Chapter - I

INTRODUCTION

India has had a long history of physical education, far more ancient than Greece. But in our times when the Olympic Games occurring every four years have become probably the biggest planetary event, most people know that the Games originated more than two thousand years ago in Greece. In addition, Greeks have given the Western world through many beautiful statues a keen sense of bodily perfection, an ideal of physical beauty unsurpassed to this day. There was such an emphasis on the importance of beauty and physical processes that some of the highest honors in Greek society were bestowed on athletes, to an extent unknown before and unsurpassed since.

India had already very cultured society one or two millennia at least before the Greek awakening around 800 B.C. Yet, if ancient Greeks are easily perceived as very physical in their preoccupations, Indians in contrast are rather seen as metaphysical beings, hardly interested in material things. And it is indeed true that at a certain stage of the development of Indian culture, a deep influence has been cast on Indian collective psyche, bringing about a tendency to consider physical life as somewhat unreal.
Yet India is also well known as the native place of Yoga. Therefore knowledge about body and spirit and methods appropriate to perfection of body and spirit could evolve in India. Could this have happened in an environment generally indifferent to physical exercises and physical education?

We should remember the heroes that India gave to herself who represent not only great qualities of courage and valour but also of physical strength and excellence. Here is how Valmiki, describes Rama in the opening verses of the Ramayana:

There is a famous king by the name of Rama, born in the line of great Ikshwaku. He is of subdued sense and of exceeding might. He has mighty arms reaching to the knees. His throat is marked with three auspicious conch shell lines. He has high and broad shoulders, well-formed head, graceful forehead, strongest jaws, and deeply embedded collar bones. His eyes are large, and his color is of soft lustrous green. He is neither too tall, nor very short, but well-formed and of symmetrical limbs. This highly beautiful and mighty Rama is supremely intelligent, and of eloquent speech.

Centuries later, Rama was described again by the poet Kalidasa echoing Valmiki’s description: Young, with arms long as the pole of the yoke, with sturdy shoulders, with a chest broad as a door panel, and a full broad neck, Raghu was above his father by
the excellence of his body, and yet through his modesty he looked smaller.

Let us think of Arjuna, as described in Mahabharata: Without him whose arms are long and symmetrical, and stout and like unto a couple of iron maces and round and marked by the scars of the bow-strings and graced with the bow and sword and other weapons and encircled with golden bracelets and like unto a couple of five-headed snakes, without that tiger among men the sky itself see meth to be without the sun.

Similarly for Bhima, whose body was beautifully proportioned, perfect specimen of manhood with his broad chest, slim waist and narrow hips and Kama, tall like a golden palm tree capable of slaying a lion, and many others, endowed with resplendent bodies, whose feats of strength, endurance and agility fill the pages of Mahabharata. These heroes are not abstract images; their bodies are not less praised than their commitment to dharma, their loyalty, their devotion or their generosity.

What was the secret of this superhuman force of body and mind which we see pulsating in the heroes of Ramayana and Mahabharata? What was, it that stood behind a civilization which produced such characters? Without a great and unique discipline involving a perfect education of body, soul and mind, this would
have been impossible. We will see later how physical education was an integral part of the educational curriculum, but first it must be said that, at the basis of the ancient system of education was the all important discipline of Brahmacharya. Ancient Indians knew that, in the same way a wave is not separate from the ocean, man is not separate from the universe and the universal energy. The same force which moves in stars and planets moves in man. And they knew that the source of energy is spiritual but in the physical world the basis, the foundation on which it stands is physical. Man can increase his capacity as a receptacle of this energy. By the discipline of Brahmacharya, by keeping alive his burning aspiration for the knowledge of the Brahman, by having control over his desires and passions, by maintaining a receptive state of mind, he can retain and even largely increase energy in his soul, brain and body. And indeed, if we turn to the ancient texts, the Vedas and Upanishads, we will see that the body, far from being regarded by spiritual seekers as an obstacle, something to be discarded, was considered as a receptacle for strength (bald). Strength was among physical qualities the most praised: When one study Ayurveda, the real extent of the importance given by ancient India to the body, its proper development and its proper training, stands fully revealed. Ayurveda, also known as the science for prolongation of life,
makes a thorough study of the human body, its different types and needs, and proposes accordingly specific exercises and methods for optimum body development, with emphasis on strength and agility. There are many important parts of Ayurveda, such as its science of nutrition and others; but presently we shall concentrate on its views on physical exercises. In Ayurveda, strength was considered as the basis of health and physical development. By the acquisition of strength, each and every internal organ, the heart, the brain, the lungs, the liver and the kidneys, the external senses, the limbs, ought to be able to perform their functions without any fault or disorder.

Exercise or Vyayama was considered the surest means of acquiring strength. Therefore, the knowledge of physical exercises, their nature, types, and exact measure of exercise, benefits of exercise and even contra indications and many details about the science of exercise were included in the curriculum elaborated by Ayurveda. To give a small example of how detailed were the prescriptions, it was said, for instance, that the appearance of perspiration on the nose, the forehead, the joints of hands and legs and dryness in the mouth were the symptoms which indicated that one has taken exercise to the half extent of one's capacity. Exercise was also used by the ancient physicians as a modality of treatment,
like in modern medical science. For some of the diseases certain exercises were prescribed but exercises could be prohibited altogether in other specific cases. Ayurveda strongly advised to exercise in right measure. Susruta recommends daily exercise, because it leads to the development of the complexion of the body, strengthens and shapes the muscles, improves the appetite and produces lightness in the body, helps in warding off laziness and gives power to endure hard work, mental strain, thirst, cold or heat. Imbecility and senile decay never approach him who exercises properly, and the muscles of his body remain firm and steady. Charaka relates the fitness of the body with a non-diseased existence: the man who is well-proportioned in flesh, well-knit in figure, and firm

Physical exercise brings about lightness, capacity to work, stability, immunity to ailments, elimination of morbidities as well as a good metabolism.

At the base of Ayurveda is an important distinction between different types of bodies: the body can be of three kinds: Sthula (obese), Madhya (medium) and Krsa (thin). However, Ayurveda holds that every individual has his own physical personality beyond these types and it should be recognized as such. Of the three types the medium type personality is considered best
by Ayurveda. There is another classification of body types based upon the preponderance of the three basic humours, Vata (wind), Pitta (bile), Kapha (phlegm). So there are Vata types, Pitta types and Kapha types. The idea is to have the three humors equally balanced, which leads to perfect health. For each type of body different regimens are suggested. In addition, there are other factors influencing the personality, which are to be taken into consideration before one begins to take physical exercise, such as strength, diet, as well as the season of the year and the physical nature of the country.

One important outcome of a regular practice of appropriate physical exercise is the symmetrical development of body parts. The concept of such development was highly elaborated in Ayurveda. The Sanskrit literature of the epic period has ample references describing the ideal symmetrical body: the neck is strong and stable, the shoulders are broad and muscular, the arms long and heavy, the chest broad, the waist or girdle slim like conch, the forehead broad and the head round, etc. Charaka and Susruta both have described such ideal development. They gave minute descriptions of every part of the body and of the signs and symptoms of their perfect and ideal development. They described
all parts of the body, up to the smallest, from the sole of the feet up to the texture of hairs.¹

**The History of Fitness**

As we enter the 21st century, one of the greatest accomplishments to be celebrated is the continuous pursuit of fitness since the beginning of man’s existence. Throughout prehistoric time, man's quest for fitness has been driven by a desire to survive through hunting and gathering. Today, though no longer driven by subsistence requirements, fitness remains paramount to health and well-being. This article will highlight historical events and influential individuals who have shaped the history of fitness beginning with primitive man up to the foundation of the modern fitness movement.

**Primitive Man and Fitness (Pre-10,000 B.C)**

Primitive nomadic lifestyles required the continual task of hunting and gathering food for survival (1). Tribes commonly went on one- or two-day hunting journeys for food and water. Regular physical activity apart from that necessary for hunting and gathering was also a principal component of life. Following

successful hunting and gathering excursions, celebration events included trips of six to 20 miles to neighboring tribes to visit friends and family, where dancing and cultural games could often last several hours. This Paleolithic pattern of subsistence pursuit and celebration, demanding a high level of fitness and consisting of various forms of physical activity, defined human life (2).

**The Neolithic Agricultural Revolution (10,000-8,000 B.C.)**

The Neolithic Agricultural Revolution marked the conclusion of primitive lifestyle and signified the dawn of civilization. This historic period was defined by important agricultural developments including animal and plant domestication, and the invention of the plow. These human advancements made it possible for hunting-gathering tribes to obtain vast amounts of food while remaining in the same area, thus transforming primitive man into an agrarian (agriculture and farming) society (3). This era in history symbolizes the beginning of a more sedentary lifestyle, as man began to alleviate some hardships of life while, simultaneously decreasing daily physical activity.

**Ancient Civilizations - China and India (2500-250 B.C.)**

**China**

In China, the philosophical teachings of Confucius encouraged participation in regular physical activity (4). It was
recognized that physical inactivity was associated with certain diseases (referred to as organ malfunctions and internal stoppages, which sound similar to heart disease and diabetes) were preventable with regular exercise for fitness. Consequently, Cong Fu gymnastics was developed to keep the body in good, working condition. Cong Fu exercise programs consisted of various stances and movements, characterized by separate foot positions and imitations of different animal fighting styles (5). In addition to Cong Fu gymnastics, other forms of physical activity existed throughout ancient China including archery, badminton, dancing, fencing, and wrestling.

India

In India, individual pursuit of fitness was discouraged as the religious beliefs of Buddhism and Hinduism emphasized spirituality and tended to neglect development of the body. Consequently, the importance of fitness within society in general was relatively low. However, an exercise program similar to Chinese Cong Fu gymnastics developed, while still conforming to religious beliefs, known as Yoga. Though its exact origin has yet to be identified, Yoga has existed for at least the past 5000 years. Translated, Yoga means union, and refers to one of the classic systems of Hindu philosophy that strives to bring together and
personally develop the body, mind, and spirit. Yoga was originally developed by Hindu priests who lived frugal lifestyles characterized by discipline and meditation. Through observing and mimicking the movement and patterns of animals, priests hoped to achieve the same balance with nature that animals seemed to possess. This aspect of Yoga, known as Hatha Yoga, is the form with which Westerners are most familiar and is defined by a series of exercises in physical posture and breathing patterns (5). Besides balance with nature, ancient Indian philosophers recognized health benefits of Yoga including proper organ functioning and whole well-being. These health benefits have also been acknowledged in the modern-day United States, with an estimated 12 million individuals regularly participating in Yoga.²

As J. F. Kennedy rightly said, "Physical fitness is not only one of the most important keys to a healthy body, it is the basis of dynamic and creative intellectual activity." This statement clearly shows us the Importance of Physical Fitness. However, if in the past you have been maintaining a sedentary lifestyle (and maintain unhealthy eating habits), you are doing injustice to yourself. Therefore, to keep yourself physically fit, you not only need to have a proper diet, but follow a proper exercise regimen too.

²http://www.unm.edu/~lkravitz/Article%20folder/history.html
Physical fitness is a state or condition in which both your body and your mind are healthy and physically sound (by taking in proper nutrition and maintaining a good workout schedule). It is not necessary for a person who is physically fit to have a lean body that can be achieved by maximum calories burned. Rather, they should have strong body endurance, along with good muscle strength and cardiovascular fitness. It is also important to remember that a physically fit body is generally accompanied with a happy and satisfied state of mind.

Gone are the days when physical exercises were meant for people serving in the armed forces (or those having physically demanding jobs). These days, a physically fit body, free from ailments of any kind, is believed to be one of the most important assets that a human being can possess. The importance of physical fitness and exercise, customized to the specific requirements of both young and old, has led to the popularity and use of exercise equipment. The easy access to gyms and fitness centers further highlights the importance of physical fitness. This has resulted in people leading longer and healthier lives that their predecessors could not have dreamed of.

Physical fitness not only improves our quality of life, but also helps us in the long run. It increases cardiovascular fitness and
body endurance. Regular exercise can also help increase the strength of your heart.

What's more, being physically fit also increases blood circulation and helps it to deliver oxygen and nutrients to all the tissues. This not only helps the muscles increase your overall body strength, but increases its ability to exert force and sustain contractions.

Physical fitness makes your joints and body more flexible, and regular exercise results in a decrease of body fat. It increases lean body mass, resulting in a balanced and healthy body composition. Never negate the importance of physical fitness, and work towards achieving a healthy disease-free body!³

Physical fitness is the ability to perform vigorous physical activity. It is not measured in terms of achieving specific motor skills, but rather it is assessed in terms of muscle strength, endurance, and flexibility. The circulatory and respiratory systems are also involved because of their role in supplying muscles with blood and oxygen. In considering muscles, strength is the maximum force that can be exerted by a muscle, and endurance is the ability to perform a muscular activity at less than maximum force, for example, in

³http://www.3fatchicks.com/the-importance-of-physical-fitness-in-your-life/
doing a series of chin-ups. Flexibility is the ability of a joint to move through a normal range of motion. The components of physical fitness (strength, endurance, flexibility, and capacity of circulatory and respiratory systems) can only be maintained through regular exercise. Although the percentage of body fat is not a main factor in physical fitness, it must be considered because of its effect on a person's ability to exercise. There is debate in the fitness community about whether an individual can be considered fit if he or she is overweight. The body will adapt to a regular exercise program by improving the function of the cardiac and respiratory systems. The blood will have a greater capacity to carry oxygen, which in turn will improve the body's ability to work. The heart and respiratory systems will be more efficient during rest and exercise, and the resting heart rate is usually reduced. These changes take place when a person participates in a rhythmic endurance activity such as walking, running, and cycling, or continuous sports activities such as basketball or tennis. In addition, an individual participating in a regular exercise program will notice the effects on the skeletal, muscular, and nervous systems. The body will show improved flexibility of the joints along with greater muscle strength and muscle endurance.

Concept of physical fitness is as old as humankind.
Throughout the history of mankind physical fitness has been considered an essential element of everyday life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings.

The expert committee of the World Health Organization (1981) described physical fitness as “the ability to undertake muscular work satisfactorily.” Physical fitness is the capacity to early out, reasonably well, various forms of physical activities, without being unduly tired and includes qualities important to the individual’s health and well-being.

Human body is a gift by nature. Life in the computer age is not less than the blessings of God. Scientific discoveries have changed the entire face of our planet. It has changed the entire face of our planet. It has changed the thorny life into the bed of roses. Good health provides sound and solid foundation on which fitness rests and at the same time fitness provides one of the most important key to health and living one’s life to fullest.

In villages which formed the first habitation of civilized man rural sports grew out of sheer necessity. Joint defense against on
sleights of a common foe and dangerous animals must have given birth to sports like wrestling, running, jumping, weight lifting and such performing arts as measuring strength by holding wrists, twisting hands etc.

Same is the case with games and sports in rural and urban settings. We notice that there is a lot of difference in the interest of children. Like we observe that in rural areas children are indulging in minor, indigenous activities and field games like football, kabaddi, kho-kho, hockey, wrestling, athletics etc. whereas, in urban we find children playing basketball, swimming, badminton, tennis, squash, golf etc. The main cause of difference is the availability of facilities and financial support of parents. The urban people with the growth of cities has come a great transformation in the living habits of society. The city is the hub of much social life, and it influences its standards. Intellectual growth and habits, moral codes and conditions, behavior patterns and cultural conditions resolve around it. New communities, new group, new ethnic relations and a multitude of classes make of the city an intricate and complex unit of modern society.

Physical fitness is the ability to perform daily activities willingly and actively. Physical fitness includes not only components of sports but those of health as well. Regular physical
activity prevents or limits weight gain, and gain in Body Mass Index (BMI).⁴

**IMPORTANCE OF PHYSICAL FITNESS**

In its most general meaning, physical fitness is a general state of good physical health. Obtaining and maintaining physical fitness is a result of physical activity, proper diet and nutrition and of course proper rest for physical recovery. In its simplest terms, physical fitness is to the human body what fine-tuning is to an engine. It enables people to perform up to their potential. Regardless of age, fitness can be described as a condition that helps individuals look, feel and do their best. Thus, physical fitness trainers, describe it as the ability to perform daily tasks vigorously and alertly, with left over energy to enjoy leisure-time activities and meet emergency demands. Specifically true for senior citizens, physical fitness is the ability to endure, bear up, withstand stress and carry on in circumstances where an unfit person could not continue. In order for one to be considered physically fit, the heart, lungs, and muscles have to perform at a certain level for the individual to continue feeling capable of performing an activity. At the same time, since

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what humans do with their bodies directly affects the state of mind, fitness influences to some degree qualities such as mental alertness and emotional expression. The Surgeon General's report on physical activity, the Centers for Disease Control and the American College of Sports Medicine all stress the importance of regular and sustained bouts of moderate-intensity physical activity (Pate et al. 1995) because it is clear that physical activity is very important to preventive disease management, wellness, and employee productivity.

Cardiovascular endurance is the ability of the body to deliver oxygen and nutrients to tissues and to remove wastes over sustained periods of time. Muscular strength and endurance, strength deals with the ability of the muscle to exert force for a brief time period, while endurance is the ability of a muscle, or group of muscles, to sustain repeated contractions or to continue to apply force against an inert object. Flexibility denotes the ability to move joints and use muscles through their full range of motion. Body composition considered as one of the components of fitness, composition refers to the body in terms of lean mass (muscle, bone, vital tissue, and organs) and fat mass. Actually, the optimal ratio of fat to lean mass is an indication of fitness. Performing the right set of exercises can help people get rid of body fat and increase or maintain muscle
You're more likely to live a long and healthy life.

Regular exercise reduces the risk of developing heart disease, high blood pressure, high cholesterol, type 2 diabetes and certain types of cancer. It also reduces the risk of having a stroke. In one eight year study of more than 20,000 men, those who were lean but unfit had twice the risk of death as those who were lean and fit.

You'll have more energy, strength and stamina.

People who complain that they don't have enough energy to exercise fail to realize that working out gives you energy. In one study, middle-aged women who lifted weights for a year became 27% more active in daily life than before they started lifting weights. Regular exercise also increases your strength and stamina, allowing you to better handle common activities such as carrying a heavy bag of groceries or climbing a flight of stairs.

You'll keep excess body fat off.

If you try and lose weight simply by dieting, you'll lose some muscle along with any body fat you lose and you'll slow down your metabolism. If your weight loss program includes exercise, you'll lose body fat without losing muscle and without slowing down your metabolism. If you're currently at a healthy weight, regular exercise will help you avoid putting on excess body fat in the future.
4. **You'll keep your bones strong.**

Both men and women start losing bone mass around age 35. Lifting weights can not only stop the loss of bone mass, but in some cases it can even reverse it. This drastically reduces the risk of osteoporosis. Weight bearing exercises like walking and running also help keep bones strong.

5. **You'll prevent or reduce low back pain.**

Strengthening your abdominal and lower back muscles can help prevent low back pain, and it can also reduce discomfort if you already suffer from this pain. You might also be able to avoid back surgery by strengthening your abdominal and lower back muscles. In one study, 35 of 38 people who had been recommended for back surgery were able to avoid surgery by following an aggressive strengthening program.

6. **You'll keep your mind sharp.**

Multiple studies have confirmed that regular exercise is one of the best things you can do for your mind. Regular exercise improves brain function, which helps prevent dementia and Alzheimer's disease.

7. **You'll improve your mood.**

A large amount of research shows that you have a better sense of well-being following a workout. Thanks to chemicals
released in the brain during exercise, feelings of depression, anxiety, stress and anger are diminished during a workout.

8. **You'll get sick less often.**

Both aerobic exercise and weight lifting strengthen the immune system. The stronger your immune system, the less often you'll get sick.

9. **You'll sleep better.**

People who exercise regularly fall asleep faster and wake up less often during the night than people who are sedentary.

10. **You'll enjoy life more.**

Life is much more enjoyable when you're fit and healthy. You look good and you feel good, and you're more productive in everything you do.

Why is physical fitness important? Because many common health problems are the result of a sedentary lifestyle and they can be minimized or prevented by improving your physical fitness.⁵

**TRAINING**

The work ‘Training’ has been a part of human language since ancient times. It denotes the process of preparation for some task. This process invariably extends to a number of days and even

months and years. The term ‘Training’ is widely used in sports. Some experts especially belonging to sports medicine understand sports training as basically doing physical exercise. Training aims at improving the fitness of persons. Today, through training, as in ancient times, the athlete prepares himself for a definite goal. In physiological terms, the goal is to improve the body’s systems and functions in order to optimize athletic performance. Training is led, organized and planned by a coach whose task is very complex since they deal with many physiological, psychological and sociological variables. Training is a systematic athletic activity of long duration, progressively and individually graded, aiming at modeling the human’s physiological and psychological functions to meet the demanding tasks.  

Physical fitness is to the human body what fine tuning is to an engine. It enables us to perform up to our potential. Fitness can be described as a condition that helps us look, feel and do our best. More specifically, it is: "The ability to perform daily tasks vigorously and alertly, with energy left over for enjoying leisure-time activities and meeting emergency demands. It is the ability to endure, to bear up, to withstand stress, to carry on in circumstances

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6www.Active Fitness World.com/Health and Training/introduction.com
where an unfit person could not continue, and is a major basis for
good health and well-being."

The BMI is a statistical measurement derived from your height and weight. Although it is considered to be a useful way to estimate healthy body weight, it does not measure the percentage of body fat. The BMI measurement can sometimes be misleading - a muscleman may have a high BMI but have much less fat than an unfit person whose BMI is lower. However, in general, the BMI measurement can be a useful indicator for the 'average person'. The BMI equation (BMI = Body Mass Index) was originally framed by Adolphe Quetelet, a Belgium mathematician and scientist, between 1830 and 1850. Adolphe was the first person to think of relating weight to height in a statistical, expressible manner.

While the BMI tool is fairly reliable, it is only one tool that physicians use in evaluating a person's health status. It is important to take other measures like blood pressure, cardiac health, physical inactivity and abdominal girth. Also keep in mind that BMI does not distinguish between muscle mass and fat mass. A particularly athletic person whose weight is higher due to muscle may have a BMI that indicates that they are overweight, when their weight is simply higher due to muscle mass. We can find out the BMI by
using the formula: \( \text{BMI} = \frac{\text{WEIGHT (in kilograms)}}{\text{Height (m)}^2} \).\(^7\)

The Body Mass Index (BMI), or Quetelet index, is a heuristic proxy for human body fat based on an individual's weight and height. BMI does not actually measure the percentage of body fat. It was invented between 1830 and 1850 by the Belgian polymath Adolphe Quetelet during the course of developing "social physics". Body Mass Index is defined as the individual's body weight divided by the square of his or her height. The formulae universally used in medicine produce a unit of measure of kg/m\(^2\). BMI can also be determined using a BMI chart, which displays BMI as a function of weight (horizontal axis) and height (vertical axis) using contour lines for different values of BMI or colors for different BMI categories.

\[
\text{Formula} \quad \text{BMI} = \frac{\text{Mass (Kg)}}{(\text{Height(m)})^2}
\]

BMI has become controversial because many people, including physicians, have come to rely on its apparent numerical authority for medical diagnosis, but that was never the BMI's purpose; it is

\(^7\)http://bmi4all.blogspot.in/p/introduction.html
meant to be used as a simple means of classifying sedentary (physically inactive) individuals with an average body composition. For these individuals, the current value settings are as follows: a BMI of 20 to 25 may indicate optimal weight; a BMI lower than 20 suggests the person is underweight while a number above 25 may indicate the person is overweight; a person may have a BMI below 20 due to disease; a number above 30 suggests the person is obese (over 40, morbidly obese).  

Body Mass Index (BMI) is one of the most accurate ways to determine when extra pounds translate into health risks. BMI is a measure which takes into account a person’s weight and height to gauge total body fat in adults. Someone with a BMI of 26 to 27 is about 20 percent overweight, which is generally believed to carry moderate health risks. A BMI of 30 and higher is considered obese. The higher the BMI, the greater the risk of developing additional health problems.

Heart disease, diabetes and high blood pressure are all linked to being overweight. A BMI of 30 and over increases the risk of death from any cause by 50 to 150 percent, according to some estimates. According to health experts, people who are overweight but have no other health risk factors (such as high cholesterol or

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high blood pressure) should eat healthier and exercise to keep from gaining additional weight. For people who are overweight and also have health risks, they recommend trying to actively lose weight. Be sure to consult your doctor or other health professional before beginning any exercise or weight-loss program.

In June 1998, the federal government announced guidelines which create a new definition of a healthy weight -- a BMI of 24 or less. So now a BMI of 25 to 29.9 is considered overweight. Individuals, who fall into the BMI range of 25 to 34.9, and have a waist size of over 40 inches for men and 35 inches for women, are considered to be at especially high risk for health problems.

To use the table below, find the appropriate height in the left-hand column. Move across to a given weight. The number at the top of the column is the BMI for that height and weight. Pounds have been rounded off. SOURCE: National Heart, Lung, and Blood Institute.

Both Body Mass Index (BMI) and Waist Circumference (WC) can be useful measures of determining obesity and increased risk for various diseases. According to the National Institutes of Health, a high WC is associated with an increased risk for type 2 diabetes, dyslipidemia, hypertension and cardiovascular disease when BMI is between 25 and 34.9. (A BMI greater than 25 is
considered overweight and a BMI greater than 30 is considered obese.) WC can be useful for those people categorized as normal or overweight in terms of BMI. (For example, an athlete with increased muscle mass may have a BMI greater than 25 - making him or her overweight on the BMI scale - but a WC measurement would most likely indicate that he or she is, in fact, not overweight). Changes in WC over time can indicated an increase or decrease in abdominal fat. Increased abdominal fat is associated with an increased risk of heart disease.

To determine your WC, locate the upper hip bone and place a measuring tape around the abdomen (ensuring that the tape measure is horizontal). The tape measure should be snug but should not cause compressions on the skin. The following chart should be helpful in determining the possible risks associated with your BMI and WC.
### International Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risks

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Obesity Class</th>
<th>Disease Risk* Relative to Normal Weight and Waist Circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>-</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5-24.9</td>
<td>-</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0-29.9</td>
<td>Increased</td>
</tr>
<tr>
<td>Obesity</td>
<td>30.0-34.9</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>35.0-39.9</td>
<td>Very High</td>
</tr>
<tr>
<td>Extreme</td>
<td>40.0+</td>
<td>Extremely High</td>
</tr>
</tbody>
</table>

* Disease risk for type 2 diabetes, hypertension, and CVD.

+ Increased waist circumference can also be a marker for increased risk even in persons of normal weight.

SOURCE: National Heart, Lung and Blood Institute.⁹

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⁹[http://www.caloriecontrol.org/healthy-weight-tool-kit/body-mass-index-calculator](http://www.caloriecontrol.org/healthy-weight-tool-kit/body-mass-index-calculator)
Measuring Obesity in Children

Weight-to-age percentiles are used to measure obesity in children. However, it should be kept in mind that this method, among other methods, should only be used as a tool. Only a physician can best determine and diagnose weight status in your child.
Plotting Child's Weight-to-Age Percentile

To plot child's weight-to-age percentile, find the age of child on the bottom of the chart and look to the left to locate their body weight. Once you locate their weight and age, locate the corresponding shaded color on the bottom of the chart to determine your child's percentile.
A child is defined as "overweight" if their weight-to-age percentile is greater than 95 percent. A child is defined as "at risk for overweight" if their weight-to-age percentile is greater than 85 percent and less than 95 percent.\(^\text{10}\)

BMI values are age-independent and the same for both sexes. However, BMI may not correspond to the same degree of fatness in different populations due, in part, to different body proportions. The health risks associated with increasing BMI are continuous and the interpretation of BMI gradings in relation to risk may differ for different populations.

In recent years, there was a growing debate on whether there are possible needs for developing different BMI cut-off points for different ethnic groups due to the increasing evidence that the associations between BMI, percentage of body fat, and body fat distribution differ across populations and therefore, the health risks increase below the cut-off point of 25 kg/m\(^2\) that defines overweight in the current WHO classification.

There had been two previous attempts to interpret the BMI cut-offs in Asian and Pacific populations, which contributed to the growing debates. Therefore, to shed the light on this debate, WHO

\(^{10}\text{http://obesityfoundationindia.com/bmi.htm}\)
convened the Expert Consultation on BMI in Asian populations (Singapore, 8-11 July, 2002).

The WHO Expert Consultation concluded that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMI’s lower than the existing WHO cut-off point for overweight (= 25 kg/m$^2$). However, the cut-off point for observed risk varies from 22 kg/m$^2$ to 25 kg/m$^2$ in different Asian populations and for high risk, it varies from 26 kg/m$^2$ to 31 kg/m$^2$. The Consultation, therefore, recommended that the current WHO BMI cut-off points (Table 1) should be retained as the international classification. But the cut-off points of 23, 27.5, 32.5 and 37.5 kg/m$^2$ are to be added as points for public health action. It was, therefore, recommended that countries should use all categories (i.e. 18.5, 23, 25, 27.5, 30, 32.5 kg/m$^2$, and in many populations, 35, 37.5, and 40 kg/m$^2$) for reporting purposes, with a view to facilitating international comparisons.\footnote{http://apps.who.int/bmi/index.jsp?introPage=intro_3.html}

**What is Co-ordination?**

It is the act of organizing, making different people or things work together for a goal or effect to fulfill desired goals in an organization. Co-ordination is a managerial function in which different activities of the business are properly adjusted and
interlinked.

Coordination is the ability to repeatedly execute a sequence of movements smoothly and accurately. This may involve the senses, muscular contractions and joint movements.

Everything that we participate in requires the ability to coordinate our limbs to achieve a successful outcome - from walking to the more complex movements of athletic events like the pole vault.

**Coordination skills in sport**

All sports require the coordination of eyes, hands and/or feet and maybe an implement and a ball. Racket sports (e.g. tennis and squash) require the coordination of hand, eyes and racket to connect the racket with the incoming ball as well as position our body in an appropriate position to return the ball in an efficient and effective manner.

Hockey requires the coordination of hands, eyes and hockey stick to connect with the ball, Football primarily requires the coordination of feet, eyes and ball and Rugby the coordination of hands, eyes and ball.

**Children**

Children have a better sense of balance and coordination due to their body size and lower centre of gravity and have the ability to
learn complicated movements/skills like those required by a
gymnast.

As they experience growth spurts muscle development may
take 12 to 18 months to adjust to the new bone growth and during
this time they may find the following are negatively affected:

- Coordination skills
- Athletic performances
- Mobility/Flexibility

It is important that coaches educate their athletes as to why
they are experiencing these problems. Now is an appropriate time
to focus on developing their flexibility to help muscles adjust to the
growing bones.¹²

**Muscular Strength**

Most people are describing human power as physical
strength and many don’t know what means muscular strength.
Physical and muscular it’s very common word but many people are
accustomed to say physical than muscular.

Muscular strength helps our muscles to do heavier work. It
means the more we have muscular strength the more muscles can
do. You have to know this term if you are willing to build muscle,
because you have to muscular strength exercises that can help you

¹²http://www.brianmac.co.uk/coord.htm
to increase muscular strength so in the same it will make muscles look bigger and stronger.\textsuperscript{13}

\textbf{Introduction to Muscle}

Skeletal muscle is a classic example of a biological structure-function relationship. At both macro- and micro-scopic levels, skeletal muscle is exquisitely tailored for force generation and movement. This page is an attempt to at least mention some of the important aspects of the basic science of the neuromuscular system, a kind of table of the development of the neuromuscular system is typically divided into at least three phases. My genesis (perhaps synchronous with axonal outgrowth) refers to the fusion of the precursor myoblasts into true muscle fibers. Nerves attach to, or innervate, fibers as (or perhaps just before) they develop during the phase of synaptogenesis. This process results in most fibers being multiply innervated. The several axons in contact with each fiber compete for control during synapse elimination until each fiber is synapse with only one axon. Single innervations are believed to be very important, as the axon is thought to have a strong influence on the properties of the fiber.

\textsuperscript{13}http://fitnessblogger.net/introduction-to-muscular-strength-and-health/
**Muscle Fiber Structure**

Muscle cells are roughly cylindrical, with diameters between 10 and 100 µm but up to a few centimeters long. Each cell is embedded in a basal lamina of collagen and large glycoprotein’s. Between the fiber and the basal lamina are large numbers of satellite cells, which are important in the growth and repair of the fiber. The fiber itself contains specialized structures for excitation-contraction coupling to ensure that a contractile stimulus (received at the synapse) is rapidly and evenly communicated to the whole fiber. Contractile and performance characteristics vary, but are closely linked to the myosin heavy chain is form expressed by the fiber. Force production occurs in the myofibrils, which are chains of sarcomeres running from one end of the fiber to the other. Energy for contraction comes from metabolism of fats and sugars.

**Muscle Architecture**

The properties of a whole muscle depend not only on the properties of the fibers, but also on the organization of those fibers: the muscle architecture. Fibers rarely run the whole length of the muscle, tending to be somewhat oblique to the muscle's line of action. Peak force production is related to the physiological cross sectional area (PCSA), which estimates the sum of the cross
sectional area of all the fibers. Contraction velocity and excursion range are related to fiber length.

**Control of Contraction**

Although each fiber is innervated by a single axon, a motor neuron may have a hundred or more axons. A single motor neuron, with all the fibers it controls, is called a motor unit. As the brain's signal for contraction increases, it both recruits more motor units and increases the "firing frequency" of those units already recruited. Even during a "maximal voluntary contraction", it is unlikely that all the motor units (and hence muscle fibers) are activated.

**Biomechanics of Strength**

The above discussion focused on the muscle itself. All joints, however, are set up as lever systems: the fulcrum where two bones meet, one force produced by the muscle, and the other by a load. Strength is not just muscle force, but muscle force as modified by the mechanical advantage of the joint. To complicate matters further, this mechanical advantage usually varies with joint rotation (as does the muscle force). The net result is strength that varies with joint angle and may be somewhat decoupled from muscle force. Joint strength can (obviously) be increased with exercise.\(^{14}\)

\[14\]http://muscle.ucsd.edu/musintro/over.shtml
What is Speed?

Speed is the ability to move quickly across the ground or move limbs rapidly to grab or throw. Speed is not just how fast someone can run (or cycle, swim etc.), but is dependent on their acceleration (how quickly they can accelerate from a stationary position), maximal speed of movement, and also speed maintenance (minimizing deceleration). Movement speed requires good strength and power, but also too much body weight and air resistance can act to slow the person down. In addition to a high proportion of fast twitch muscle fibers, it is vital to have efficient mechanics of movement to optimize the muscle power for the most economical movement technique.

Who Needs Speed?

Speed is one of the main fitness components, important for success in many sports. For some athletes such as Track and Field sprinters, sprint swimmers, cyclists and speed skaters, speed is the most important aspect of fitness. In many other sports, including team field sports, good speed is also very important as part of the overall fitness profile. A vote of the top sports requiring speed has
the obvious ones of track and field sprinters on top. See also another list ranking sports in which speed is important.\textsuperscript{15}

Speed in Sports is a unique sports performance institute focused on speed and movement training enhancing all areas of athletic performance. Understanding that movement transcends all sports, our comprehensive training methods are designed for the most effective approach combining optimal movement, speed, strength, power, balance, functional flexibility, trunk training, core stability, explosion and recovery to enhance athletic performance.

Developed solely for the athlete, Speed In Sports is comprised of elite performance specialists, strength and conditioning specialists, physical therapists, sports medicine physicians, nutritionists, chiropractic sports physicians, sports massage therapists, optometrists and sports psychology.

Speed In Sports has trained athletes from virtually every major professional sport to collegiate, high school and amateur athletes. The program offers the cutting edge of athletic performance enhancement and most efficient methodology, along with an emphasis on injury prevention and regeneration.\textsuperscript{16}

\textsuperscript{15}http://www.topendsports.com/fitness/speed.htm
\textsuperscript{16}http://www.speedinsports.com/welcome.html
Explosive Strength

The ability to expend energy in one explosive act or in a series of strong sudden movements as in jumping, or projecting some object (e.g. a javelin) as far as possible. Explosive power drills are often used by athletes who need to generate a quick burst of maximal effort, such as movements required in football, track and field sports, court sports and even cycling. The types of exercises used to build this quick, explosive power are movements that are require a maximum or near maximum power output from the athlete in a short amount of time. Explosive exercise training routines are one way to increase power output. The goal of explosive exercise training is to ultimately move heavy weights very quickly. But to get to that point safely, without risking injury, it's important to start with light weights and slow controlled movements. Over a matter of training session (several weeks), but the weight lifted and speed at which it's lifted will be increased. Explosive exercises at their final level are often referred to as plyometric or ballistic movements.\(^\text{17}\)

\(^{17}\)http://sportsmedicine.about.com/od/strengthtraining/a/PowerTraining.htm
**Flexibility**

Flexibility refers to the ability to move joints through their entire range of motion, from a flexed to an extended position. The flexibility of a joint depends on many factors including the length and suppleness of the muscles and ligaments and the shape of the bones and cartilage that form the joint. Flexibility can be genetic, but it can also be developed by stretching.

Flexibility is an important component of fitness and exercise tends to increase the amount of flexibility in a joint. Flexibility is also specific to the type of movement needed for a sport so it is more important for some sports than others. Cyclists, for example, require less hip flexibility than hurdles, and swimmers need more shoulder flexibility than runners.

**How to Increase Flexibility**

Improving flexibility is done mainly by performing stretching exercises. The most common forms of stretching exercises are static, sustained stretching exercises that are slow and controlled. Static stretches are thought to be safe for most people. They involve a slow, gentle stretch of the muscle that is held in a lengthened position for 10 to 60 seconds and repeated about three times.
Another type of stretching exercise is called dynamic stretching. Dynamic stretching involves gradual increases in your range of motion and speed of movement with a controlled swing (not bounce) that reach the limits of your range of motion in a controlled manner. You never force this type of stretch. Examples of dynamic stretching are slow, controlled leg swings, arm swings, or torso twists.

Dynamic stretching exercises improve flexibility required in most sports and are often performed after a warm up before aerobic exercise training. Dynamic stretching exercises include 10 to 12 repetitions of the movement. Ballistic stretching uses momentum in an attempt to force a joint beyond its normal range of motion. Bouncing-type stretches are ballistic and very different from dynamic stretching because they are trying to force a greater range of motion. This type of stretch is not recommended because there is an increased risk of injury (from overstretching the muscles, tendons or ligaments) with ballistic stretching.

**How to Increase Flexibility**

Before stretching, it's important to warm up the muscles and joints. Stretching cold, tight muscles can lead to injury, so perform some gentle joint rotation exercises and an easy aerobic exercise
first. Joint rotations are done by working head to toe using small, slow circles (clockwise and counterclockwise) at every joint until they all move smoothly and easily. You can also do some marching or even jumping jacks to raise your core temperature and increase your circulation before you stretch.

For a stretch exercise to improve flexibility, it needs target the specific joint and provide enough stretch to the muscles and ligaments over time to allow an adaptation to a new, increased, range of motion. Basically, what this means is that when you stretch, you need to feel the tightness and slight burning sensation that comes from going slightly beyond your normal range of motion. By doing so, you will develop a new range of motion over time. It is important to avoid over-stretching the muscles and causing an injury or muscle strain. The recommendation is to stretch to the point of mild discomfort but not to the point of pain.

To develop long-term improvements in flexibility, stretch every other day for at least six weeks. Keep in mind that when you stop using or stretching this new flexibility, you are likely to lose the gains you made.

**Benefits of Flexibility**

As an athlete, keep in mind that overall flexibility is less important than having the right flexibility for your sport. Research
shows that the relationship between flexibility and injury risk is misunderstood. Having more flexibility doesn’t necessarily mean fewer injuries and an athlete with poor flexibility isn’t more likely to get injured. The key is to have the right flexibility for your sport, so you can easily move through the range of motion without straining muscles.

In fact, research also supports the idea that performing a proper warm up before exercise is far more likely to help reduce injuries. Warm up by lightly exercising the major muscle groups to be used in your sport. You can also warm up with marching, arm circles, jumping jacks, or starting your sport at a very slow pace. If you lift weights, it’s important to stretch and the best time is right after a workout. Static stretching a fatigued muscle can increase flexibility and improve muscle building. Static stretching helps loosen muscles, removes lactic acid and prevents the muscle tissues from healing at a shorter length after a heavy workout.18

What is Agility?

Sports Definition: the ability to quickly change body position or direction of the body. Agility is also influenced by body balance, coordination, the position of the center of gravity, as well as

18http://sportsmedicine.about.com/od/flexibilityandstretching/a/Flexibility.htm
running speed and skill. Agility can be improved with agility training drills but also by improving the specific individual fitness elements of speed, balance, power and co-ordination.

**Who Needs Agility?**

Agility is one of the main fitness components, important for success in many sports, such as in the team sports of football and hockey, and in individual sports of tennis and squash. A vote of the top sports requiring agility has the sports of soccer, basketball and tennis ranked highest. See also another list ranking sports in which agility is important.19

Agility is the ability to change the direction of the body in an efficient and effective manner and to achieve this you require a combination of:

→ **Balance**

The ability to maintain equilibrium when stationary or moving (i.e. not to fall over) through the coordinated actions of our sensory functions (eyes, ears and the proprioceptive organs in our joints)

Static Balance - ability to retain the centre of mass above the base of support in a stationary position

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19[http://www.topendsports.com/fitness/agility.htm](http://www.topendsports.com/fitness/agility.htm)
Dynamic Balance - ability to maintain balance with body movement

→ **Speed**

The ability to move all or part of the body quickly

→ **Strength**

The ability of a muscle or muscle group to overcome a resistance

→ **Co-ordination**

The ability to control the movement of the body in co-operation with the body's sensory functions e.g. catching a ball (ball, hand and eye co-ordination)\(^\text{20}\)

**Statement of the Problem**

The purpose of study was to compare Body Mass Index and Physical Fitness of Players and Non-Players of tribal school children.

**Delimitations**

1. The study was delimited to the boy’s school students only.
2. The study was delimited to the tribal school children.
3. The age group of children was between 15 to 17 years.
4. Study was delimited to Dahod district only.

\(^{20}\)http://wiki.answers.com/Q/What_is_agility_in_Sport
**Limitations**

1. In this study, the difference regarding the diet was not taken into consideration.
2. Any external force due to which subjects getting strength was not taken into consideration.
3. Any medical problem of the students was not taken into consideration.

**Objective of the Study**

1. The objective of the study was to check Body Mass Index of Players of tribal school children.
2. The objective of the study was to check Body Mass Index of Players of tribal school children.
3. The objective of the study was to check Coordination, Muscular Strength, Speed, Explosive Strength, Flexibility and Agility scores of Player of Tribal school children.
4. The objective of the study was to check Coordination, Muscular Strength, Speed, Explosive Strength, Flexibility and Agility scores of Non-player of Tribal school children.
5. The objective of the study was to compare Body Mass Index scores of Players and Non-player of Tribal school children.
6. The objective of the study was to compare Coordination, Muscular Strength, Speed, Explosive Strength, Flexibility
and Agility scores of Players and Non-player of Tribal school children.

**Hypotheses**

1. It was hypothesized that there will not be positive difference in Body Mass Index scores of Non-Players of tribal school children.

2. It was hypothesized that there will not be positive difference in Coordination, Muscular Strength, Speed, Explosive Strength, upper body strength and Flexibility scores of Players of tribal school children.

**Definitions and Explanations of Terms**

**Body Mass Index**

An index for assessing overweight and underweight, obtained by dividing body weight in kilograms by height in meters squared.\(^{21}\)

**Coordination**

Coordination is the ability to repeatedly execute a sequence of movements smoothly and accurately. This may involve the senses, muscular contractions and joint movements.\(^{22}\)

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\(^{21}\)www.dictionary.reference.com/browse/body+mass+index

\(^{22}\)www.brianmac.co.uk/coord.com
Muscular Endurance

Muscular endurance is the ability of a muscle or group of muscles to sustain repeated contractions against a resistance for an extended period of time.\(^{23}\)

Speed

Speed is the ability to move quickly across the ground or move limbs rapidly to grab or throw.\(^{24}\)

Explosive Strength

The ability to keep your muscle fibers turned on for an extended period of time against a resistance.\(^{25}\)

Flexibility

The ability to move a joint smoothly through its complete range of motion.\(^{26}\)

Agility

The ability to perform a series of explosive power movements in rapid succession in opposing directions.\(^{27}\)

Player

The child who has participated in any game at district or higher

\(^{23}\)www.sportsmedicine.about.com/od/glossary/g/MuscleEndur_def.htm
\(^{24}\)www.topendsports.com/fitness/speed.htm
\(^{25}\)www.strnthcoch.tripod.com/explo.html
\(^{26}\)www.answers.com/topic/flexibility
\(^{27}\)www.brianmac.co.uk/conditon.htm
level sports competition.

**Non-Player**

The child who has not participated in any game at district level or higher level sports competition.

**Significance of the Study**

1. The study may provide guideline about Body Mass Index and Physical Fitness of the Tribal Students.
2. The study may provide guideline about Coordination of the Tribal Students.
3. The study may provide guideline about Muscular Endurance of the Tribal Students.
4. The study may provide guideline about Agility of the Tribal Students.
5. The study may provide guideline about Explosive Strength of the Tribal Students.
6. The study may provide guideline about Flexibility of the Tribal Students.
7. The study may provide guideline to physical education teachers and coaches to increase Physical Fitness of the Tribal Students.