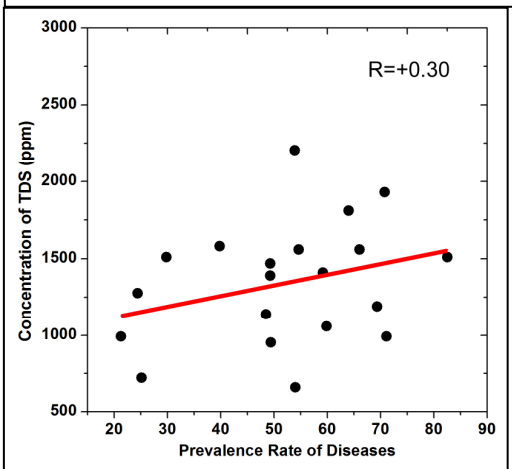


Fig.6.64: Prevalence Rate and *TDS*

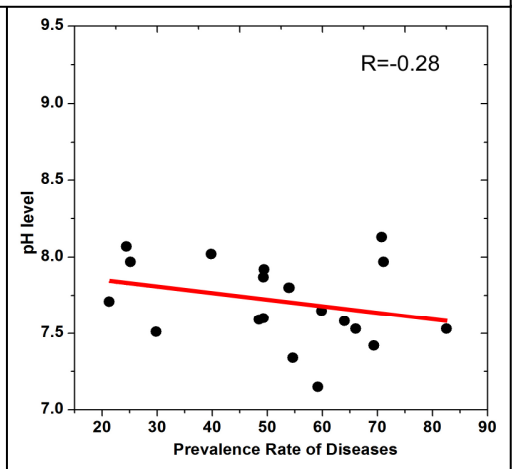


Fig.6.65: Prevalence Rate and *pH*

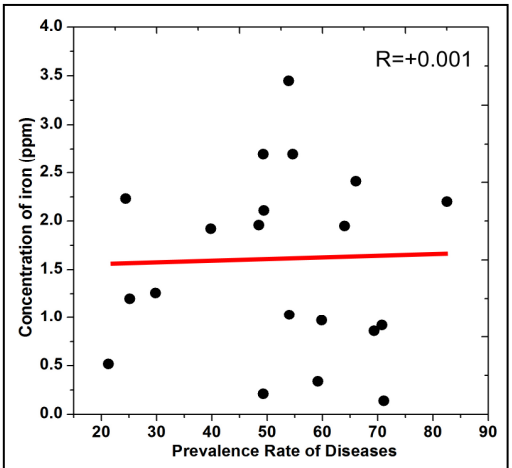


Fig.6.66: Prevalence Rate and *Iron*

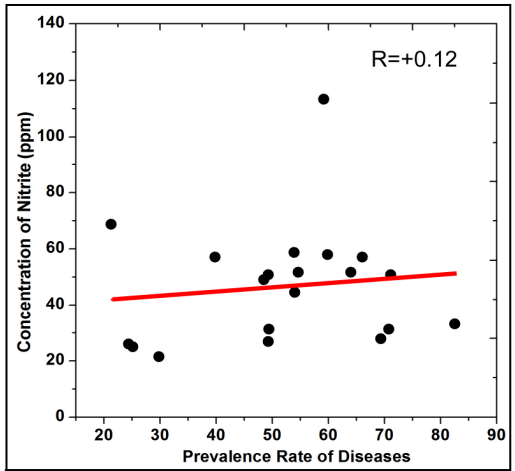


Fig.6.67: Prevalence Rate and *Nitrite*

## Surface Water

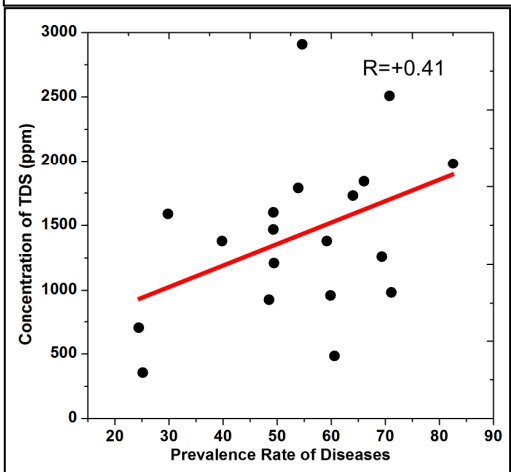


Fig.6.68: Prevalence Rate and *TDS*

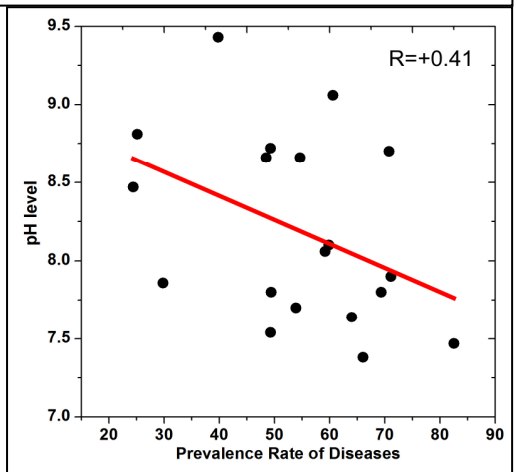


Fig.6.69: Prevalence Rate and *pH*

the prevalence rate. (-)0.34 was the correlation value between *nitrite* level in surface water and prevalence rate indicating weak relationship between *nitrite* concentration and prevalence rate. Strong positive relationship existed between magnesium in

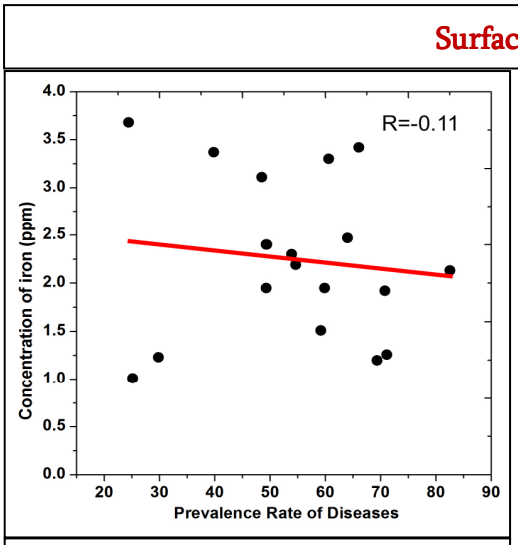


**Fig.6.70: Prevalence Rate and *Iron***

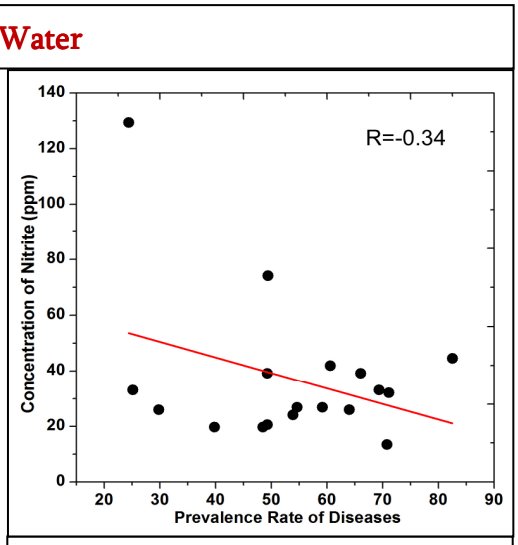


**Fig.6.71: Prevalence Rate and *Nitrite***

surface water and prevalence rate (+0.60). It means that as the concentration of *magnesium* increased the prevalence rate also rose. Similarly, as the *magnesium* level decreased the prevalence rate also declined. The correlation between concentration of *calcium* in surface water and prevalence rate also depicted stronger positive

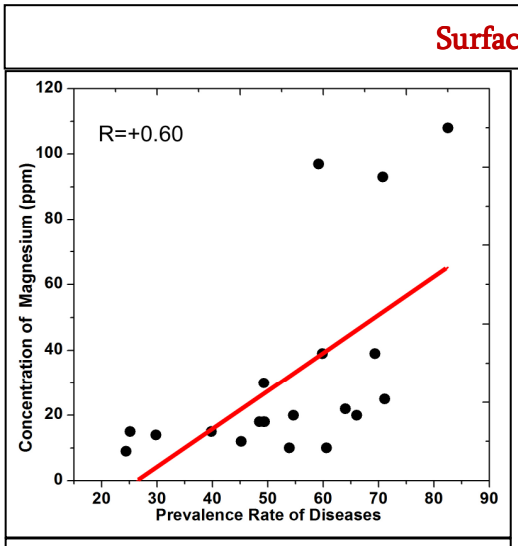


**Fig.6.72:Prevalence Rate and *Magnesium***

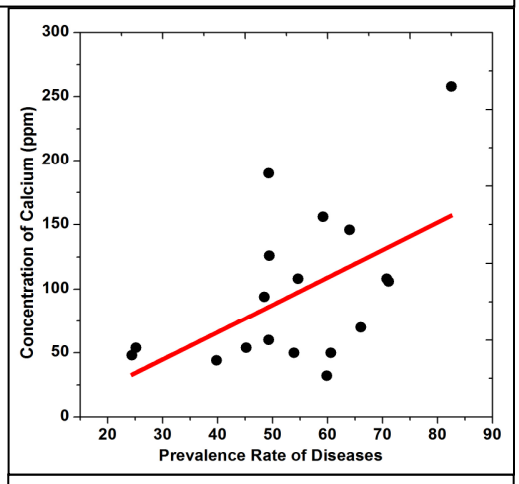


**Fig.6.73: Prevalence Rate and *Calcium***

relationship (+0.55). It indicated that both the level of calcium and prevalence rate either increased or decreased simultaneously. There was low positive relationship

between *sodium* concentration in surface water and prevalence rate. Thus, change in level of *sodium* in surface water did not intensely effected the prevalence rate. Similarly, the level of *potassium* in surface water and prevalence rate were not strongly correlated (+0.36).

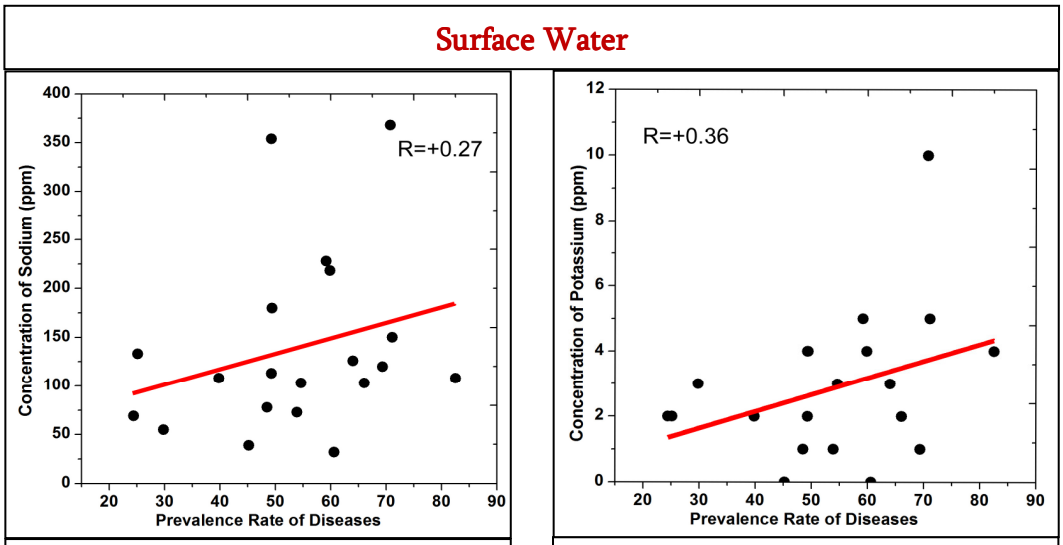


**Fig.6.74: Prevalence Rate and *Sodium***

**Fig.6.75: Prevalence Rate and *Potassium***

From the scatter diagram, it was observed that there was weak correlation between *iron* concentration in soil and prevalence rate (-0.11). Similar trend was noted between the level of *nitrite* and prevalence rate. It can be concluded that change in concentration of *iron* and *nitrite* in soil were not concurrent with prevalence rate

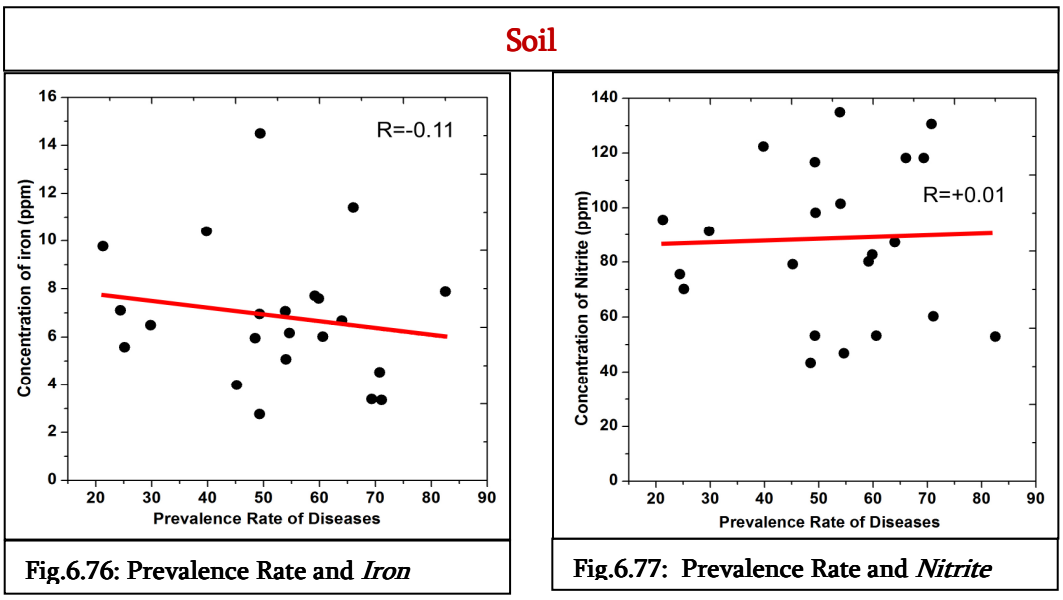


**Fig.6.76: Prevalence Rate and *Iron***

**Fig.6.77: Prevalence Rate and *Nitrite***

## 6.13 PREVALENCE RATE AND SOCIO-ECONOMIC FACTORS

In the present study, relation between the dependent variable (prevalence rate) and the independent variables (socio-economic factors) was examined. To fulfil the study, hierarchical regression analysis was performed. Hierarchical regression is a statistical technique of investigating the relationship between dependent variable and several independent variables. The independent variables may be numeric or categorical. While running the hierarchical regression the independent variables are not entered into simultaneously, but in step by step (Woltman et al., 2012).

For the study, a research question: *"Which factors (personal, professional or infrastructural and hygienic condition) influence prevalence rate?"* were set. Considering the prevalence rate as the dependent variable this research question involves a hierarchy with three levels (Table:6.25). At the stage one (level-1) professional related variables such as occupation, income and education were considered. The variable at the second stage of the hierarchy (level-2) were infrastructural facilities and hygienic condition which included sources of drinking water, health facility and sanitary condition. Variables at the third stage of the hierarchy (level-3) were personal related variables, such as gender, marital status, age and body mass index (BMI).

**Table 6.25: Factors at Each Hierarchical Level that Affect Prevalence Rate**

| Hierarchical level | Data set | Variables |
|---|---|---|
| Level 1 | Professional information | Occupation, Income and Education |
| Level 2 | Infrastructural and Hygienic factors | Sources of Drinking Water, Health Facility and Sanitary Condition |
| Level 3 | Personal Information | Gender, Marital Status, Age and BMI |

*Source: Computed*

The model 1 (professional information) of the hierarchical regression showed that $R^2 = 0.003$ (Table 6.26), ANOVA results for model 1 depicted $F(3, 18184) = 15.79$, $p = .000$ (p value should be <0.05 for statistically significant). Thus, it can be concluded that professional related factors like educational status, income and occupation was a

significant predictors of prevalence rate. The model 2, which included professional information and infrastructural and hygienic factors depicted $R^2$ = 0.004 (Table 6.26) and $F$ (6, 18181) = 12.99, $p$ =.000 (Table 6.26). Therefore, when taken together as a group, professional information and infrastructural and hygienic significantly predicted prevalence rate. In model 3, all the variables of professional, infrastructural and hygienic and personal factors were incorporated. The result indicated $R^2$ = .146 and $F$ (10, 18177) = 310.88, $p$ = .000 (Table 6.26). Hence, all the factors are significant predictor of prevalence rate.

Change in $R^2$ is a way to evaluate how much predictive power was added to the model by addition of another variable in next step. In model 2 the percentage of variability accounted for went up from 0.3% to 0.4% which is very less increased. In model 3 the change in $R^2$ = 0.142 (14.2%), it indicated that personal factors accounts for a significant amount of variance above and beyond professional information and infrastructural and hygienic factors. Thus, gender, marital status, age and BMI have more effect on prevalence rate above and beyond the occupation, income, education sources of drinking water, health facility and sanitary condition.

From the coefficient table it was observed that all the individual predictors are statistically significant (<0.05) except the health facility. The most significant predictors are age, gender and sources of drinking water (Table 6.28).

Table 6.26: Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .051[a] | .003 | .002 | 1.04860 |
| 2 | .065[b] | .004 | .004 | 1.04780 |
| 3 | .382[c] | .146 | .146 | .97045 |

a. Predictors: (Constant),Education, Income Occupation

b. Predictors: (Constant), Education, Income Occupation, Sanitary Condition, Health Facility, Sources Drinking Water.

c. Predictors: (Constant), Education, Income Occupation, Sanitary Condition, Health Facility, Sources Drinking Water, Age, Gender, BMI, Marital status.

*Source : Computed*

Table 6.27: ANOVA[a]

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 52.11 | 3 | 17.372 | 15.799 | .000[b] |
| | Residual | 19994.25 | 18184 | 1.100 | | |
| | Total | 20046.36 | 18187 | | | |
| 2 | Regression | 85.567 | 6 | 14.261 | 12.990 | .000[c] |
| | Residual | 19960.79 | 18181 | 1.098 | | |
| | Total | 20046.36 | 18187 | | | |
| 3 | Regression | 2927.85 | 10 | 292.785 | 310.889 | .000[d] |
| | Residual | 17118.51 | 18177 | .942 | | |
| | Total | 20046.36 | 18187 | | | |

a. Dependent Variable: Prevalence Rate

b. Predictors: (Constant),Education, Income Occupation

c. Predictors: (Constant), Education, Income Occupation, Sanitary Condition, Health Facility, Sources Drinking Water.

d. Predictors: (Constant), Education, Income Occupation, Sanitary Condition, Health Facility, Sources Drinking Water, Age, Gender, Bmi, Marital status.

*Source : Computed*

Table 6.28: Coefficients[a]

| Model | | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|
| 1 | (Constant) | | 22.158 | .000 |
| | Occupation | -.039 | -5.257 | .000 |
| | Income | -.002 | -.250 | .803 |
| | Education | .028 | 3.680 | .000 |
| 2 | (Constant) | | 19.421 | .000 |
| | Occupation | -.038 | -5.140 | .000 |
| | Income | -.001 | -.106 | .916 |
| | Education | .029 | 3.839 | .000 |
| | Sanitary Condition | .009 | 1.282 | .200 |
| | Sources of Drinking Water | -.038 | -5.166 | .000 |
| | Health Facility | .010 | 1.319 | .187 |
| 3 | (Constant) | | -4.428 | .000 |
| | Occupation | .007 | .891 | .373 |
| | Income | -.018 | -2.635 | .008 |
| | Education | .021 | 2.998 | .003 |
| | Sanitary Condition | .014 | 2.106 | .035 |
| | Sources of Drinking Water | -.031 | -4.532 | .000 |
| | Health Facility | .011 | 1.663 | .096 |
| | Gender | .114 | 15.909 | .000 |
| | Marrital Status | -.029 | -2.990 | .003 |
| | Age | .333 | 35.545 | .000 |
| | BMI | .016 | 2.132 | .033 |

a. Dependent Variable: Prevalence Rate

*Sources: Computed*

## *Resume*

*In this chapter, the impact of industrial activities and socio economic factors on human health was analysed. The high prevalence of diseases was observed in the study area and highest was observed at Dasharath which is adjacent to GSFC. Females were more affected than the males. Prevalence rate was high among aged population. Statistical analysis depicted that socio economic factors play an important role in the incidence of diseases. The following chapter summarises the finding of all the chapters.*

**Fig.6.78: Villagers Working at Effluent Channels from IPCL**
*Source: Photograph during Field Visit*

**Fig.6.79: Villagers Working at Industrial Waste Disposal Sites**
*Source: Photograph during Field Visit*

**Fig.6.80: Women Washing Clothes near GACL**
*Source: Photograph during Field Visit*

**Fig.6.81: Children at Industrial Waste Disposal Sites**
*Source: Photograph during Field Visit*

**Fig.6.82: Skin Diseases**
*Source: Photograph during Field Visit*