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- Malthus was unsuccessful in providing a link between the preventive checks and positive checks in his theory.
- Malthus was unable to distinguish between physiological capacities to reproduce and actual reproductive performance. In other words, he was unable to distinguish between fertility and fecundity.
- Malthus provided poor classification of population checks. Both preventive checks and positive checks were not independent categories.
- Malthus placed undue emphasis on the limitation of the supply of land.
- Malthus painted a gloomy picture of population growth; his prediction did not come true due to the green revolution.
- Malthus did not focus on industrial development as the increasing means of subsistence.
- According to Ralph Thomlinson, the religious belief of Malthus prevented him from understanding the possibility of the widespread use of contraceptives.
- Malthus favoured postponement of marriage and even total abstinence.

In spite of the above-mentioned criticisms, the Malthusian theory of population brought an evolution in the field of demography, sociology and economics and in many other branches of social sciences. According to Kingsley Davis, the theory was *theoretically significant*. His name occupies an important place in the history of population study.

1.5.2 Theory of Optimum Population

The term 'optimum' refers to a condition which is most favourable. This could be *temperature*, *climate*, *light*, *population* or anything else.

Till the time of Malthus, most theories of population were based on social or biological factors. Soon, however, economists realized that besides social and biological factors, economic factors are also responsible for change in population. Therefore, the optimum population theory was formulated to study the correlation between population and national income. There is no exact reference as to who invented this theory. Some believe it had its origins in the writings of Karl Winkelblech (1810–1865), a German professor who classified nations according to population into three categories—under-populated, over-populated and normal populated. Edward West's *Essay on the Application on Capital to Land* (1815) also throws light on the impact of growth of population on the growth in production. The fundamental idea in the theory of optimum population was used by Henry Sidgwick. He did not use the term *optimum*, but his indication in the writing was for the same. Later on, the term 'optimum' was systematically used by Edwin Cannan, Hugh Dalton and A.M. Carr Saunders.

According to Edwin Cannan, 'at any given time, the population which can exist on a given extent of land, consistent with the greatest productiveness of industry at that time is definite.'

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According to the United Nations, 'the concept of optimum population is the size of the population which results in the highest per capita income, the highest productivity as measured in different manners, or the highest level of other less well-defined economic indicators, such as economic welfare, level of living, real income, and in some cases employment'.

To understand the concept of optimum population of a country, Dalton presented a formula, which is as follows:

$$M = (A–O)/ O$$

where,

M = Maladjustment

A = Actual number of people

O = Optimum number of people

When M is positive, we have overpopulation, if it is negative we have under-population and if it is zero, the population is of optimum size. Since changes in 'O' cannot be measured; the formula is of doubtful utility. Unless optimum size is known, one cannot say whether a country is overpopulated or under-populated.

Thus, the theory of optimum population does not deal with how and why the population of a country increases. In fact, the theory inserts the concept of 'optimum' in the field of population. This concept is dynamic in nature and changes with natural resources, technology and production techniques to yield maximum output and per capita income. This theory supposes the optimum population as a mid-point between over and under-population.

Assumptions of the optimum population theory

The optimum population theory is based on certain assumptions which are as follows:

- The theory assumes that there is a direct relation between the average production of labour and per capita income. The proportion of working population to the total population remains unchanged in a country. This means that any change in the average productivity will introduce the same change in per capita national income.
- The theory assumes that after a certain point, the law of diminishing returns operates in the field of production. The natural resources, amount of capital and technical know-how remains unchanged at a particular time in a country whenever population increases.

Criticism of the optimum population theory

Some of the criticisms aimed at the optimum population theory are as follows:

- It is difficult to determine the optimum point in the growth of a population. Most demographers disagree on this point.

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- The concept of optimum population is essentially a static concept, which is based on the assumption that there is an optimum limit of resources, technology, foreign trade and social structure.
- The theory mainly focuses on 'optimum' concept of economic theory and neglects the cause of change in population. It fails to explain the theories of population increase.
- It fails to explain how per capita income becomes highest.

1.5.3 Marxist Views on Population

German philosopher Karl Marx (1818–1893) is considered to be the founder of modern communism. He never separately formulated any theory of population, but has discussed it as an aspect of communism. While studying population, he presented the theory of surplus population. Karl Marx believed in socialist society, hence he completely rejected the Malthusian theory. Marx believed that there can be no natural or universal law of population, and said, 'An abstract law of population exists for plants and animals only, and only in so far as man has not interfered with them.' According to him, 'Every special historic mode of production has its own special laws of population, historically valid, within its limit alone.' Thus, according to him, the theory of population is very unusual to the capitalist system of production.

Marx believed that communism is the only solution to all human pecuniary problems. According to him, any type of economic problems arising due to growth in population can be resolved through communism.

Marx firmly believed that capitalism is responsible for the rise of deficiency in food in relation to population. He firmly opposed the Malthusian view of people suffering due to the faster growth of men than the production of subsistence.

Marx believed that with the emergence of communism, all problems of population will disappear. Thus, according to Marx, there is a relation between population and the economic system.

The very process of production and distribution in a capitalist society is based on the expectation of '*surplus value*', exploitation of which deteriorates the condition of labour. According to him:

> It is the working population which, while affecting the accumulation of capital also produces the mean whereby it is itself rendered relatively superfluous, is turned into a relatively surplus population; and it does so to an ever increasing extent. This is a law of population peculiar to the capitalist method of production; and in fact, every method of production that arises in the course of history has its own peculiar, historical valid law to population. It is only for plants and animals that there is a law of population in the abstract; and that only in so far as man does not interfere with them.

Thus, according to Marx, poverty and unemployment is a gift of capitalism. They both are the medium of population growth. The low per-capita income land, the traditional *zamindari* system, and uncertainty of ownership cause low productivity and thus problems in population rise.

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According to Marx, the population of a country increases on account of capitalism and not on account of fertility. The capitalists form the labour part of production through which they gain maximum surplus value. This results in the spread of unemployment, decline in wages and increase in poverty. Thus, according to Marx, incorrect capitalist policies is the main reason of surplus population.

Marx firmly believed that there is a separate law of population in every period of production. From time to time, there is a constant change in the mode of production which always demands a new approach of production. As a result, several problems prevail in a capitalist society. Thus, according to him, reproductive behaviour in humans will create a complete harmony between society and the individual in a socialist society.

Criticism of Marxist views on population

The following are the criticisms of Marx's views on population:

- Economic inequality cannot be the main force behind rising birth rates. Had it been so, then birth rates in capitalist countries where such inequalities have come to an end should not differ.
- It is delusional to presume that in a socialist system there is no need for any check on population at any stage.
- Even communist countries keep population in check by forcing families to adopt single or two-children norms.

1.5.4 Demographic Transition Theory

Depending upon the fertility and mortality of human populations, development takes place in different stages in both developed and developing countries. These stages are sometimes termed 'population cycles' or 'demographic transition', i.e., the progress from one demographic condition to another.

Several demographers such as Warren Thompson in 1929 and Adolphe Landry in 1909, attempted to describe demographic transition on the basis of high and low mortality and fertility conditions.

Adolphe Landry

According to Landry, a population is based on economic and demographic regimes. There are three regimes that are based on the relationship between population and economic development and food supply.

- A primitive regime
- An intermediate demographic regime
- A modern epoch

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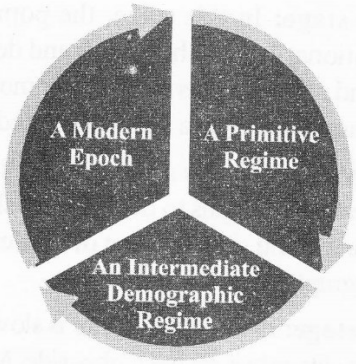

Fig. 1.4 Landry's Regimes of Demographic Transition

(i) **Primitive regime:** Food supply plays an important role in this stage of population change. The rate increase and decrease in population is based on the supply of food material. Mortality is dependent on the availability of food.

(ii) **Intermediate demographic regime:** In this stage, the change in population depends on economic development of the country rather than on food supply.

(iii) **Modern epoch:** In this stage, there is no direct relation between population and food supply and economic development. This stage is also referred to as the 'population revolution' stage.

C.P. Blacker

According to C.P. Blacker, demographic transition in developed nations can be divided into five phases. These are:

- High stationary stage
- Early expanding stage
- Late expanding stage
- Low stationary stage
- Diminishing stage

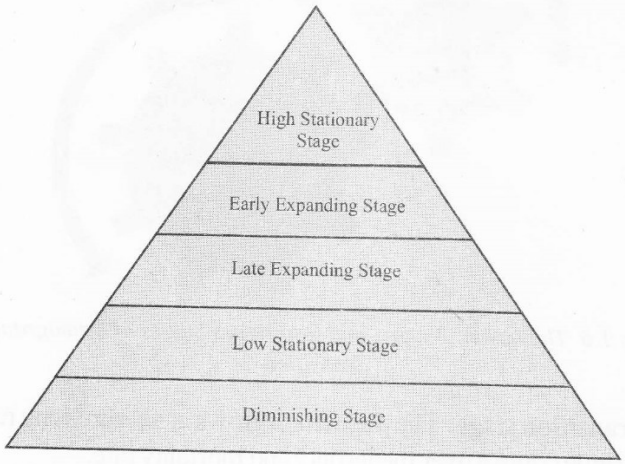

Fig. 1.5 Blacker's Five Stages of Demographic Transition

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- **High stationary stage:** In this stage, the population of a country is approximately stationary due to high birth and death rates, ranging from 40–50 per thousand per year. This stage is common in those countries that are dependent on agriculture. As a result, the standard of living is very low.
- **Early expanding stage:** In this stage, the birth rate is stationary (high level), whereas death rate begins to decline very slowly. As a result of this, the population starts rising slowly. Most of the developing countries have this stage of demographic transition.
- **Late expanding stage:** In this stage, there is slow decline in the birth and death rate but mortality rate is on the higher side. Most urbanized countries fall in this category.
- **Low stationary stage:** In this stage, both the birth rate and the death rate are under control and at a low level. Thus, in this stage the growth rate in population is almost negligible. There is very low fertility and mortality rate. Most of the developed countries fall in this category.
- **Diminishing stage:** In this stage, the growth of population starts declining because of a low fertility rate and a high mortality rate.

Thompson, Bougue and Notestein

Here, demographic transition is divided into three stages. These are:

- Pre-transition stage
- Transition stage
- Post-transition stage

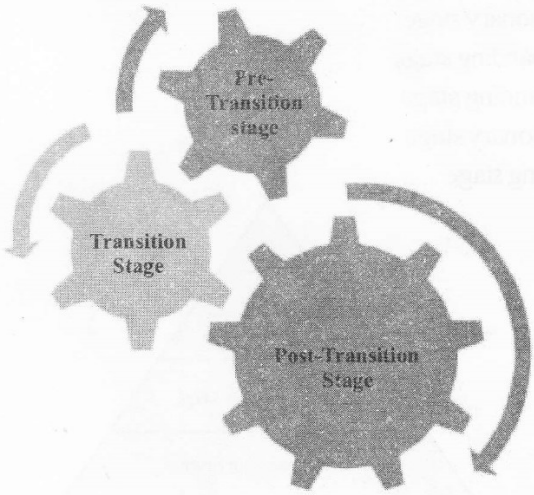

Fig. 1.6 Thompson, Bougue and Notestein's Stages of Demographic Transition

(i) **Pre-transition stage:** The population grows at an increasing rate and there is very little control over the fertility and mortality rate.

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(ii) **Transition stage:** In this stage, the death and birth rate of the population are declining. As a result, there is a decline in population growth.

(iii) **Post-transition stage:** The country is responsible for reducing the rate of mortality and fertility at a low level. As a result of which the growth rate of population is almost zero. In this stage, the standard of living of the people is very high.

Others, such as Donald Olen Cogwill and Karl Sax also pointed out various stages of demographic transition. According to Cogwill, a population passes through five stages, which are the primitive cycle, modern cycle, future cycle, probable cycle and population cycle. According to Karl Sax, population passes through four different stages.

The United Nations Organization also attempted to define demographic transition. UNO shifted from classifying the growth of population in different stages to different types of population growth, which are as follows:

- High birth and death rates
- High birth rate and declining fairly death rates
- High birth rate and fairly low death rates
- Declining birth rates and low death rates
- Low or fluctuating birth and death rates

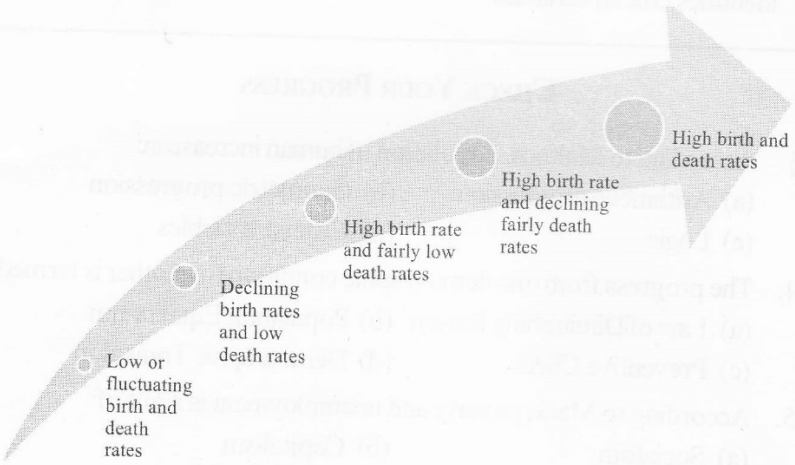

Fig. 1.7 UNO's Classification of Types of Population Growth

(i) **High birth and death rates:** This refers to a high number of both births and deaths. This is applicable in very few developing and underdeveloped countries.

(ii) **High birth rate and declining fairly death rates:** Under this category, only those countries are included which have very high number of births and deaths, but the number is declining at a very fast pace.

(iii) **High birth rate and fairly low death rates:** In this category, the population has a tendency to rise due to high birth rates and fairly low death rates.

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(iv) **Declining birth rates and low death rates:** In this category, the population increases at a diminishing rate. Here, the death rate has reached its minimum level and the birth rate shows a tendency to decline.

(v) **Low or fluctuating birth and death rates:** In this type of classification, the birth and death rates either keep on fluctuating or always remain low.

Criticism of the demographic transition theory

There are several criticisms to the demographic transition theory. These are:

- The theory is a broad generalization and was based on population changes in Western countries. Since population growth in other countries does not follow an identical pattern, no theory can explain population growth everywhere.
- The theory failed to explain the theoretical view of fertility as a force in demographic transition.
- The theory failed to explain the concept of the 'baby boom' in Western countries.
- The theory does not have predictive value. It does not provide any explanation of fertility decline nor does it identify crucial variables in it.
- The theory neither extracts fundamental processes from a phenomenon nor identifies crucial variables.

Check Your Progress

13. According to Malthus, population of human increase in:
    (a) Arithmetic progression (b) Geometric progression
    (c) Logic (d) Crucial variables
14. The progress from one demographic condition to another is termed as:
    (a) Law of Diminishing Return (b) Population Equilibrium
    (c) Preventive Check (d) Demographic Transition
15. According to Marx, poverty and unemployment is a gift of:
    (a) Socialism (b) Capitalism
    (c) Population (d) Urbanisation
16. At any given time, the population which can exist on a given extent of land, consistent with the greatest productiveness of industry at that time is definite is a statement of:
    (a) Edwin Cannan (b) Karl Marx
    (c) Robert Malthus (d) Dalton
17. List two criticisms of the demographic transition theory.

1.6 SUMMARY

- Demography is an important field of study in social science. It provides detailed information on population its composition, and distribution.
- It provides information on several socio-economic issues such as unemployment, production, consumption, saving, standard of living, income condition, marital status, composition of the family, growing trend about caste, religion and education, urbanization, labour condition, etc.
- With the constant increase in the scope of study of this subject, there is a growing recognition of its importance.
- There are three principle sources of demographic data, which are census, vital statistics and sample surveys.
- Some important theories of population include those of the mercantilists, the physiocrats, Thomas Malthus, Karl Marx, etc.

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1.7 KEY TERMS

- **Demography:** The study of human population, especially size, growth, density, distribution and vital statistics
- **Macro-demography:** The study of demography that deals with the causes of slow or rapid growth of a population, slow and rapid growth of birth rates and death rates, sex ratio and health condition of the population
- **Micro-demography:** The study of demography that deals with small units such as an individual, family or group
- **Census:** The collection of data, publication and tabulation of socio-economic demographic avenues for the population of a particular region or area
- **Vital statistics:** Statistics related to some important events in the lives of humans such as birth, death, marriage, widowhood, adoption, abortion, etc.

1.8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. (a) 2. (b) 3. (b) 4. (a) 5. (d) 6. (b) 7. (a, b)
8. (c) 9. (b) 10. (a, b) 11. (a)
12. The National Sample Survey in India was established in 1950 as a permanent organization with an aim to obtain comprehensive information on social, economic, demographic and agricultural characteristics of the entire country.
13. (b) 14. (d)
15. (b) 16. (a)

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17. Two criticisms to the demographic transition theory are:
    - The theory is a broad generalization and was based on population changes in Western countries. Since population growth in other countries does not follow an identical pattern, no theory can explain population growth everywhere.
    - The theory failed to explain the theoretical view of fertility as a force in demographic transition.

1.9 QUESTIONS AND EXERCISES

Short-Answer Questions

1. Explain the various objectives of demography.
2. What is a census?
3. Explain the optimum theory of population.
4. What is vital statistics?
5. Explain the concept of demographic data.

Long-Answer Questions

1. Define demography and discuss its scope and subject matter.
2. Explain the various thoughts of early thinkers on population.
3. What is demographic data? What are the various sources of demographic data?
4. How is demography an important field of study?
5. Explain Malthus' and Marx's views on population.

1.10 FURTHER READING/REFERENCES

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UNIT 2 FERTILITY

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Structure

2.0 Introduction
2.1 Unit Objectives
2.2 Relationship Between Fertility, Fecundity and Reproductive Span
2.3 Measurement of Fertility
2.4 Differential Fertility
2.5 Physiological and Socio-Cultural Factors Affecting Fertility
2.6 Methods of Contraception
2.7 Summary
2.8 Key Terms
2.9 Answers to 'Check Your Progress'
2.10 Questions and Exercises
2.11 Further Reading/References

2.0 INTRODUCTION

Fertility is a vast subject. Knowing everything about it in detail requires a lot of time and energy. This unit will deal with some of the most important topics on fertility, such as the relationship between fertility, fecundity and the reproductive span of a woman. There is a very close relation between each of them, and all the three factors play a vital role in understanding the dynamics of population.

Later in the unit you will be able to understand fertility measurement and various statistical ratios that are applied to it.

You will also learn about differential fertility and the factors that are responsible for it. You will come across various physiological and socio-cultural factors influencing fertility such as religion, education, cultural beliefs and practices, employment, hypertension, stress, mental disorder, etc.

In the last part of the unit, you will learn about contraception and the various methods of contraception.

2.1 UNIT OBJECTIVES

After going through this unit, you will be able to:

- Define fertility and fecundity
- Understand the concept of reproductive span
- Describe the relationship between fertility, fecundity and reproductive span
- Understand fertility measurement
- Explain differential fertility
- Know about contraception and the various methods of contraception

2.2 RELATIONSHIP BETWEEN FERTILITY, FECUNDITY AND REPRODUCTIVE SPAN

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The study of fertility, fecundity and reproductive span is very important in demography. These are some of the most important factors that directly or indirectly affect the rate of population. These factors are also indicative of social, economic and health issues such as population pressure, public health, low per capita income, low standard of living, and low growth of population. Before we understand the relationship between fertility, fecundity and reproductive span, it will be appropriate to know the meaning and definition of each of them.

Fertility

The term 'fertility' denotes the ability to reproduce by natural means. In demographic terms, fertility refers to the actual production of offspring. It is the ability to give live birth. According to the UNFPA, live birth refers to:

> The complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which after such separation, breathes or shows other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born.

Thus, fertility records live births through women of child-bearing age. It varies depending upon the reproductive behaviour of individuals.

Fertility is a voluntary biological process. There are various important social, biological and economic factors that determine fertility.

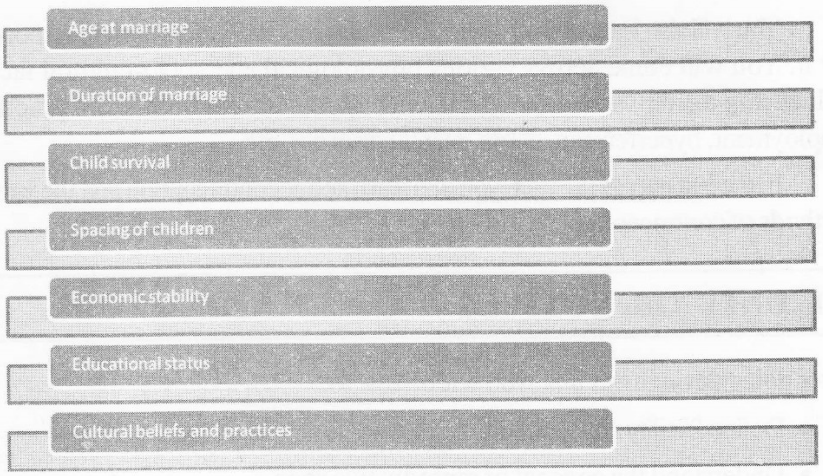

Fig. 2.1 Factors Determining Fertility

Fecundity

The physical capacity of bearing a child is termed as 'fecundity'. In other words, any married woman (leaving maidens, divorced women, widows or women using

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contraceptives) who has the capacity to conceive a child is termed as *fecund*. It is an inherent physiological capacity uniformly distributed in both sexes.

Fecundity for a man starts at puberty and continues throughout his life. Fecundity attains its maximum during the second and third decades of life and diminishes gradually. The fecundity of a women starts at menarche and ends at menopause. It continues through the entire reproductive span.

A woman who stays married throughout her reproductive age span and participates in the reproductive processes without taking any kind of contraception has an average fecundity potential.

Reproductive span

The physiological occurrence of menarche and menopause comprise the reproductive span. Both the processes only occur in females at a particular age. The first menstrual cycle or the beginning of first menstrual bleeding among females is termed as *menarche*. On the other hand, the end of menstrual cycle is termed as *menopause*. Both menarche and menopause are together responsible for determining the reproductive span in females.

Relationship between fertility, fecundity and reproductive span

Going by the definitions of fertility, fecundity and reproductive span, it is clear that there is a close relation between each of them. All three factors play a vital role in understanding the dynamics of population.

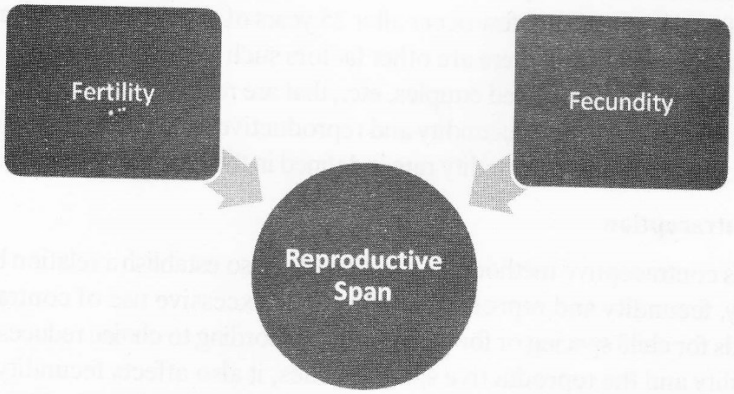

Fig. 2.2 *Relation Between Fertility, Fecundity and Reproductive Span*

It is the reproductive span that determines the fertility of a couple and especially of a woman. The reproductive span of a female spouse determines the fertility potential to a great extent. There are various biological and environmental factors which throw light on the relationship between fertility, fecundity and reproductive span. These are described as follows.

1. Age of marriage

The age of marriage is a crucial factor that determines fertility. Women are highly fertile in the early period of their reproductive span. Their fecundity starts at

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menarche and ends at menopause. It continues through the reproductive span. And when the marriage of a girl and the menarche happens together, she has a good scope for bearing children for the full reproductive span of about 30–35 years.

When a woman stays married throughout her reproductive age span and participates in the reproductive processes without taking any kind of contraception she is said to have an average fecundity potential. A delay in marriage reduces fertility by reducing the reproductive span.

Things to know

- Prior to 1951, the average age of marriage for a girl was 13 years in India.
- In India in 1996 the average age of marriage for a girl was 19.4 years.
- In India, girls are still married off at the age of 15 in most villages.

Length of marriage

The length and duration of marriage also establishes a relation between fertility, fecundity and reproductive span. The fecundity of a woman starts at menarche and ends at menopause. If marriage is held late or the duration of marriage is short, the fertility as well as the fecundity period of the woman also gets reduced.

It is the length and duration of marriage that determines the reproductive span of a couple and of a woman. Out of all births that occur to a couple, 20 per cent occur in the first five years of marriage, 50 to 55 per cent occur in the next ten years of marriage and very few occur after 25 years of marriage. Besides marriage age and marriage length there are other factors such as death of spouse, divorce or separation among married couples, etc., that are responsible for establishing a relation between fertility, fecundity and reproductive span. On the basis of these factors, the fertility and fecundity rate is defined in the reproductive span.

2. Contraception

Various contraceptive methods used by females also establish a relation between fertility, fecundity and reproductive span. The excessive use of contraceptive methods for child spacing or for bearing child according to choice reduces the rate of fertility and the reproductive span. Besides, it also affects fecundity among women. The physical capacity of bearing a child also gets reduced with excessive use of contraceptives.

3. Health

The health of a couple also establishes a relation between fertility, fecundity and reproductive span. In the entire reproductive span, the fitness of individuals affects their fecundity and fertility potential. Proper nutrition and proper lifestyle is essential. Throughout her life, a woman goes through a number of physical, chemical and hormonal changes. An imbalance in diet or an unhealthy lifestyle could lead to various complications that affect fertility and fecundity, such as breast conditions, ovarian failure, sexually transmitted diseases, etc.

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Genetic conditions such as diabetes, asthma, haemophilia, etc., also affect the reproductive span of females. Diabetes prevents reproduction in young males because the condition affects sexual and growth hormones. It can cause delayed sexual maturation in prepubescent males. Among female, diabetes provoke a range of reproductive and sexual health problems such as menstrual changes, fertility disorders, urinary and vaginal infections, urinary incontinence and sexual dysfunction. All these reproductive health problems affect the fertility rate and fecundity period of a female in her entire reproductive span.

4. Environment

Environment plays a significant role in determining the fertility, fecundity and reproductive span of individuals. It has been commonly noted that the puberty sets later among children raised in higher altitudes, and earlier in lower altitude regions. The reproductive span of women is longer in warmer regions than among women in colder regions. Therefore, the fertility and fecundity potential is high among people in warm climates and low among people in colder regions.

Check Your Progress

1. The physical capacity of bearing a child is termed as:
   (a) Reproductive behaviour
   (b) Fertility
   (c) Fecundity
   (d) Fertility Rate
2. The actual production of offspring determines:
   (a) Reproductive behaviour
   (b) Reproductive span
   (c) Reproductive process
   (d) Fertility
3. The physiological occurrence of menarche and menopause is termed as:
   (a) Reproductive behaviour
   (b) Reproductive span
   (c) Reproductive process
   (d) Fertility
4. The first menstrual cycle or the beginning of first menstrual bleeding among females is termed as:
   (a) Menarche
   (b) Menopause
   (c) Contraception
   (d) Fertility measurement

2.3 MEASUREMENT OF FERTILITY

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A lot of effort in the social sciences, especially in the last fifty years, has gone into the study of human fertility. Social scientists have used two different approaches, primary and secondary, to measure fertility. In the primary approach, fertility is measured with respect to live births per couple during childbearing age. This is also known as the *family approach* since it is based on the number of children born in a family. In the secondary approach, fertility is measured on the basis of vital statistics.

It is important that the two approaches are kept separate as they do not provide the same results. In the primary approach, stress is given on the complete reproductive performance of a woman within her childbearing age. In the secondary approach, focus is on the reproductive performance of a woman of different ages in particular years. This way, the first approach is part of micro-demography and the second approach is part of macro-demography.

In order to measure the fertility of a population, a variety of statistical rates and ratios are used. These fall into three categories. These are:

- Original rate
- Derived rate
- Related rate

Original rate

The refined and crude rate that estimates the frequency of birth occurring in a population, especially in women, during their entire reproductive span, is referred to as original rate. This method of measurement is further divided into three. These are:

1. Crude birth rate
2. General fertility rate
3. Age-specific fertility rate

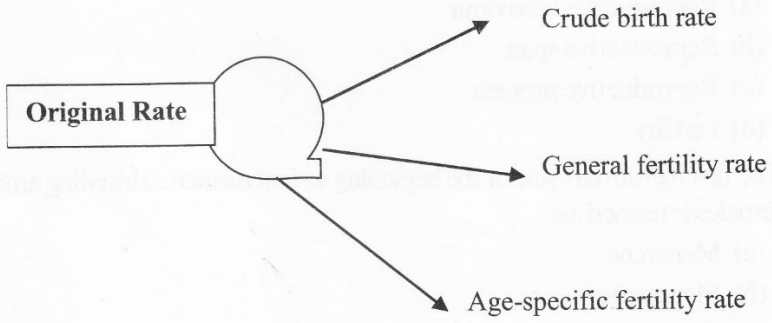

Fig. 2.3 Measuring Original Rates of Fertility

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1. **Crude birth rate:** The number of live births that occur in a community per 1000 mid-year population of that community in a year is the crude birth rate. In other words, crude birth rate is the ratio between the specified number of people in a population over a given period of time and the number of live births that occur in a population over the same period of time. Mathematically, crude birth rate is calculated as:

   Crude Birth Rate = B/P x K

   Here, 'B' and 'P' represent 'the number of children born' and 'mid-year population in that respective year, respectively. 'K' stands for the constant 1000.

   This ratio is also termed crude birth rate because of the nature of its birth and population statistics, which is in a very crude form. The crude birth rate generally varies with social, economic, political, cultural, geographical and biological factors at a particular time in a country. As for example, if a country has a population of one million and 18,000 children were born last year, we divide 18,000 children and 1,000,000, i.e., the total population, by 1000 to obtain the rate per 1000. Thus the crude birth rate is 18 per 1000.

   Under this calculation, the requirement of data is minimal compared to other fertility measuring tools. The most basic use of crude birth rate is to find the outcome by comparing the crude birth rate and the crude death rate. It can also be used to calculate rate of rate of population growth. The crude birth rate is mainly affected by age, sex distribution and immigration.

2. **General fertility rate:** Compared to the crude birth rate, the general fertility rate is a refined way of measuring fertility. It removes crude elements from the crude birth rate. General fertility rate is the number of live births that occur in a country, in a given year, per 1000 mid-year population of women in the childbearing age group of that country in that respective year. In other words, general fertility rate refers to the number of births per 1000 women ages 15–49 in a given year.

   Mathematically, the general fertility rate is calculated as

   Number of births per year/Number of women (ages 15–49) × 1000 = General fertility rate

   The general fertility rate does not take marital status into consideration. It includes all women of childbearing age, both married and unmarried. A more refined measure of fertility is obtained through the general fertility rate which requires knowledge of only the total number of births and the total female population, ages 15 to 49. This rate does not provide any insight into childbearing behaviour. The general fertility rate is not as widely used as other measures.

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3. **Age-specific fertility rate:** Age-specific fertility rate refers to the number of live births that occur in a country to women in a particular age per mid-year population of women of that age in that country in that particular year. Age-specific fertility rate can be calculated separately for every single year of age or for specific age groups. It can also be calculated exclusively for married women as age-specific marital fertility rate.

   Mathematically, the age-specific fertility rate is calculated as

   Number of live births (Age group) /Total female population (in thousands) in each age group = Age-specific fertility rate

   The analysis of the pattern of fertility by age of women and analysis of changes in the timing of childbearing is only possible though age-specific fertility rate measurement. It is helpful in calculating the fertility measures such as the total, gross and net reproduction rates. This is also very useful in an input in cohort-component population projections.

   One of the major drawbacks of age-specific fertility rates is that it requires very detailed data on the number of births by age or age group of mothers and data on the number of women of childbearing age by age or age group. Such data is rarely available in any of the developing countries in the world.

Derived rate

Rates that are deduced from the original fertility rate in order to estimate the average number of live births, more specifically female births, are termed as *derived rates*. The derived rate is further divided into three:

1. Total fertility rate
2. Gross reproduction rate
3. Net reproduction rate

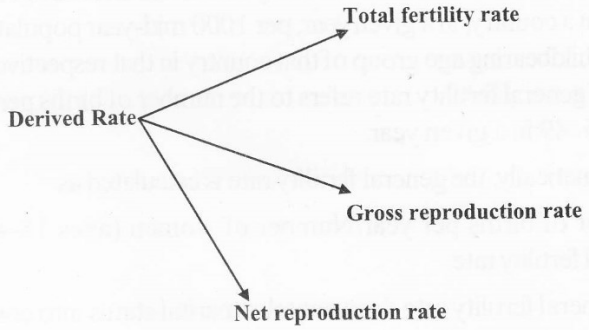

Fig. 2.4 Measuring Derived Rate of Fertility

(i) **Total fertility rate:** Total fertility rate is a synthetic measure of fertility that is independent of the age structure of the female population. The total fertility rate estimates the average number of live births that a woman will have during her total reproductive span. In other words, the total number of children the average women in a population is likely to have based on current birth rates throughout her life defines the total fertility rate.

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The total fertility rate is the sum of age-specific fertility rates of a woman of a country per 1000 mid-year population of women in the reproductive age group of that country in that particular year. This is the best single measure to compare fertility across populations in a country. The calculation of total fertility rate can simply be done by adding the single-year age-specific fertility rates of the entire 30-year reproductive age span of the female population of a country. For married women, the calculation of total fertility rate is done separately and is termed as *total marital fertility rate*.

One of the major drawbacks of the total fertility rate is that it does not point out how many additional children an average woman of any selected age will actually have over her remaining reproductive lifetime in a given year. Thus the total fertility rate would be depressed for a time and then rise again when women begin to have children at an older age. Hence, the total fertility rate may be a poor measure of the complete fertility of women.

(ii) Gross reproduction rate: The average number of female births that a woman is expected to undergo during the entire reproductive span of her life is termed as *gross reproduction rate*. The gross reproduction rate reflects the potential of women in a country to produce their own kinds, which is female giving birth to female. The gross reproduction rate highlights the importance of females in the fertility of a country and shows that the fertility process can be handed over from one cohort of female population to another. The gross reproduction rate translates other measures of fertility into a clear result.

In order to obtain gross reproduction rate (GRR), first add the single-year age-specific fertility rates (ASFR) of women of a country that covers the entire 30 year reproductive age span and then multiply the product by the new born sex ratio of the country. It can also be calculated by simply multiplying the total fertility rate (TFR) of the country by the new born sex ratio of the country.

GRR= ASFR × Bf/Bm+Bf

GRR= TFR × Proportion of female births

Just like crude birth rate, the gross reproduction rate also requires minimal information in comparison to other fertility measuring methods. The changes in the timing of births greatly affects the gross reproduction rate.

(iii) Net reproduction rate: The net reproduction rate indicates the average number of females that would be born to a woman in a country throughout her lifespan, if she is exposed to the fertility and mortality experience of that country for that period. In other words, the average number of daughters that would be born to a woman, if she passed through her lifetime from birth to the end of her reproductive years conforming to the age specific fertility and mortality rate of a given year is termed as net reproduction rate.

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The net reproduction rate is obtained by multiplying each single-year female age-specific fertility rate (ASFR) by the proportion of female survivors in that year in that country and adding up the product to get the rate. It can also be calculated by multiplying the group specific fertility rates by the number of years covered by each group and then multiplying the product by the proportion of female survivors in that age group in that country and adding up the product to get rate.

Related rate

A related rate includes marriage rate, abortion rate, pregnancy rate and family size. Thus, related rate estimates several attributes of a population that influences the reproductive behaviour of a male and a female in a country.

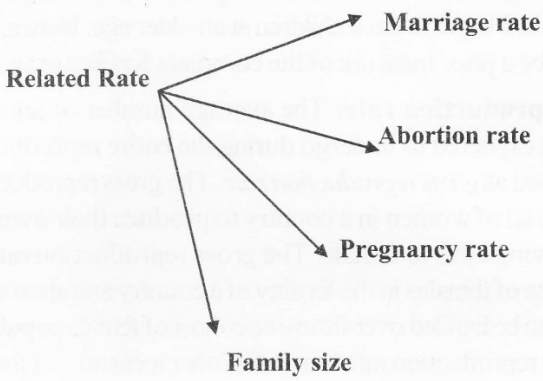

Fig. 2.5 Measuring Related Rate of Fertility

(i) **Marriage rate:** This denotes the number of marriages that occur in a country or in a community, in a particular year, per 1000 mid-year population of that country or community in that year. Its denominator is a community comprising heterogeneous mixture of married and unmarried and to be married individuals.

(ii) **Abortion rate:** The number of abortions in a community or in a country, in a particular year, per 1000 mid-year population of that country or community in that year defines the rate of abortion.

(iii) **Pregnancy rate:** Pregnancy rate is the number of pregnancies in a community or in a country, in a particular year, per 1000 women in the reproductive age span of that country in that year. The rate includes all the pregnancies irrespective of their outcome, be they stillborn, aborted or live born.

Pregnancy rate can be calculated as the number of pregnancies occurring to a woman in the reproductive age span per 1000 years of their reproductive experience.

(iv) **Family size:** This defines a rate between the number of children under five years of age present in a country or in a community at a particular time and the number of women of childbearing age living in that country at that time.

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Thus, the study of fertility conditions pertaining to a given population can be measured through various measuring tools. These rates are determined by various economic circumstances, social customs and personal relationships in addition to physiology. The measurement of fertility is also influenced by demographic and social choices for reproduction, cultural practices and the use of contraception and infertility treatments.

Check Your Progress

5. The average number of female that would be born to a woman in a country throughout her lifespan, if she is exposed to the fertility and mortality experience of that country for that period, indicates:
   (a) Total fertility rate
   (b) Gross reproduction rate
   (c) Age-specific fertility rate
   (d) Net production rate
6. Mathematically, the crude birth rate is defined as:
   (a) Crude birth rate = B/P × K
   (b) Crude birth rate = B/P × K
   (c) Crude birth rate = F/M × K
   (d) Crude birth rate = K/P × B
7. The number of live birth that occur to women of a country, in a particular age, per mid-year population of women of that age in that country in that particular year is termed as:
   (a) Crude birth rate
   (b) Gross reproduction rate
   (c) Age-specific fertility rate
   (d) Net production rate
8. How can you mathematically obtain the GRR of a country?
9. What are the constituents of related rate of birth?

2.4 DIFFERENTIAL FERTILITY

A recurrent concern in many societies is that not all groups reproduce at the same rate. In retrospect, there has been increasing evidence that the growth of population has been fluctuating in many parts of the world. In many Asian countries, population growth has been curbed at a pace much faster than most of the demographers had anticipated earlier. In Western countries, the rate of growth of population is optimum or is on the verge of growth. This tremendous fluctuation in the growth of population or reproduction rate worldwide mainly depends on the rate of fertility and the

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differentiation in fertility rate is termed as *differential fertility*. Usually, the rate of fertility varies depending on social, economic, political, geographical and biological factors.

Sociologists study the various ways in which fertility varies by social patterning based on variables like *religion*, *income* and *class*. On the other hand, population geographers are more interested in the fashioning of spatial fertility variations by ecological patterning. Such patterning is itself largely the product of particular spatial mixes of social factors.

The basic essence of differential fertility is that there exist social groupings with norms and values within country and within societies. These norms and values maintain and determine the size of the family. But, since these groupings have common characteristics, it is analytically difficult to assess the impact of any specific variables.

The importance of differential fertility varies over time, especially in relation to demographic transition. As demographic transition gets underway, fertility differentials are at their broadest. Differential fertility figures prominently in demographic transition theory, as fertility decline is often regarded as a starting in particular social group, and then diffusing throughout society, with time lag due to group differences in values and attitudes and in birth control practices.

Differential fertility has often been treated as a special, virtually autonomous subdivision of demography. J.W. Innec has pointed out that 'only a few studies of trends in differential fertility have been made by comparison with numerous studies simply establishing the existence of group differential at a single point of time'. One of the major tasks of differential fertility is to discover the effect on reproductive behaviour of each group affiliation or social attribute considered singly.

Various research on differential fertility shows that there are several factors responsible for the occurrence of this phenomenon, such as differentiation in region, caste/religion, women employment, age of reproduction, income, etc.

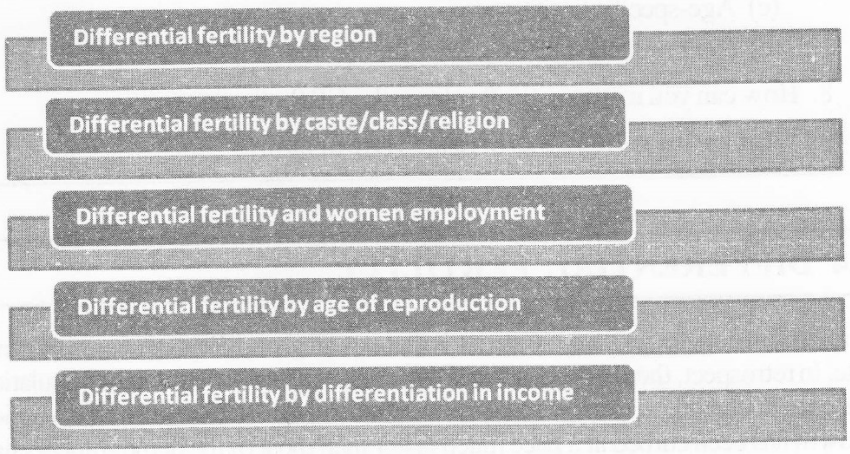

Fig. 2.6 Factors of Differential Fertility

(i) Differential fertility by region: It is a widely accepted fact that the rate of fertility differs greatly between regions and even between countries in the

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same region. Differential fertility is also visible between industrialized countries and developing countries, and between rural areas and urban areas. Industrialized countries and urban regions have low fertility rates in comparison to underdeveloped and developing countries and rural regions. The differential seems to occur due to the adoption of modern birth control practices, income disparity and preference for small families in industrialized and urban areas.

As stated before, the rate of fertility is also low in high altitude regions, and high in low altitude regions.

In India, the first effort to deal with urban-rural fertility differential was made by Kingsley Davis. According to him:

> In India and Pakistan, as in other places, the cities manifest a lower fertility than the country. Furthermore, the larger the city the lower its fertility becomes, so that there is an inter-city as well as a rural urban differential. The differential, though significant, are not so large, however, as those found in Western European and American countries three ellipses the data with respect to the three largest cities and their environs indicate a substantial difference between rural and urban birth rate. The difference approximates, but does not equal, that found in most European and American countries.

He adds that 'fertility differential exists not only between rural and urban areas but also between larger and smaller cities. In general, as measured by the child-women ratio, reproduction varies inversely with size of the city.'

(ii) **Differential fertility by caste/class/religion:** Within most Western countries, the fertility rate is higher among Roman Catholics than among the rest of the population. The fertility rate among Muslims, however, is higher than in any other religion. The proscription by the Roman Catholic Church on 'unnatural' methods of birth control is well known, although survey data reveal an increasing majority of Catholic women deviating from it. More important is thought to be the higher value attached to a larger family in Catholic doctrine than in Protestant teaching, which tends to emphasize more on the quality rather than quantity of children. There is plenty of evidence to show that many fundamentalist Christian groups such as Mormons, Nazarenes, Pentecostals and Jehovah's Witness in the US have an even higher fertility level in comparison to Catholics.

In India, the notion of 'son preference' and the complementary concept of 'daughter aversion' in Hindu society together have created the phenomena of differential fertility. In some families the desire for a male child compels a couple to keep bearing children till their need for a son does not get fulfilled, whereas, in some families, the fear of the female child stops a couple from having more children. Consequently, the desire for sons increases family size while the fear of daughters limits it. In 1998–99, the findings of the National Family Health Survey (NFHS) show that the Total Fertility Rate (TFR) was 2.8 in India for Hindus, whereas, it was 3.6 for Muslims.

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(iii) Differential fertility and women employment: It is an accepted fact that the participation of women in the labour force demands more time and energy at the expense of child-raising and childbearing, whereas women involved only in domestic work spend more time on child-raising and child-bearing. This tendency of women to either work or to stay at home creates the phenomena of differential fertility in a society.

It has been noted that women participation in non-agricultural occupations outside home has been shown to reduce fertility, mainly by increasing opportunity cost of children. Women's participation in white collar and technical occupation is likely to bring strong negative influence on fertility. Economic activities outside the house evoke an enlightenment and increased awareness among women, which creates a sense of responsibility to limit the size of the family. Besides, the desire to earn money diverts many employed women from their child-bearing responsibility and when they decide to extend their family, they are found in the upper age group i.e., 35 years. As a result of this, they are either not able to conceive or face many reproductive problems which lowers their rate of fertility.

(iv) Differential fertility by age of reproduction: Usually, there is a higher degree of fertility in women who attain puberty early than in those of delayed puberty age, unless the women of early puberty age is not affected by some kind of reproduction problems.

Table 2.1 *Age-specific Differential Fertility for Women Aged 15–19 by Major Area, 1995–2000*

Major Area	Fertility rate for women aged 15–19 (per 1,000)
World	54
More Developed Region	29
Less Developed Region	58
Least Developed Countries	133
Africa	115
Asia	39
Europe	25
Latin America and the Caribbean	75
Northern America	51
Oceania	39

Source: *World Population Prospects: The 2000 Revision*, Vol.1, Comprehensive Table United Nations publication, Sales No. E, 01, X1118, and corrigendum from table 10.

(v) Differential fertility by differentiation in income: The income of a family also defines the rate of fertility. It has been noted that fertility is higher among women whose families own more land and assets, whereas it is lower among better educated women who believes in higher standards of living.

In many developing nations, the notion of more helping hands required in the field of agriculture also increases the rate of fertility. People living below

poverty line add more children in their family to have maximum income. In this way, the economic disparity also creates a trend of differential fertility.

Check Your Progress

10. The findings of the National Family Health Survey (NFHS), conducted in 1998–99 show that, the Total Fertility Rate (TFR) in India for Hindus was:
    (a) 2.8
    (b) 2.9
    (c) 3.1
    (d) 2.6
11. According to sociologists, there are various ways in which the fertility varies by social pattering based on variables like:
    (a) Religion
    (b) Health
    (c) Technology
    (d) Income
12. The tendency of women to work and women to stay at home creates the phenomena of:
    (a) Fertility
    (b) Fecundity
    (c) Infertility
    (d) Differential fertility
13. The fertility rate is high in:
    (a) Early puberty age
    (b) Medium puberty age
    (c) Delayed puberty age
    (d) Intermediate puberty age
14. Which fundamentalist groups have higher fertility rate than Catholics, in the US?
15. The differential fertility figures prominently in:
    (a) Malthusian theory
    (b) Optimum theory
    (c) Marxist theory
    (d) Demographic transition theory

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