Chapter I

INTRODUCTION

Obesity and overweight constitute two of the most significant medical and health problems in the world today. The effects appear to be as much psychological as physiological. It has been estimated that as ten million teenagers are overweight, representing approximately 20 percent of total teenage population in the United States. It has also been estimated that the average individual in the country who is 25 years of age or older will gain approximately one pound of additional weight per year. At the same time bone and the muscle mass is decreasing by approximately 0.025 to 0.50 pounds per year. This yields a net gain in fat of 1.25 to 1.50 pounds per year; 12.5 to 10 pounds in 10 years.¹

Obesity often is a long term process. Obesity usually begins early in childhood. When this is the case, the chances of adult obesity are three times greater than children having a normal amount of body fat. Simply stated a child generally does not “grow out of” an over fat condition. Children of obese parents are at two of the three times increased risk of obesity as adults compared to children.

in families in which neither parent is morbidly obese. This is not only for genetic reasons but also because of families’ poor dietary and exercise habit. Excessive fatness also develops slowly during adulthood, ages 25 to 44 being the danger years.2

Obesity is perhaps the most prevalent form of malnutrition in developed countries both among adults and children. It is extremely difficult to access the size of the problem and compare the prevalence rates in different countries as no exact figures are available and also because the definitions of obese are not standardized. Further, there has been an increased awareness of the problem in recent years. However, it has been estimated to affect 20 to 40 percent of the adults and 10 to 20 percent of children and adolescents in developed countries. It is a misconception that obesity is primarily a problem in the affluent countries; it is found in all countries in varying degrees.3

The history of human being is a witness to the fact that as long as man was busy in his day-to-day routine work in the absence of modern means of life, he did not have the problems being graced by today’s man. The development in the field of technology has

provided numerous comforts to the modern man as compared to the ancient one. There is an increased efficiency in the work and also increase in the leisure hours, remarkable increase in the production, in the industrial as well as forming out put, drastic changes in the communication system is available, unbelievable progress and development in the war gadgets, much improved transport system is available. The advancement in the field of medicine and surgery have made possible for the nations to fight with dangerous disease causing prolongivity in life and reducing the death rates etc. On the other hand all this advancement have made the man's muscles inactive and lethargic, creating problems of obesity and overweight, decrease in immunity, life relying on drugs and so on. The problem of obesity and overweight alone is the root cause of many physical problems of human beings. However, the problem of obesity overweight is not the product/result of only one specific factor, there are many contributing factors, for example physical inactivity comfortable life style, dietary habits, genetics, social and psychological attitude towards life and so on. In a nutshell, all these factors have contributed a lot to make man physically weak and responsible to diseases.

4 Ajmer Singh, Jagtar Singh Gill and Jagdish Bains, Modern Text Book of Physical
The convenience culture also is the cause of obesity. In office buildings we ride elevators rather than walk up one or two flights of stairs; parents drive their kids to the neighbour’s instead of telling them to ride bikes or walk; home gardeners use power mowers rather than old fashion blade movers. Alas, Indians have become less and less active, and they have become more and more reliant on machines specially the automobiles to do the work, their ancestors had to do with their own muscles. As if this profusion of conveniences were not enough problems, Indians now eat foods high in fat and refined starches and sugar, all of which are high in calories. They are eating fewer of the foods called complex carbohydrate whole grains, fruits and vegetables that have fewer calories and greater nutritional value. This combination of less physical exertion and more empty calories has left many Indians “over weight and out of shape”\(^5\)

Obesity can be defined as excessive enlargement of the body’s total quantity of fat. There is no biological reason for men and women to get fatter as they grow older but now days; obesity has been called the main health problem of modern society. Child

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obesity is becoming more prevalent. The seriousness of this situation is underlined by a similar rise in overweight related diseases\textsuperscript{6}.

Obesity may be defined as an abnormal growth of adipose tissue due to an enlargement of fat cell size (hypertrophy obesity) or an increase in fat cell number (hyperplasic obesity) or a combination of both. Obesity is often expressed in terms of body mass index. A BMI of 30 or more in males and 28.6 or more in females indicates obesity. The obesity or term “overweight” means a weight in excess of the average for a given sex, height and age. Overweight is usually due to obesity but can arise from causes such as abnormal muscle development or fluid retention.\textsuperscript{7}

Obesity is a disease; it has symptoms also. Due to this, the person’s work capacity changes. People who are obese may tire easily, and they may often be short of breath and have pain in their legs, back and feet. More than people of average weight, they suffer from hypertension and heart attacks, gallbladder and liver diseases, diabetes and other serious diseases. They may suffer mentally too, because our culture has imposed rigid limitations on what is


portrayed as attractive or acceptable. Therefore, they may feel unattractive and may withdraw from social contacts.⁸

It is indeed unfortunate that in our modern era of technology and scientific achievement, in which man has walked on the moon, developed surgical procedures to prolong and enhance the quality of life, and discovered many of the secrets of molecular interaction, there is no adequate explanation for a seemingly simple question "why do" people become too fat and what can be done to prevent it? Obesity often begins early in childhood and, if this occurs chances of adult obesity are more. The major cause of obesity was believed to be overeating. If obesity were truly a unitary disorder, and gluttony and over-indulgence were the only factors associated with an increase in body fat, the easiest way to permanently reduce would surely be to cut back on food. Of course, if it were that simple, obesity would soon be eliminated as a major health problem. There are obviously other factors operative such as genetic, environmental, social and perhaps racial influences. Research also suggests that differences in specific factors may predispose a person to excessive weight gain. These include: eating patterns, environment, food packaging, body image, and biochemical differences related to

resting metabolic rate, dietary-includes thermogenesis, level of spontaneous activity. Observations of older men and women who maintain active lifestyles suggest that the pattern of fat gain in adulthood can be attenuated significantly. In fact, increases in body fat may be more a function of activity level than age. For both young and middle-aged men who exercised regularly, the time spent in activity was inversely related to their fat level. Surprisingly, no relationship emerged between body fat and caloric intake. This suggested that the greater body fat observed among the active middle-aged men compared to their younger counterparts was the consequence of less-vigorous training and not greater food intake. Such findings indicate that the trend for increases in body fat aging can be some what blunted with increases in daily physical activity.

There is some confusion as to whether being overweight without being over fat is related to excess risk for cardiovascular disease. Some studies have shown that blood pressure and cholesterol were significantly greater in men who were significantly overweight and not obese compared to normal weight, non-obese men. These men also appeared to be at greater risk for premature heart disease. Although it has been argued that a moderate excess in body fat is not, in itself harmful, a report from the National
Institutes Of Health concluded that obesity should be viewed as a disease; because there are multiple biologic hazards at surprisingly low levels of excess fat that represent only 5 to 10 IB above "desirable body weight".

A person's fat content is generally evaluated in terms of the percent of body mass that is fat (percent body fat) or in relation to the size and number of individual fat cells. Where do we draw a line, however, between what is considered normal and what is obese? We believe that one criterion for what is considered "too fat" should be that established for younger men and women- above – 20 % for men and above 30 % for women. Standards for over fat men- 20 %and women- 30 %. It should be kept in mind that there is gradation in obesity that progression from the upper limit of normal- 20 % for men and 30% for women- to as high as 50 to 70 % of body mass in massively obese people. This group includes people who weigh in the range of 170 to 250 kg or higher. In this situation body fat often exceeds lean body mass and obesity may be life- threatening.

When obese adults reduce body size, there is a decrease in fat cell size but no change in cell number. If normal body mass and body fatness are achieved, then individual fat cells shrink and
actually become smaller in size than the fat cells of non-obese individuals.

It is difficult to determine quantitatively the importance of excess of fats in the body. It increases the risk factors. Impairment of cardiac function due to an increase in heart's mechanical work, and autonomic and left ventricular dysfunction, hypertension and stroke, diabetes as about 80 % of adult-onset diabetes are over weight, renal disease, gallbladder disease pulmonary diseases and impaired function due to added effort to move the chest wall, problem in administration of anesthetics during surgery, Osteo arthritis, degenerative joint disease, gout, menstrual irregularities and an enormous psychologic burden. The people who are more obese are found to be less active. They take so much time to do any work and have so many problems. One should be clear that obesity itself is not a disease, but sick and death rates among the obese person are significantly greater than normal ones.9

In the field of sports medicine and exercise physiology one of the greatest challenges for experts is the obesity and weight control whether for development of physical fitness and athletics or in sports

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training. The ancient Greeks recognized that human fitness consisted of a "sound mind in a sound body." However, since about the middle 1950s, the major focus has been on physical fitness, this is probably because it is more concrete and measurable than psychological or social fitness. Research has shown that those who are engaged in a planned program of physical fitness also tend to feel better mentally, emotionally, and socially. Living adequately in today's world requires that we will be totally fit- and physical fitness is the basis for it. We are totally fit if all the organs and systems of the body are functioning to their optimal level; when we are able to deal with most of our mental and emotional problems. So, for every work we need physical fitness but if the person is obese he/she can't get physical fitness and is unable to do his/her daily routine as well as sports activities.10

Obesity is not necessarily due to overeating. Until recently, the major cause of obesity was believed to be overeating. If obesity were truly a unitary disorder and gluttony and over indulgence were the only factors associated with an increase in body fat, the easiest way to permanently reduce would surely be to cut back on food. Of

course, if it were that simple, obesity would soon be eliminated as a major health problem. There are obviously other factors operating such as genetic, environmental, social and perhaps racial influences. Research also suggests that differences in specific factors may predispose a person to excessive weight gain. These include eating patterns, environment, food packaging, and body image and biochemical differences related to resting metabolic rate.

Being over fat indicates an excess accumulation of body fat, thus the prediction of body fat from body composition analysis is required before this term can be used. Body composition is often expressed as the relative amounts of fat mass to fat-free mass. Fat mass includes both essential and storage fat. Essential fat is found in bone marrow, brain, spinal cord, muscles, and other internal organs, and is "essential" to normal physiological and biological functioning. The minimum level below which the essential fat should never go is believed to be approximately 3% of the total body weight for men and 12% of total body weight for women. Women have a higher essential of fat storage requirement because of sex-specific fat deposits in breast tissue and surrounding the uterus. When essential fat drops below these critical values, normal physiological and biological functioning may be impaired. Storage
fats is comprised of two types of fat, yellow fat and brown fat which is rich in mitochondria and can increase production because of a slightly lowered biochemical efficiency of ATP (adenosine triphosphate) synthesis, yellow fat is found in adipose tissue and serves three basic functions: (1) as a insulator to retain body heat (2) as an energy substrate, and (3) as padding against trauma. The majority of adipose tissue is found directly beneath the skin, subcutaneous fat distribution can vary between sexes and with age. Men tend to store more fat around the waist (android obesity), whereas women tend to store more fat around their hip and thighs (gynoid obesity).11

Perhaps as many as 15 percent of all children and teenagers are seriously overweight, and among adults the percentage is even greater. Why do some people manage to balance their input and output of energy, while others do not?

Among the physical traits we inherit is body type, or body build. Some people tend to be plump; while others have a slimmer, taller body build. People who tend towards plumpness, the endomorphs, need to watch their weight much more than do people

who are slender, the ectomorphs. People who are muscular, the mesomorphs, are also less likely to have weight problems than endomorphs. Few people are just one type; mostly everyone has some traits of each. Studies have shown that about 75 percent of the children of two obese parents are obese themselves. If only one parent is obese about 50 percent of children are also obese. If neither parent is obese only about 9 percent of the children are obese. These statistics do not really show whether obesity (or overweight in general) is inherited genetically, because families pass on their eating, exercise, and work habits— all of which are cultural or environmental as well as their genes.

Obesity can occur in any age and to any sex. There are eating factors, which may cause obesity. Eating habits (for example eating in between meals, preference to sweets, refined foods and fats) are established very early in life. The compositions of the diet, periodically with which it is eaten and amount of energy derived from it are all relevant to the aetiology of obesity. A diet containing more energy than needed may lead to prolonged post-prandial hyperlipidaemia and to deposition of triglycerides in adipose tissue resulting in obesity. It has been calculated that a child whose energy requirement is 2000kcal/day and who consumed 100kcal/day extra
will gain about 5 kg a year. The accumulation of one kilo fat corresponds to 7,700 kcal of energy. Psychological factors are also responsible for this. (e.g., emotional disturbance) are deeply involved in the aetiology of obesity. Overeating may be a symptom of depression, anxiety, frustration and loneliness in childhood as it is in adult life. Excessively obese individuals are usually withdrawn, self-conscious, lonely and secret eaters. Familiar tendency: obesity frequently runs in families but this is not necessarily explained solely by the influence of genes.\textsuperscript{12}

Body composition refers to the relative amounts of the compounds in the body. Typically, research scholars have focused on the proportion of the body mass that is water, protein, mineral, and fat. There are many techniques for the body assessment. The assessment of the body composition is generally performed in order to determine and monitor one’s health and fitness status, and to aid in planning, training programs for athlete. It has been established that a high percentage of body fat is associated with a higher risk of heart disease, diabetes, hypertension, cancer, hyperlipidemia, and variety of others health problems. On the other hand a high percentage of lean body mass and low-fat mass is associated with

\textsuperscript{12} K. Park preventive and social medicine (M/S Banarsidas Bhanot Publisher 2000) P: 296-297.
prowess and good health. Over weight is defined as body weight in excess of a reference standard, generally a mean weight for a given height and skeletal frame size grouped by sex. The body mass index is the ratio of weight to height squared.

\[ \text{BMI} = \frac{\text{body mass (kg)}}{\text{height (m)}^2} \]

For example an 80 kgs person who is 1.7m tall has following body mass index. \( \text{BMI} = \frac{80}{1.7^2} = 27.68 \text{kg/m}^2 \) being over fat indicates an excess accumulation of body fat thus the prediction of body fat from body composition is required. The body can be divided into two simple components: lean and fat body mass. Since this time, lean body mass has been identified as not being completely fat free, because it contain lipid within muscle, cell membranes, bone marrow, and so forth. The term fats free body mass there for represent a large component of lean body mass.\(^{13}\)

There are numerous methods to assess body composition that require expensive and/or large piece of equipment, typically found in a laboratory facility. The laboratory that rely on the two-component model. Densitometry (density= mass per unit volume; ometry measurement) is the study of the measurement of human body

\(^{13}\) Robert A Robergs Scott O. Roberts, Exercise Physiology for Fitness Performance and Health. (Library of Congress Cataloging in Publication Data) P: 29
density. Density has long been measured using the procedure of hydro densitometry. Hydro densitometry or hydro state weighing has been the “gold standard” by which other methods of body composition assessment have been validated. Hydrostatic weighing is based on Archimedes Principle, which states that when an object is placed in water it is buoyed up by a counterforce equal to the water it displaces. Thus, there are two ways to measure body density (1) by measuring the displaced water volume, or (2) by measuring the change in body weight underwater. Two-component model-a model of body composition that divides the body into fat free lean components. Body density the density of the body when submerged in water, expressed in g/ml. hydro densitometry the method of determining body density by underwater weighing. There are so many ways to determine the fats in the body but mostly we use skin fold calliper to measure the fat because its easy and accurate method to measure the fats in the body. There are two callipers that meet these specifications and have been used, the Harpenden and the Lange skin fold. Skin fold thickness gives an estimation of total body fat, in as much as 50 percent of total fat lies immediately under the skin\textsuperscript{14}.

\textsuperscript{14} Mayer, \textit{Overweight: Causes, Cost, and Control} (Englewood Cliffs, N.J: Prentice- Hall, Inc
It is possible to measure the subcutaneous fat at selected sites with skin fold calliper and predict the percentage of body fat by using various regression equations. Assessing body composition by measuring the thickness of selected skin fold sites is probably the most common and widely available technique in use today. It is important that fitness instructors and exercise physiology students become proficient in this technique. There are varieties of skin fold calliper in the market that includes Harpenden, Lange, and Lafayette callipers. The Harpenden skin fold calliper was specially devised for the Harpenden growth study in England. This calliper has a spring, which exerts a jaw force of 900 grams, and its jaw force of millimetres; the measuring range is from 2 to 40 millimetres. The Lange calliper allows tension of 10gm/mm2; the size of the contact arm is on a swivel, so that it may conform to the slope of varying skin folds; a step tester “accompanies the instrument for purpose of calibration.\textsuperscript{15}

After measurement of the fat content in the body it is important to find the correct way to loose the weight. Most people start to diet because they want to feel better themselves. But for a certain kind of

\textsuperscript{168} P: 31.

\textsuperscript{15} H Harison Clarke David h. Clarke, Application of Measurement of Physical Education (Library Of Congress Cataloging in Publication Data) P: 69-70.
young women, mostly between the ages of 10 and 20, the decision to
go on a diet initiates a kind of hate affair with her, in the form of a
psychological condition called anorexia nervosa. It is not that these
young women do not get hungry; they do, but simply forbid
themselves to take in more than a handful of calories a day. For
them, the goal of dieting is not merely to loose a certain number of
pounds to reach the weight suitable for their height and body build
but loosing weight becomes instead an end in itself, and an
obsession, a mania. Eventually the anorectic’s limbs become as thin
as the celery that is often her only regular food. Some anorectics
seem to be driven by self-hatred, by an attempt to punish themselves
through self-denial. Others have had unpleasant experiences with
boys or men or may be afraid of their own developing sexuality— a
sexuality they try to escape from by becoming thinner and thinner.
Still others may be trying to punish someone, especially parents.
(Some young women resent it when their parents suggest that they
weigh too much. The daughter becomes anorectic and thus obeys her
parents and, at the same time, defies them) many victims of anorexia
can be treated through psychotherapy. But for some, the cause of
self-starvation progresses all the way to death. High protein diet,
low-carbohydrate diet, high fat diet, low-fat dieter seems to be
shortage of calories. Some of these diets promote one kind of nutrient and other prohibits the eating of foods from one food or other. But most nutrient experts believe that a well-balanced diet-one that contains low- to moderate- calorie foods all four-food groups is essential for good health. All the diets which we wrote above are unhealthy sites, but at least they are diets: they introduce awareness and order into eating, albeit the wrong kind of awareness and order. Some people believe that if they will take the diet pills to loose the weight then it will be fine but diet pills do not even do that; they claim to release the dieter from the need to make any conscious choices at all- by suppressing the appetite, do the pills work? Are they safe/ when dieters stop taking the pills, they often regain any weight they might have lost. And like all strong drugs, diet pills can have serious side effects including allergic reactions, addiction to the pills themselves and high blood pressure with all its symptoms. Behaviour modification: for most people, eating is not just a biological need, but a major activity in the day's routine, studies have shown that people with severe weight problems are more likely than others to be pre-occupied by food- that is, to think about it constantly – and to eat, not so much because they are hungry, as in response to certain foods but related cues around them. Some
overweight people feel that a meal is not truly a meal unless they have two or three helpings of everything. And the eating habits of many overweight people are completely controlled by the clock; they take meals and snacks at certain times, even when they are not hungry or when the only foods available are high in calories. Some therapists use behaviourist techniques to help overweight people become aware of the cues that provide their eating. Their new-found awareness helps them to resist these cues and to become the masters, not the slaves, of food they eat. This, of course, is at the heart of any food diet. In case you are taking real diet then the question is: does anything work and now for the good news: yes—despite all the mumbo-jumbo and sheer fraud that surrounds dieting; the keys to weight reduction are sure and simple. You can influence body weight in two ways; by controlling of intake energy, that is, food and by controlling your output of energy that is physical exertion. The way to lose weight is to ensure that your energy output exceeds your energy input, you can control your energy output by exercising systematically. You can control your energy input by remembering that calories do count, for calories are simply the measure of the energy contained in food. The more energy you take in, the more energy you will need to burn up or you will gain weight. If your
weight causes you concern; if you feel you have problems because you are fat if you tire easily because you are carrying extra pounds; if you find that your weight is more than 20 percent greater than the weights set for your height; if you fail the pinch test; then it is time to loose a few pounds. Then the question will be how much how soon? If you are moderately overweight, losing 1 or 2 pounds a week is sensible and realistic. To lose 1 pound a week you must burn 3,500 calories without replacing them. Each pound of body fat is the equivalent of 3,500 calories. To lose one pound you must reduce caloric intake or increase your level of activity enough to burn this amount. This means 5000 fewer calories a day. If you really want to do something good for your obesity, avoid heavy meals, especially in the evening. It is generally better to eat three of four low to moderate calorie meals than to skimp on breakfast and lunch, then gorge at dinner. It is all right to eat snacks as long as you remember to include them in the total number of calories you eat each day. First you should see that how much calories you are eating to see how much you should eat, and then subtract 500 calories from them. Then sub tract any calories you eat as snacks and divide the remainder by 3. The result is the number of calories you should eat at each meal. Never attempt to lose pounds by dehydrating yourself.
At the beginning of a diet the body often loses water, as it does when you are physically active. If you are thirsty, drink plenty of water (or if your diet permits, juice or skim milk).

Other ways to lose weight: sometimes the plan we have described just is not enough, or it does not work at all. In that case you might have to consider some other ways of losing weight. One of the ways to reduce the weight is fasting. Fasting as a means of losing weight means taking in nothing but water, vitamins, and minerals. It is used only when cases of extreme obesity have not responded to any other method, and it is unusual even then. In any case, fasting is only a short-term treatment, and when the fast ends a carefully controlled diet must be worked out to maintain the new weight level or reduce it further. Another way to reduce the fats from the body is surgery. When obesity does not respond to less extreme measures it is sometimes treated by surgery. These surgical techniques shorten the digestive tract and thus limit the surface that absorbs nutrients. Surgery of this sort is risky and can be even more dangerous than obesity itself.\(^{16}\)

If you really want to live a healthy life without any kinds of health problems then for it physical fitness is the basic. So if the

\(^{16}\text{Russell Whaley, M.P.H, Health Practice (Hill, Ink, New Jersey. 1982) P: 71.}\)
person is physically fit he may not have the problems like obesity and other health problems. Several misconceptions have been accepted as facts over the years. First, it has been assumed that the obese individual eats more food than his or her lean counterpart. Several studies have shown just the opposite to be true, that is, the obese individual eats even less food. The major difference is that the obese individual is considerably more sedentary and expends far fewer calories each day. A second misconception that has existed for a number of years are that exercise, itself, stimulates the appetite to such an extent that voluntary food intake is increased as a result of exercise. This concept has also been proved to be incorrect when applied to moderate to vigorous exercise of up to an hour in duration actually acts to depress the appetite. Thus, exercise does appear to be a mild appetite suppressant. It is true that with exercise one can reduce the fats. ¹⁷

The effectiveness of regular exercise in achieving weight loss is linked to one’s degree of obesity. Exercise is the best way to reduce the weight. Generally, persons who are obese loose weight and fat more readily with exercise than their counterparts of normal weight.

In addition, aerobic exercise, even without dietary restrictions, provides a significant positive ‘spin-off’ because it favourably alters body composition (reduced body fat and maintenance or even a small increase in fat-free body mass) in the otherwise healthy person, the cardiac patient, and the physically challenged. Even exercise programs that involve less energy-demanding conventional resistance training help maintain fat-free body mass during weight loss compared to programs relying solely on food restriction. Because fat-free body mass is metabolically more active than body fat, this conservation of lean tissue contributes to the maintenance of a high level of resting metabolism and may enhance lipid oxidation during rest, thus lessening the associated increase in adiposity. When exercise is used for weight loss, factors such as frequency, intensity, duration, and the specific form of exercise must be considered. Continuous, big-muscle, aerobic activities having moderate to high caloric costs, such as walking, running, rope skipping, stair stepping, cycling, and swimming are ideal. Many recreational sports and games also are effective in reducing body mass, although precise quantification and regulation of energy expenditure is difficult during such activities. Aerobic exercise also stimulate lipid metabolism, establish favourable blood pressure responses, and
generally promote cardiovascular fitness. There generally is no selective effect of running, walking, or bicycling: each is equally effective in promoting fat loss. An extra 300 kcal daily caloric expenditure induced by moderate jogging for 30 minutes, for example, causes a 0.45 kg fat loss in about 12 days. This represents a yearly caloric deficit equivalent to the energy in 13.6 kg of body fat. So exercise is the best way to reduce the weight.

The total energy expended in exercise is directly related, in a close-response relationship, to the effectiveness of exercise in weight loss. An overfat person who starts out with light exercises such as slow walking can accrue a considerable caloric expenditure simply by extending the exercise duration. This duration effect offsets the inability (and inadvisability) of the previously sedentary, obese person in beginning a program of more strenuous exercise. Also, the energy cost of weight bearing exercise such as walking is proportional to body mass; thus, the overweight person expends considerably more calories in such exercise than some one of normal body mass. The importance of exercise duration in weight loss was illustrated in a study of three groups of men who exercised for 20

weeks by walking and running for either 15, 30 and 45 minutes per session. Compared to a sedentary control group, the three exercise groups significantly decreased in body fat, fat folds, and waist girth. Comparisons between the three groups indicated that the 45-minute training group lost more body fat than either the 30-or15-minute group. This extra fat loss was attributed to the greater caloric expenditure of the longer exercise period.19

The initial stage of an exercise program for a previously sedentary, over fat person should be developmental in nature and should not include a high total energy output. During this time, the individual should be urged to adopt long-term goals, personal discipline, and a restructuring of both eating and exercise behaviours. It is often counterproductive to include unduly rapid training progressions because men and women initially show psychological resistance to physical training. During the first few weeks slow walking is replaced by intervals of walking and jogging that eventually lead to continuous jogging. At least 6 to 8 weeks are required before observable changes occur. Behavioural approaches should also be applied to cause meaningful lifestyle changes in

physical activity. For example, walking or bicycling can replace the use of the auto, Stair climbing can replace the elevate it and manual tools can replace power tools. The exercise should be regular then it will help for weight loss. In one study six sedentary, obese young men exercised 5 days a week for 6 weeks doing 90 minutes of walking on a motor-driven treadmill at each session. The men lost an average of almost 6 kg of body fat, representing a decrease in percent body fat from 23.5 to 18.6%. In addition, physiologic fitness work capacity improved, as did the level of high-density lipoprotein (15.65) and the high/low-density lipoprotein ratio (35.9%). Whenever we do the exercise schedule for the particular purpose, regularity is the key. Exercising frequently is important when considering exercise for weight reduction. In a summary of six studies that investigated optimal training frequency, it was observed that training 2 days a week did not change mass, fat folds, or percent body fat. Training 3 and 4 days a week, however, had a significant effect. Subjects who trained 4 days a week reduced their body mass and fat folds significantly more than the 3 days per week group. Reduction in percent body fat, however were similar for both groups. At least 3 days of training per week are required to bring about changes in body composition through exercise. More frequent
exercise may even be more effective. More than likely, this effect is the direct result of the added caloric output provided by the extra exercise. Although it is difficult to precisely determine threshold energy expenditure for weight reduction and fat loss, it is generally recommended that the caloric-burning effect of each exercise session should be at least 300 kcal. This can be achieved with 30 minutes of moderate to vigorous running, swimming, or bicycling, or walking for at least 60 minutes. For moderately obese children and adults, combinations of regular aerobic exercise and diet offer considerably more flexibility in achieving a negative caloric balance and accompanying fat loss than either exercise alone or diet alone. In fact, the addition of exercise to the program of weight control may facilitate a more permanent fat loss than would total reliance on caloric restriction.

In the field of sports medicine and exercise physiology one of the greatest challenge for experts is the obesity and weight control. Whether for development of physical fitness and athletic or in sport training. Recently the concept of health related physical fitness has become more popular. It is includes those aspects of physiological function that offer protection from disease resulting from a sedentary lifestyle. Health related physical fitness components are associated
with some aspects of health. It includes cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition.

Since the research scholar is keenly interested in the area of health related physical fitness, she intends to make a sincere effort to investigate effect of varied type of physical activity on health related physical fitness of obese children.

**Statement of the Problem**

The purpose of the study was to investigate effect of selected training programmes on health related physical fitness components of obese children.

**Delimitation**

1. The study was delimited to the girl students of Mussoorie International School Mussoorie aged 10-14 years.

2. The study was delimited to three training treatments namely brisk walking, jogging, and circuit training programme

Further study was delimited to the health related physical fitness components of muscular strength, muscular endurance, cardiovascular endurance, and flexibility and body composition.
Limitations

Lack of restricted diet was considered as a limitation of this study, as all the subjects were boarders at Mussoorie International School, Mussoorie.

Hypothesis

It is hypothesized that there may not be a significant difference on health related physical fitness of obese children by virtue of the treatments of brisk walking, jogging and circuit training programme.

Definition and Explanation of the Terms

Obese

Obese means overweight and "obesity is defined as an excessive accumulation of fat" increase in weight beyond that considerably desirable with regard to age, height and weight structure.²⁰

Health Related Physical Fitness

Health related physical fitness includes those aspects of physiological function that offer protection from disease resulting from a sedentary life style.

Brisk Walking

Brisk means active and energetic. Walking means move at a fairly slow pace using one’s foot or travel on foot or move from one place to another place with the help of foot. But when it includes brisk walking then it is one type of active and energetic walking which include all the parts of the body.\textsuperscript{21}

Jogging

Run in a steady, gentle pace. Jog along or continue in a steady uneventful way.\textsuperscript{22}

Jogging is a term used to include all speeds of running, but it usually refers to slow continuous running. Recently, jogging has gained a great deal of popularity, particularly among adults seeking fitness for health reasons. For example, the improvement in the circularity and respiratory systems resulting from jogging program.\textsuperscript{23}

Circuit Training Programme

A circuit consists of a number of carefully selected exercises which are simple to perform and arranged in a form of a circuit, in such a manner as to enable large number of individuals to proceed

from one exercise to another without undue local fatigue, and at a
work rate compatible with each person's capacity. Progression on a
circuit is measured initially by decreasing time of performance and
secondly by increasing load of repetitions.24

**Significance of the Study**

In today's world our life has under gone revolutionary changes.
Super-technological advancement has made life luxurious and
comfortable. This has made life greatly sedentary. One of the major
health problems in the world and in our country today is the growing
obesity. Children are growing more and more obese and accordingly
the health is affected. An increased size of the children population is
getting obese. This is a serious issue and of great concern because
today's child is tomorrow's citizen. Very few studies have been
conducted, especially in India on obese children therefore the
research scholar intends to sincerely work in this area. The proposed
investigations will be helpful in the following ways:

1. It will help to understand the physiological response of obese
children towards physical exercises.

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2. Findings of the study will bring to light the more effective exercises towards controlling the obesity.

3. The investigator also will bring to light the effect of walking, jogging and circuit programmes on the health related components of obese children.

4. The findings will provide suggestions in formulating effective physical education programme for obese children.

5. The study may be useful to health scientist, physical educationist, coaches, trainers and those who want use it as per their need and necessity in their respective areas.

6. The results of the study will indicate the level of health related physical fitness among the schoolgirls.