UNIT 11  SOMATOTYPING AND HUMAN PHYSIQUE

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Learning Objective

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

- body shape by using somatotype method using body size variables i.e., anthropometry;
- body shape and size have definite ethnic specificity and has a great role in population variation; and
- the conceptual change over body shape study or phenotypic expression study over time by using Sheldon, Pernell and Heath-Carter method.

11.0  INTRODUCTION

Modern human diversity is the result of demographic history, and selective effects that have acted to adapt different populations to their environments. Present day Biological Anthropology integrates multiple level of analysis, from ultimate (evolutionary) to proximate (molecular) causes. Apart from that, biological attributes in the form of phenotypic traits related to anthropometric variability are remarkable due to the influence of different factors, such as nutritional and socio-economic factors. Human body composition and physique phenotypes are complex multifactorial traits. These traits have evolved under the interactive influence of dozens of effectors from the social, behavioural, physiological, metabolic, cellular and molecular domain and expressed as qualitative and quantitative observable variables. Worldwide variation in body size, body proportion and body physique exist between the genders and among different populations. Anthropometric somatotyping is essentially an updated and developed version of Sheldon’s methodology, which was later developed by

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Pernell, but it gained traction in the last two decades after Heath and Carter introduced a simpler method for somatotyping. The changes in the physique of human body have always been an interesting concept to physical anthropologists and human biologists. To understand the morphological structure of body, it becomes important to analyse the factors which are associated with determining the physique of body. It is expressed in a form of rating (three form rating) that indicates the three physique segments namely endomorphy, mesomorphy, and ectomorphy (Heath and Carter, 1990).

11.1 SOMATOTYPING

Human physique classification and research can be traced all the way back to ancient era, when people with strong bodies and great ability to fight, hunt, and lead, had to stand out and be recognised by society, including the kings. Greek philosopher and physician, Hippocrates who lived in the fifth century BC, distinguished between two types of bodies: slim and lean people with long limbs and short people with thick and massive bodies. According to Singh, although the former is thought to be more susceptible to tuberculosis, the latter were much more susceptible to cardiovascular diseases (Singh, 2007)

An individual’s body physique is influenced by a multitude of factors such as gender, age, ethnicity, dietary pattern, genetic and evolutionary factors, and multiple environmental factors as well. A person’s physique not only defines the form of his or her body, but it is also a primary determinant of a healthy life.

Somatotyping is a unique system of evaluation and classification of human physique. The somatotype is an attempt at general human taxonomy or classification with the aim of providing the subject with some kind of identification tag. It conveys the sense of the human body’s totality of morphological features and reflects the body’s overall outlook. Endomorphy, mesomorphy, and ectomorphy are the three elements of somatotyping, which are used to describe body types. Endomorphy refers to a person’s “relative fatness”, while mesomorphy refers to a person’s “relative musculoskeletal robustness”, and ectomorphy refers to a person’s “relative linearity or slenderness”. A somatotype is normally represented by a three-number composite, with each number indicating the intensity of the individual component pieces.

Heath and Carter method of anthropometric somatotype is the most widely and commonly used method.

There are certain factors that influences the determination of somatotype which are: age, physical performance, nutrition, smoking habits, genetic factors, high altitude and occupation. There are various limitations that comes at the time of assessing somatotyping because of the stigma that had been in the research areas that relates biological causes of crimes. As per the surveys, it has been reported that Sheldon’s method of somatotyping was consuming less time in comparison to other methods and is less expensive. The other limitation of this approach that it requires subjects to get naked for the purpose of measurement, and along with that pictures were also taken, with that some of the subjects were not comfortable.
11.2 METHODS IN THE ASSESSMENT OF PHYSIQUE

11.2.1 Viola’s Method (1921)

In the 20th century, an Italian physician named Viola, suggested a classification of physique based on anthropometric measurements. All these measurements are combined with each other and derives to originate different indices, which are further used for the classification of human body.

The ten measurements for the purpose are

a) Sternum length,
b) Upper abdominal height,
c) Lower abdominal height,
d) Arm length,
e) Leg length,
f) Transverse thoracic diameter,
g) Antero-posterior thoracic diameter,
h) Transverse hypochondric diameter,
i) Antero-posterior hypochondric diameter,
j) Biiliac diameter.

The following values or indices were then calculated using different measurements of human body:

Thoracic Index = ‘Length of thoracic’ + ‘breadth of thoracic’ + ‘depth of thoracic’

Upper Abdominal Index = ‘Breadth of upper abdominal’ + ‘Length of upper abdominal’ + ‘Depth of abdominal’

Lower Abdominal Index = ‘Breadth of lower abdominal’ + ‘length of lower abdominal’ + ‘depth of abdominal’

All these above measurements are used to calculate the Total Abdominal Index,

Total Abdominal Index = Index of upper abdominal + index of lower abdominal

Then, these measurements are further combined with each other to derive the trunk and extremities values in a following manner,

Trunk Value = Index of Thoracic + Total abdominal Index

Limb value = Length of upper extremity + Length of lower extremity

Other factors were also taken into account, such as stature, trunk height, and total abdominal height. A measure of trunk volume and four morphological indices are calculated, namely the thoracic index, upper abdominal index, lower abdominal index, and total abdominal index, using all of these measures.

He grouped physique as four types (Singh, 2007)
a) **Longitype** having relatively long limbs compared to the trunk, massive thorax compared to the abdomen, and greater transverse diameters relative to the antero-posterior ones;

b) **Brachitype** or broad type, having the characteristics opposite to those of the longitype;

c) **Normotype** which fall in between the above two categories and
d) **Mixed type** who show characteristics of different types in different parts of the body, i.e. they maybe brachitype in one part, longitype in the other and normotype in still another, etc

### 11.2.2 Kretschmer’s Method

A German psychiatrist named Kretschmer (1921) defined and explained the attributes/characteristics of three forms of humans which are: pyknic or fatty, athletic or muscular, and leptosome or lean, in the early twentieth century. His approach consisted of anthroposcopic studies of human subjects. Kretschmer also linked a person’s physique to their personality traits, such as temperament. (Singh, 2007).

In the first edition of his book “Korperbau und Charakter” (Physique and Character) published in 1921, Ernst Kretschmer identified four physical and psychic types: pyknic, athletic, asthenic, and dysplastic physiques. Later, leptosomic was used instead of asthenic.

According to this method,

a) **Pyknic type** has a short stature. They have thick bodies and narrow shoulders. These types of individuals have large and heavy head, massive thoracic and abdomen, and their extremities are more developed.

b) **The leptosome** is characterized by linearity of trunk, limbs, and face. The bones are small and there is little musculature.

c) **Athletic physique** also called as leptosome, has a well-developed musculature and bony structure and the body is generally well proportioned. They have less amount of fat in their bodies, but have substantial muscle amount.

d) **Dysplastic category** covers individuals with incongruous admixtures of the other three types.

### Check Your Progress 1

1) What is Somatotype?

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2) Write the Viola’s and Kretschmer’s method of Somatotyping.

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11.2.3 Sheldon’s Method

When you look into the aspects of life, there are various factors required to be taken into consideration. These things involve the basis of our thoughts, what is believed to be true, and what is believed to be false. This is the constitutional theory that majorly concentrates on the findings and the results behind the behavior of crime and how this theory is dealing with the crime and criminology. Let’s study in detail about this method,

William Herbert Sheldon (1898-1977), an American physician was a pioneer in the field of research, having established Somatotyping as a method for analysing and measuring human body shape. In the year 1940, Sheldon along with the contribution of S.S Stevens and W.B Tucker, presented the concept of somatotype in the book ‘The Varieties of Human Physique’. They coined the name and definition of somatotype. As the three basic elements determining body builds, the focus of Sheldon was on intestines which are produced from embryological Endomorphy, bones and muscles developed from Mesomorphy, and skin, sensual organs, and nervous development from Ectomorphy, and then they are combined to classify into a few categories. Sheldon also proposed that every individual (instead of being a specific type) was a combination all the three elementary physical characteristics which are:

- Ectomorphy
- Mesomorphy, and
- Ectomorphy

**Endomorphy**: As per Sheldon, endomorphy is described as a virtual preponderance of soft roundedness in the human body. The term endomorphy refers to a feature of the body that is derived from the endoderm, the innermost embryonic layer. The predominance of digestive viscera appears to be the cause of the characteristic endomorphs with fatty deposition and soft rounded features. There are tendencies to overeat, and as a result, the body assimilates more than is needed.

**Mesomorphy**: The mesoderm, or middle embryonic layer, is responsible for the formation of bones, muscles, and connective tissues. The second portion of physique, or mesomorphy, contains these constituents. Mesomorphy refers to the body’s virtual predominance of muscle, bone, and connective tissue. The shape of a mesomorphic body is usually heavy, hard, and rectangular.

**Ectomorphy**: Ectomorphy denotes a preference for linearity and fragility over other characteristics. As a result, tissues originating from the ectodermal embryonic layer are comparatively dominant in his bodily economy.
A person’s somatotype is determined by the contribution of the three components described above. To put it another way, Sheldon determined that each person was a mix of all three components of physique rather than belonging to a single form, and that the components were present in varying degrees in different people. Sheldon analysed 4000 male college students to determine the spectrum of human physique variations. Sheldon uses other parameters as well such as height, weight and three photographs of a front, side and rear views of the naked participants in a standardized format.

To prevent deformation when photographing the students, special attention was paid to the type of camera, lens, camera distance, and lighting. Somatotyping was performed using visual observations on naked images of the student in the three poses. From the above-mentioned survey, he was able to identify as many as 79 different types of physique.

Somatotype can be written in three numeral forms where the first numeral is for Endomorphy, the second is for Mesomorphy and, third indicates Ectomorphy. Sheldon’s components of physique were rated on a 7-point scale, with each component ranging from 1 to 7, where 1 value was assigned to the least or minimum possible development, 4 indicating moderate expression, and 7 was assigned to the maximum development. Sheldon’s rating scale consisted of no rating higher than 7 and no rating lower than 1 for any one variable. Because of the fact that no human displays a complete lack of any physique segment, zero value was not assigned.

Sheldon found out that there were three extremes in physique/body size. 7-1-1 indicates the first extreme, which represents Endomorphy. 1-7-1 indicates extreme mesomorphy, 1-1-7 indicates Ectomorphy which represents the third extreme. 711, 171 and 117, all of which had a negligible proportion in the entire sequence, suggesting that these extreme types are extremely rare. 4-4-4 represents a balanced somatotype with all the three body components being equally represented. Sheldon also found out that an individual cannot have extreme somatotypes of 7-7-7 or 1-1-1. A person with an extreme is one component cannot have an extreme in another component of physique. Sheldon identified 76 different somatotypes, with 3-4-4, 4-3-3, and 3-5-2 being the most common. The somatotype is determined by the number of the ratings for each variable, which must be no less than 9 and no more than 12.

The Somatotypes with the extreme value were as follows; with Extreme Endomorphic people (i.e Somatotype rating is 7-1-1) having soft and round body parts, round head, flat abdomen, weak legs, the thighs and upper arms which are fatty and weak, well developed and built wrists, and ankles, less linearity and muscularity, more fat deposition. Sheldon also highlighted that Endomorphic people were more susceptible to diabetes and depression. Extreme Mesomorphic (i.e Somatotype rating is 1-7-1) means the relative predominance of bone, muscles, connective tissue with muscled arms and legs, uneven body with the rectangular outline. Broad shoulders, massive head in a cubical form, chest, less fat deposition and linearity. Extreme Ectomorphy (1-1-7) is characterised by linearity which is a common trait, the face is slim, the forehead is high, the chin is receding; the chest and abdomen are thin and narrow; there is less weight and muscularity. Ectomorphy has been attributed to pulmonary tuberculosis, anxiety, and schizophrenia susceptibility.
Later in 1954, Sheldon published “Atlas of Men,” a book focused on a massive survey of 46,000 human subjects ranging in age from 18 to 64 years old and from all walks of life. Tables of the distribution of height over cube root of weight ratios at various ages were created using this extensive data. Using this distribution, the somatotyping process was rendered less time-consuming and subjective. At any given height-to-weight ratio, only a few somatotypes are possible. First, the height-to-weight ratio is determined, as well as the somatotypes that can be assigned to that ratio. Then the somatotype photograph of the subject is compared with standard photographs available in an atlas, to make out with which it tallies most and a final decision is made regarding his somatotype.

Sheldon later created somatotype-HWR (height weight ratio) tables to aid raters in rapid somatotyping. These tables show the various somatotypes for a given height-to-weight ratio. It is considered to be easier to find out the most suitable and ideal somatotype from a limited range. Based on people with 18 years and above, 1175 somatotype photographs were given. Four criticisms persisted despite this approach: (1) somatotypes alter, (2) somatotyping method is non-objective, (3) instead of three, there are two primary components, since both ectomorphy and endomorphy are basically opposite of each other, and (4) somatotyping ignores one of the most important factors i.e., size. In reply to the above discussed criticism and negative responses to his somatotype scheme, which was reported and then published in ‘The Varieties of Human Physique’ and in the ‘the Atlas of Men’, Sheldon developed a new index method for new trunk. The trunk index is the “ratio of the area of the thoracic trunk to the area of the abdominal trunk” in a subject’s somatotype photograph. Planimetric measurements of a typical somatotype photograph were used to determine the required ratio. A planimeter is a basic geometrical instrument that is useful in areas of calculation of non-uniform figures. A new somatotyping method was developed based on the trunk index and 7-point scale was retained in the new method. Moreover, the sum of the three components of the somatotype may vary from 7 to 15.

The trunk index method bore no resemblance to Sheldon’s previous methods, but it did not appear to address any of the critiques levelled at the original Sheldon somatotyping process. It lacked scientific accuracy and was not based on a theory that had been tested. On the basis of anthropometric measurements, several attempts by various scholars were made later in this direction to make somatotyping more objective, simpler and to be easily executed. The Heath-Carter somatotyping process, which is based on anthropometric measurements, is one such attempt to meet those criteria to a large degree and is commonly used.

Fig. 11.1: Comparison of Body types
Somatotyping and Human Physique

around the world. The Heath-Carter somatotyping approach has been widely used in anthropology, sports sciences, human biology, and infant development research, among other areas.

Sheldon was consistently criticized for his work on somatotyping because of certain features:

- The changes in relation to somatotyping
- Somatotyping is not considered to be objective
- Somatotyping does not consider size as a factor

Sheldon described a new method of Trunk Index to meet all these above discussed criticisms. It is derived from the ratio of the thoracic and abdominal areas measured on the photographs taken for somatotrophic measurements.

- This index is presumed to be constant throughout the life and it is also possible that in the series of different life stages, the area of the thoracic trunks to the trunk of abdomen remains constant. These two areas increase/decrease in size in respect of one another.

- He also reported a method for measuring the massiveness i.e., HWR, a trunk index that is a separator for the different types of masses into mesomorphy and endomorphy, then, finally a measure of rate of stretching out to a respective height. When the last two factors are known, that is called what ectomorphy is defined as.

- In this new approach, height is used as one of the factor to measure size, and it is a substitute for ectomorphy.

- The original matrix that is come out to be of 76 somatotypes and it is expanded to 88, thus the matrix of trunk index provides 267.

11.2.4 Parnell’s Method

R.W Parnell, British physician described the first method of somatotyping based entirely on anthropometry in his 1958 book titled Behavior and Physique. Parnell determined the physical kinds on the chart in term of several factors such as Fat, Linearity, and Muscularity. This corresponds to the Sheldon’s classification: Endomorph, Mesomorph, and Ectomorph respectively. Parnell devised a rating system based on anthropometric measurements, and he reported the results in M.4 deviation charts, which he used in conjunction with the photographs. Parnell’s method to determine somatotype provides supervision on the dominance of components related to somatotype in an healthy individual.

- To estimate the somatotype by Sheldon objectively and precisely.
- To predict the women’s somatotype possible.
- To reduce the labour, time and cost at the time of conducting somatotyping.

A method was devised known as Parnell’s M.4 deviation chart approach that determines somatotype objectively. Therefore, Parnell’s method was more objective in comparison to the Sheldon’s method.

Height, weight, and measurements of biceps and calf muscle girth, femoral and humeral epi-condylar diameters, and skinfold thickness in three areas (triceps,
subscapular, and suprailiac) are all needed in Parnell’s somatotyping process. Assessments of fat, muscularity and linearity were obtained to the nearest quarter point on a seven scale, giving phenotypes similar to Sheldon’s somatotypes.

Parnell replaced Sheldon’ component name with fat, muscular (muscularity), and thin type (linearity), abbreviated as F, M and L, respectively.

The fat (endomorphy type) type decision is based on skinfold measurement while the muscular type (mesomorphy type) works based on height, bone diameter, and limb thickness. The thin type (ectomorphy type) works based on HWRs. The phenotype, not the somatotype, was the focus of this method of somatotyping (Duquet, 2001; Carter, 1980).

Check Your Progress 2

3) Write Parnell’s method of Somatotyping.

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4) Write Sheldon’s Method of Somatotyping.

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11.2.5 Heath-Carter Method

During the last two decades, the Heath-Carter somatotyping approach has been commonly used around the world. It has a wide range of applications in sports sciences, anthropology, human biology, child development, and other fields. It is based on anthropometric measurements which are easy to take on the subjects. Heath (1963) investigated the flaws in Sheldon’s approach and proposed changes and modifications. Heath and Carter developed their own somatotyping system in 1967. Though this approach varies from Sheldon’s in that it assesses the body shape or physique at a given time as opposed to Sheldon’s unchanging somatotype. The ratings of three primary components of physique are allocated from the tables or can be determined directly using equations given by Carter (1980), Heath and Carter (1990), and Carter (1996).

In Health and Carter Method, there are three way to obtain somatotype,

- Anthropometric method, where the anthropometry measurements are used to predict the somatotype criteria.
- Photoscopic method, where to obtain the ratings, standard photograph are used.
Somatotyping and Human Physique

Anthropometric plus Photoscopic, where the combination of both develops a criterion method.

Sometimes, most people somehow do not get the opportunity to become raters of criterion using photographs, the anthropometric approach has proven to be the most helpful for number of applications.

Somatotype is described by the Health-Carter method as a quantitative description of the current shape and composition of the human body. Endomorphy, mesomorphy, and ectomorphy are three components of physique that are represented by the somatotype in a three-number rating. Endomorphy refers to relative fatness, mesomorphy refers to relative musculo skeletal robustness, and ectomorphy refers to relative linearity. Ratings on each somatotype component of ½ to 2½ years are considered low, 3 to 5 are moderate, 5½ to 7 are high, and 7½ and above are very high. It is applicable to both the genders from childhood to old age.

Heath and Carter calculated somatotype using both photoscopic and anthropometric methods (Carter, 2002).

The following are the somatotype components and measurements used in the Heath-Carter anthropometric protocol to determine each component:

1) **Endomorphy** the first aspect, is described as the total of three skinfolds: triceps, subscapular, and suprailiac. It refers to a person’s physique’s relative fatness.

2) **Mesomorphy** the second aspect, refers to relative musculoskeletal growth that has been calibrated for stature. It is defined as the ratio of fat-free mass to stature. Mesomorphy is calculated using biepicondylar breadths of the humerus and femur, flexed-arm circumference corrected for triceps skinfold thickness, and calf circumference corrected for the thickness of the medial calf skinfold. Subtracting the skinfold thickness from the circumference is what it takes to correct the circumferences. These four measurements are then adjusted for stature.

3) **Ectomorphy** the third part, is the relative linearity of the build. The reciprocal ponderal index is used to calculate it.

There are three ways of obtaining the somatotype (Carter, 2002).

1) The anthropometric method, in which anthropometry is used to estimate the criterion somatotype.

2) The photoscopic method, in which ratings are made from a standardized photograph.

3) The anthropometric plus photoscopic method, which combines anthropology and ratings from a photograph - it is the criterion method.

The anthropometric method has proven to be the most useful for a wide variety of applications. Following anthropometric measurements are required for obtaining the somatotype: height, weight, triceps skin fold, subscapular skinfold, supraspinale skinfold, calf skinfold, humerus biepicondylar diameter, femur biepicondylar diameter, bicepsgirth, calf girth.
Body Composition, Human Physique and Somatotyping

Measurement Techniques-

1) **Stature (height).** Taken against a height scale or anthropometer.

2) **Body mass (weight).** The subject, wearing minimal clothing, stands in the center of the scale platform.

3) **Skinfolds-** Raise a fold of skin and subcutaneous tissue firmly between thumb and forefinger of the left hand and away from the underlying muscle at the marked site. Apply the edge of the plates on the caliper branches 1 cm below the fingers of the left hand and allow them to exert their full pressure before reading at 2 sec the thickness of the fold.

   *Triceps skinfold.* With the subject’s arm hanging loosely in the anatomical position, raise a fold at the back of the arm at a level halfway on a line connecting the acromion and the olecranon processes.

   *Subscapular skinfold.* Raise the subscapular skinfold on a line from the inferior angle of the scapula in a direction that is obliquely downwards and laterally at 45 degrees.

   *Supraspinale skinfold.* Raise the fold 5-7 cm above the anterior superior iliac spine on a line to the anterior axillary border and on a diagonal line going downwards and medially at 45 degrees.

   *Medial calf skinfold.* Raise a vertical skinfold on the medial side of the leg, at the level of the maximum girth of the calf.

4) **Upper arm girth, elbow flexed and tensed, right.** The subject flexes the shoulder to 90 degrees and the elbow to 45 degrees, clenches the hand, and maximally contracts the elbow flexors and extensors.

   *Calf girth, right.* The subject stands with feet slightly apart. Place the tape around the calf and measure the maximum circumference.

Standard protocol is followed for taking measurements. Read stature and girths to the nearest mm, biepicondylar diameters to the nearest 0.5 mm, and skinfolds to the nearest 0.1 mm (Harpenden caliper) or 0.5 mm on other calipers.

**The algorithms for estimating a somatotype with the Heath-Carter anthropometric protocol are as follows (Carter, 2002)**

a) **Endomorphy** = -0.7182 + 0.1451 (X) - 0.00068 (X²) + 0.0000014 (X³)

   Where, X = “3 skinfolds viz. triceps, subscapular and supraspinale skinfolds; and adjustment for stature is made where X is multiplied by 170.18/height(cm).
b) **Mesomorphy** = \((0.858 \times \text{humerus breadth} + 0.601 \times \text{femur breadth} + 0.188 \times \text{corrected arm girth} + 0.161 \times \text{corrected calf girth}) - (0.131 \times \text{stature}) + 4.50\)

Where, Corrected arm girth = Arm Girth – Triceps skinfold in cm and Corrected calf girth = Calf girth (in cm) – medial calf skinfold in cm

c) **Ectomorphy** = \(0.732 \times \text{HWR} - 28.58\) (If HWR > 40.75)

= \(\text{HWR} \times 0.463 - 17.63\) (If HWR > 38.25 but equal or less than 40.75)

= 0.1 (If HWR is equal to or less than 38.25)

Where HWR = Height in cm divided by cube root of weight in kg

Anthropometric somatotyping has the following advantages: 1) It is an objective method of somatotyping. 2) In the absence of a photograph, the best estimate of a criterion somatotype.

### Limitations of Health-Carter Method

1) Endomorphy i.e., the first segment signifies the fat free mass and the mesomorphy i.e., the second component represents the fat mass. The somatotype concept of Sheldon only refers to shape of the body, but not to the composition of body. Although, both type of methods uses somatotype term but derives different meaning.

2) Endomorphy correlates ideally in terms of body fat, though fat free mass links poorly with the mesomorphy. Additionally, the relation between muscularity of limbs and mesomorphy is comparatively low in case of athletes on the basis of dual ray X-ray absorptiometry. The validation is required of the relationship obscured in the concepts defining physique.

3) In the Health-Carter method, the variation in the duplicability of the somatotype components is directed by intra and inter-observer measurements.

4) This method is not proved to be valid for 6 years children or below than that. This could be one of the factors characterized to studies that projects high mesomorphy ratings in young children.

### 11.3 FACTORS WHICH AFFECT SOMATOTYPE

Human body shape is a complex phenomenon with sophisticated detail and function. The general shape or figure of a person is defined mainly by the moulding of skeletal structures, as well as the distribution of muscles and fat. Skeletal structure grows and changes only up to the point at which a human reaches adulthood and remains essentially the same for the rest of his or her life (Norton, 1996).

**Female traits**

Widening of the hip bones occurs as part of the female pubertal process, and oestrogens (the predominant sex hormones in females) cause a widening of the pelvis as a part of sexual differentiation. However, not all females adhere to this stereotypical pattern of secondary sex characteristics.
**Male traits**

Widening of the shoulders occurs as part of the male pubertal process. Expansion of the ribcage is caused by the effects of testosterone during puberty.

**Fat distribution**

Estrogen causes fat to be stored in the buttocks, thighs, and hips in women. When women reach menopause and the estrogen produced by ovaries declines, fat migrates from their buttocks, hips and thighs to their waists. Later fat is stored in the belly. Thus females generally have relatively narrow waists and large buttocks, and this along with wide hips make for a wider hip section and a lower waist-hip ratio compared to men. Hormonal and genetic factors may produce male-like distribution of fat in women i.e. around the belly instead of buttocks and thighs.

Estrogen increases fat storage in the body, which results in more fat stored in the female body. Body fat percentage recommendations are higher for females, as this may serve as an energy reserve for pregnancy. Males have less subcutaneous fat in their faces due to the effects of testosterone; testosterone also reduces fat by aiding fast metabolism. Males generally deposit fat around waists and abdomens due to the lack of estrogen.

Muscles- Testosterone helps build and maintain muscles through exercise. On average, males have around 10 times more testosterone than women. Prominent muscles of the body include the latissimus dorsi, trapezius, pectoral muscles as well as biceps and triceps in the arms and quadriceps and hamstrings in the thighs (Cameron, 1984; Bell, 1993; Norton, 1996).

**Check Your Progress 3**

5) Write Heath-Carter Method of Somatotyping.

6) Write factors related with Somatotype.

**11.4 SUMMARY**

Anthropometry is the means of quantifying variation in body size and shape and universally accepted and applicable in health sciences. Human body composition and physique phenotypes are complex multifactorial traits. These traits have
evolved under the interactive influence of dozens of effectors from the social, behavioural, physiological, metabolic, cellular and molecular domain and expressed as qualitative and quantitative observable variables. Worldwide variation in body size, body proportion and body physique exist between the genders and among different populations. An individual’s body physique is influenced by a multitude of factors such as gender, age, ethnicity, dietary pattern, genetic and evolutionary factors, and multiple environmental factors as well. A person’s physique not only defines the form of his or her body, but it is also a primary determinant of a healthy life. Somatotyping is a unique system of classification of human physique. It conveys the sense of the human body’s totality of morphological features and reflects the body’s overall outlook. Endomorphy, mesomorphy, and ectomorphy are used in the assessment of physique derived from various methods such as Viola’s Method, Kretschmer’s Method, Sheldon’s Method, and Heath – Carter Method. Finally, somatotyping is regarded as a reasonable tool for quantifying existing human body shape and structure, and it has undergone continuous development in terms of methodological issues.

11.5 REFERENCES


11.6 ANSWERS TO CHECK YOUR PROGRESS

1) Somatotyping is a unique system of evaluation and classification of human physique. For details refer to Section 11.1

2) Viola suggested classification of physique based on anthropometric measurements. Kretschmer explained the three forms of human: pykni or fatty; atheletic or muscular and leptosomes or lean. For details refer to section 11.2.1 and 11.2.2

3) Parnell’s determined the physical kinds on chart in terms of fat, linearity and muscularity. For details refer to section 11.2.4

4) Sheldon was a pioneer establishing somatotyping as a method for analysing and measuring human body shape. For details refer to section 11.2.3

5) Heath–Carter method has been commonly used worldwide. For details refer to section 11.2.5

6) Human body shape is a complex phenomenon. For details refer to section 11.3