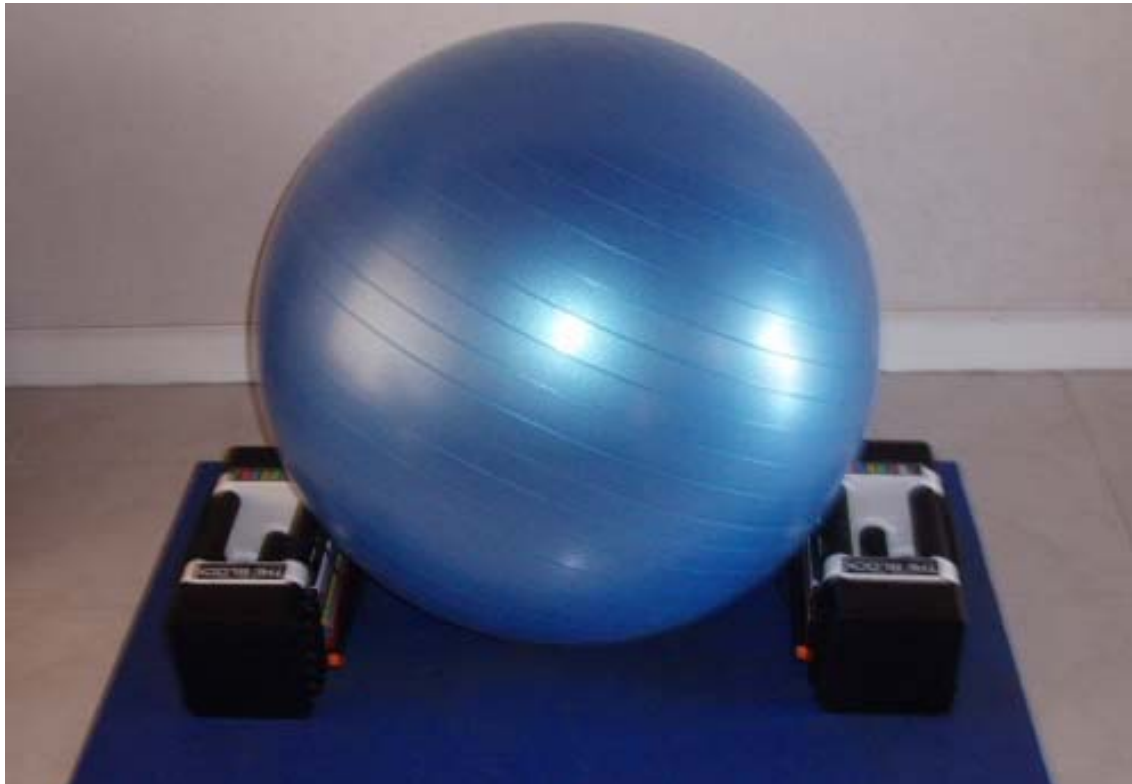


# **A Rational Approach to Diet, Exercise and Health**



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# Preface

Medical science has made tremendous strides in the past 100 years. Many infectious diseases that plagued society during the nineteenth century and early part of the twentieth century have been conquered. Unfortunately, while these diseases were being relegated to the pages of history or reduced to insignificant levels, the stage was being set for the mushrooming of a different category of disease that has plagued western society for the past forty years or so. The incidence of these chronic diseases is increasing at an alarming rate. These diseases include heart disease, diabetes, hypertension, stroke and various other metabolic diseases. The causes of these diseases can be traced directly to lifestyle changes, changes in food development and handling and the rise in the philosophy of instant gratification.

The following short thesis outlines the causes of the decline in health in affluent societies and methods to counter this trend. This is important not only to ensure the best quality of life but also to reduce the staggering costs of treating these diseases both in terms of money and lost productivity. Implementation of these recommendations across the board is in the best interest of all concerned.

This is not an exhaustive study as it aims mainly to establish the principles on which the arguments are based. However, many of the topics will be expanded on in the near future starting with comprehensive details on functional exercise.

## Chapter 1

# Evolution, Diet and Exercise

There is a preponderance of evidence that modern man with our genetics existed in Africa some 100,000 years ago. From Africa the species spread through the Middle East, the Mediterranean, Europe and the rest of the world. All humans on this earth have been shown to have descended from this same basic stock that existed in Africa.

Agricultural cultivation for food started around 10,000 years ago. This accounts for only 10 percent of modern man's existence.

The Industrial Revolution started in Britain around 1740. This gave rise to several activities not possible before the advent of mechanisation and other labour saving devices. These include many devices around the home. Although the first grain mill appeared in the United States around 1775 it was not until the mid 19<sup>th</sup> century that refining of grain became widespread. Refined grains (wheat, corn, rice etc.) have a history of only 150 years. This equates to 0.15 percent of modern man's existence. Other processed and refined foods include cured meats and many commercially available cooking oils and fats derived from vegetable oils through a process known as hydrogenation. Hydrogenation creates a group of fats known as trans fats. Trans fats do not occur naturally and have been linked directly to certain cancers. Cured and processed meats often contain chemicals shown to cause cancer in test animals.

As much as 99.9 percent of the history of mankind has been characterized by a diet free from refined or processed foods.

The sedentary lifestyle only came into existence between 50 and 100 years ago. Prior to this most individuals engaged in significant physical activity for at least 6 days per week. This activity imposed favourable stresses on the

entire body including the muscular system and was very important for our development. Human evolution as we know it would not have taken place without the stresses of this physical activity. Neither can human life continue to effectively exist without it. Physical activity is therefore an integral and necessary part of human existence.

It is therefore obvious that refined and processed foods and the sedentary lifestyle are almost foreign to man when viewed on an evolutionary scale. Before the sedentary lifestyle came into vogue man probably ate less but burned significantly more calories. Most if not all of these calories were from natural sources. Close observation will reveal that chronic diseases did not exist on a large scale until the advent of these two phenomena.

It is patently obvious therefore, that for man to remain healthy he must engage in regular, significant physical activity that challenges the muscles (both cardiac and skeletal) and consume a diet that is free from refined and processed foods. Chronic disease (heart disease, hypertension, cancer and especially the metabolic disease diabetes) is the result of ignoring this simple truth.

### Loss of Muscle Mass with Age

Skeletal muscle of the human body is comprised of two basic types of muscle fibres. Type 1 or slow twitch muscle is essentially employed in long duration, low intensity or aerobic physical activity. Type 2 or fast twitch muscle is used in short duration, high intensity explosive anaerobic physical activity such as sprinting, lifting or pushing.

Sarcopenia, a word derived from the Greek words “sarco” meaning flesh or muscle and “penia” meaning loss or deficiency generally refers to the observed, progressive loss of muscle with age. The average individual can expect to lose about 25 percent of their muscle mass by the age of 70.

Research (1, 2, 3, 4) has shown that there is a selective loss of type 2 muscle fibres. The loss of type 1 fibres is much less pronounced.

Muscle action is initiated by nerve impulses between the brain and the muscle in question. The efficiency of the action is dependent on the quality of the connection between the brain and the muscle. Constant use of the muscle in a particular action increases the quality of the connection. Increases in the amount of work a muscle can perform is a function of muscle strength as well as the neuromuscular connection. Active muscle is therefore stronger and more efficient.

Muscle loss with age often contributes to significant loss of strength, several age related conditions and loss of independence. Muscle is intimately related to carbohydrate metabolism since carbohydrate is metabolised in the mitochondria of the muscles. In addition, anaerobic muscular activity selectively uses carbohydrates stored in the liver and muscles as a preferred energy source.

## Chapter 2

# Obesity, Diabetes and the Economy

Obesity is defined as an increased body weight caused by excessive accumulation of fat. The operative phrase in the definition is “*excessive accumulation of fat*”. Unfortunately the most popular method for determining obesity (the Body Mass Index or BMI) does not measure fat either directly or indirectly. The height/weight tables developed in the mid-1950’s have been largely abandoned and replaced by the BMI. The medical community is of the view that the BMI is a better indicator of health than is the height/weight tables. The BMI is calculated by dividing the weight of an individual in kilograms by the square of their height in metres. The BMI cannot determine body composition as two individuals with the same BMI can have significantly different levels of body-fat. Although many people with high BMI’s are obese several other people with high BMI’s are very lean (athletes, bodybuilders etc.). Determination of obesity should be based on body fat levels and not some roundabout method that does not hold true for everyone. Since the same two parameters in the height/weight tables (height and weight) are used in the BMI formula the difference between the height-weight tables and the BMI is numerical rather than substantive. The widespread use of the BMI is misleading as the following example will show. Consider two male individuals each weighing 165 lbs (74.8 kg) and 5 feet 8 inches (1.73 metres) tall. Let us assume that one has a lean body mass of 120 lbs and the other a LBM of 140 lbs. The BMI for both these individuals is the same (25). However, the body-fat percentage for the first individual is 27 while that for the second individual is 15. The BMI for the two individuals is in the healthy range. However, based on body-fat, the first individual is obese while the second individual falls within the healthy range. Use of the BMI is therefore misleading and should be discontinued in favour of actual body fat measurements or formulae for body fat determination using body measurements that give a more representative assessment. The use of one such formula is available on [www.scientificpsychic.com/fitness/diet.html](http://www.scientificpsychic.com/fitness/diet.html). This formula is one of the most representative of the web based formulas. The equations on which this

formula is based are given later in this text. Another web based method for determining body fat percentage may be found on [www.linear-software.com/online.html](http://www.linear-software.com/online.html).

It has long been known that there is a strong link between obesity and chronic disease. This is especially so with diabetes. Diabetes is a disease of carbohydrate metabolism in which there is insufficient insulin for adequate carbohydrate metabolism or where the insulin does not perform adequately. This condition is known as insulin resistance. Excess carbohydrate accumulates in the blood and eventually spills into the urine. The urine test is commonly used to diagnose diabetes. Diabetes is associated with several other chronic diseases (heart disease, hypertension) and is commonly the forerunner of these diseases. Insulin is produced by the pancreas (more specifically the beta cells). When production of insulin by the pancreas is very low or if the pancreas cannot produce any insulin Type 1 or insulin dependent diabetes develop. This usually occurs sometime during the teenage years and accounts for approximately 10 percent of all cases of diabetes. It requires regular injections of insulin. Type 2 or non-insulin dependent diabetes occurs when the body cannot effectively use the insulin produced. This is also known as adult onset diabetes and is as a result of insulin resistance. The vast majority of cases are of this type. It usually affects persons over forty years of age.

What is interesting among most populations is the fact that the age at which persons are developing Type 2 diabetes is constantly decreasing. In fact, this form of diabetes is beginning to manifest itself in pre-teens. The two main causes of type 2 diabetes are (1) increased body fat (obesity) and (2) lack of physical exercise. Lack of certain nutrients in the diet is also a contributing factor. These trace nutrients (chromium, selenium, zinc and some others) are important in carbohydrate metabolism. Obesity results in insulin insensitivity.

Carbohydrates are metabolised in the mitochondria of the muscles. Weak, inactive muscles are less efficient at metabolising carbohydrates.

Many of the nutrients required for proper insulin function are found in whole grains. During milling most of these nutrients are lost. Some nutrients are added back to refined wheat (enriched flour) but rarely are the trace minerals replaced. Alloxan is a by-product of the bleaching process of flour and has been found in products made with white flour. Alloxan is used to induce diabetes in otherwise healthy lab animals. It achieves this by destroying the beta cells of the pancreas. These beta cells are responsible for the production of insulin. White flour and products made from white flour may therefore be a contributing cause of diabetes. Aspartame (trade name "Nutrasweet"), an artificial sweetener found in diet drinks and other popular food items has been found to destroy mitochondrial cells in the muscles. Carbohydrates are metabolised in the mitochondria so a destruction of these cells can have a direct impact on the development of diabetes. Aspartame also causes several serious complications for diabetics and may precipitate Alzheimer's disease.

Type 2 diabetes can, to a large extent, be prevented by having lean, functional, active natural muscle fed by a diet that consists of a wide variety of natural foods and the elimination of refined carbohydrates and other processed foods, food additives and artificial sweeteners.

### **Diabetes and other Chronic Non-communicable Diseases**

Diabetes along with the other chronic diseases has a significant effect on the economies of most western countries. Over the past 50 years life expectancy has increased significantly. We are therefore finding that these diseases which, to some extent, are age related are also on the increase. Substantial portions of the health care costs of these countries go towards managing or treating these diseases. The annual cost of treating diabetes and other chronic diseases in the US is estimated to be in the region of US\$ 100 billion or US\$ 363 per capita per year. Even half of this sum would equate in Barbados to an overall sum of 98 million Barbados dollars annually.

The major chronic non-communicable diseases include diabetes, heart disease, senile dementia (Alzheimer's disease), cancer. Stroke is also included in the non-communicable diseases although it is not chronic. It however often has lasting debilitating effects on the individual.

At first glance it may seem as though these conditions are unrelated and are often treated as such. A close examination however reveals a common thread between them.

As people age they tend to become less active. This often results in the very visible signs of loss of muscle with age. Coupled with poor eating habits and ingestion of various food additives and other chemicals (including prescription and non-prescription drugs) have seen the significant increase in the incidences of these conditions. It is to be noted that the average lifespan has almost doubled since 1900. Loss of muscle is usually accompanied by an increase in body fat levels.

A condition variously known as Metabolic Syndrome, Metabolic Syndrome X or simply Syndrome X recognises these links and tries to give a face to the problem. This syndrome is said to be present if several of the conditions listed previously are present in an individual. The Medical community does not seem to fully understand the primary cause of these conditions or how to correct or prevent them. Although the link with metabolism has been deduced (as evidenced in the name), the exact nature of the problem is not fully understood. In the meantime there are ever increasing numbers of individuals suffering from these conditions. No one to date has looked at all the factors contributing to the group of conditions or even deduced the common thread that links them all.

Over time there is an observable decrease in the effectiveness of the metabolic process to the point where it no longer functions as it is supposed to. This process is gradual (chronic) and in the end stages can be considered a breakdown (collapse) of the metabolic process. The process can be tracked from its beginning stages by carrying out regular **oral glucose**

**tolerance tests** on the individual. The condition that gives rise to the group of chronic diseases is more accurately termed **CHRONIC METABOLIC COLLAPSE SYNDROME** and needs to be recognised as a disease in itself.

### **Chronic Metabolic Collapse Syndrome**

The onset of chronic metabolic collapse syndrome or CMCS is characterised by the following markers:

1. significantly reduced muscle mass and inactivity.
2. High body fat levels.
3. High abdominal fat.
4. Inefficient digestion characterised by a feeling of fullness long after the ingestion of meals.

If any or all of these conditions are present it would be wise to carry out an oral glucose tolerance test to determine the efficiency of the digestion process (glucose metabolism). This test can determine whether or not you are on the road to CMCS. CMCS is the umbrella condition that leads to all of the chronic diseases. As such testing for this condition and implementing corrective measures is the best way to prevent the rapid rise in these chronic conditions which threaten to derail the economies of many countries.

Since muscle mass is such an important determinant in whether or not an individual develops a chronic disease it is necessary to know what levels of muscle mass and body fat levels are required for good health. Body fat can be measured in several ways. The accuracy varies between these various measures. One simple method (for those with internet access) is contained in a website previously highlighted in this document. It is based on an equation developed by Hodgson and Beckett at the Naval Health Research Center in the USA in 1984. The formulae for men and women are reproduced below. It has been found to have good correlation with the gold standard of body-fat measurement, hydrostatic weighing. Muscle mass is inferred from lean body mass (LBM) which is the body's total weight less the fat weight. Since bones,

internal organs, fluids etc. are relatively constant any change in lean body mass represents a change in muscle mass.

The formula for men is:

$$\%Fat=495/(1.0324-0.19077(\log(\text{waist-neck}))+0.15456(\log(\text{height}))) - 450$$

The formula for women is:

$$\%Fat=495/(1.29579-0.35004(\log(\text{waist+hip-neck}))+0.22100(\log(\text{height}))) - 450$$

- Height - measured without shoes.
- Weight - taken in the morning without clothes after going to the bathroom and before eating or drinking anything.
- Waist (Men) - measure horizontally, at the level of the navel (Women) - measure horizontally, at the level of minimal abdominal width.
- Neck - measure below the larynx with the tape sloping slightly downward to the front.
- Hips (Women only) - Largest horizontal circumference around the hips.

All measurements are in centimetres with an accuracy of + or – 0.5 cm.

Minimum lean body mass (LBM) figures have been determined for both sexes and are presented in the table following.

<b>Minimum lean Body Mass Levels</b>		
	<b><u>Females</u></b>	<b><u>Males</u></b>
<u>Height</u>	<u>LBM (lbs)</u>	<u>LBM (lbs)</u>
4'-10"	75.0	81.5
4'-11"	77.0	84.0
5'-0"	79.5	86.0
5'-1"	82.5	90.0
5'-2"	85.0	92.5
5'-3"	88.0	96.0
5'-4"	90.5	98.5
5'-5"	93.5	102.0
5'-6"	96.5	105.5
5'-7"	99.0	108.0
5'-8"	102.0	111.5
5'-9"	105.5	115.0
5'-10"	108.5	118.0
5'-11"	111.5	121.5
6'-0"	114.5	125.0
6'-1"	118.5	128.5
6'-2"	121.0	132.0
6'-3"	125.0	136.0
6'-4"	128.0	139.5

These figures represent the minimum level for LBM for an individual if health (and by extension) independence is not to be compromised. Acceptable levels of lean body mass may vary from 110 – 125 percent of minimum for women and 115 – 135 percent of minimum for men.

Ranges of percentage body fat levels for the various states for both men and women are given in the following table.

**Body fat levels for Men and Women**

<b><u>State</u></b>	<b><u>Women</u></b>	<b><u>Men</u></b>
Normal	14 – 24	6 - 17
Over-fat	25 - 31	18 – 25
Obese	32+	26+

Too little muscle compromises the body's ability to effectively metabolise the food eaten while too much body-fat can increase insulin resistance requiring the pancreas to produce excess insulin. This can, and often does, lead to overstress of the pancreas. Both conditions are highly undesirable as will be shown in the following sections.

**Intervention Methods**

The loss of muscle (specifically Type 2 muscle) is the single most important contributing factor to CMCS. This results in less metabolic capability and gives rise to an increase in body fat. This body fat increase lowers the body's sensitivity to insulin and therefore more insulin is required to do the same job. It in turn puts an ever increasing burden on the pancreas. Maintenance of type 2 muscle can only be achieved through frequent anaerobic activity. Resistance exercise is the only way currently known for maintaining type 2 muscle. It is therefore absolutely necessary that individuals engage in resistance exercise if health is to be maintained as the individual ages. Unfortunately, this is not the type of exercise frequently recommended by

doctors. They almost always recommend aerobic exercise with walking being the exercise of choice for older adults. Walking is the exercise form least likely to sustain adequate type 2 muscle. Functional exercise as described subsequently is the best way to maintain (or increase) active type 2 muscle.

More muscle equals more mitochondria.

More active muscle equals more efficient mitochondria.

More lean, active muscle equals more insulin sensitive, efficient muscle that is able to effectively metabolise carbohydrate and prevent the onset of *Chronic Metabolic Collapse Syndrome*.

Ingestion of the correct types of foods ensures that the body is not burdened by non-essential substances that do not contribute to health. In addition, intake of additives and other harmful chemicals are to be avoided. These can and often do disrupt natural processes in the body. Several important natural food components are removed in processing. Chief among these are fibre and trace minerals such as chromium, zinc and magnesium. As a guide food should be eaten in a state as un-fooled around with as possible.

Diabetes (type 2) is the most widespread and debilitating of all the end symptoms of CMCS. Currently the medical community is of the view that diabetes is incurable. This shows a total lack of understanding of the condition especially the factors from which it results. Increases in Type 2 (fast twitch) muscle fibres and muscle-neural connections and reduction in body fat can be easily achieved by a structured functional resistance exercise programme performed on a regular (minimum 3 times per week) basis. All the other factors (diet, increased physical activity, elimination of food additives and other harmful chemicals) can be easily modified. Elimination of CMCS will automatically cure diabetes.

The significant loss of muscle (sarcopenia) and consequent gain in body-fat (obesity) are two of the most dramatic visible signs of aging. A recent study (9) by researchers at Buck Institute for Age Research, Novato, California, McMaster University, Department of Pediatrics and Medicine, Hamilton, Canada and Centre for Genetics, Children's Hospital Oakland Research

Institute, Oakland, California has shown that resistance exercise over a six month period can reverse the aging process at the cellular and genetic levels in the mitochondria of the muscles. “Following exercise training the transcriptional signature of aging was markedly reversed back to that of younger levels for most genes that were affected by both age and exercise”.

## Chapter 3

# Functional Exercise for Health and Fitness

Function is defined as “the action for which a person or thing is particularly fitted or employed, purpose”. Functional fitness is therefore fitness with or towards a purpose. General functional fitness allows a person to perform daily physical activities effectively without undue strain on the body. In addition, sports or activity specific functional fitness is fitness geared towards a specific sport or activity.

Fitness can be measured within the framework of a set of parameters known as **Bio-motor Abilities**. Bio-motor literally means life movement. The bio-motor abilities are those requirements necessary to function effectively in everyday (life) physical activities. These bio-motor abilities are (1) strength, (2) power, (3) endurance, (4) flexibility, (5) balance, (6) coordination, (7) speed, (8) agility.

Functional fitness is achieved by engaging in properly developed and executed exercise programmes. Bio-motor testing is used to (a) assess the level of fitness of an individual and (b) develop exercise programmes to improve fitness generally or for a specific activity or sport. The first six abilities are required for general fitness while the last two tend to be more sports specific.

There are several exercise programmes available that target one or more of the bio-motor activities. The quality (and hence worth) of a specific exercise programme depends on its ability to target several of the bio-motor abilities at once. An exercise system that addresses three or more is considered of high value (bio-motor rich) while one that targets a single ability is of less worth. Some programmes and the bio-motor abilities they address are as follows:

- Weightlifting – strength, power
- Aerobic exercise (walking, running, cycling etc.) – endurance
- Yoga – flexibility, balance, coordination

Circuit resistance training – strength, power, endurance and balance and coordination with the correct mix of exercises.

This list shows that circuit resistance training and yoga are high value exercise programmes. Furthermore, these activities are complementary. A programme that alternates these activities would therefore be complete for general fitness.

Of the eight bio-motor abilities some are more dominant in respect of general fitness. They may be ranked in order of importance (dominance) as follows: strength and balance, flexibility and endurance, coordination and power and speed and agility. Alternating circuit resistance exercise with yoga would appear to be an optimal exercise routine.

### *Designing the Functional Resistance Training Programme*

Functional exercise develops a body capable of doing real-life activities in real life positions. The key to functional exercise is integration, i.e. training the various muscle groups to work together.

Functional exercise programmes must take into account how the muscles of the body function. In any physical activity the muscles of the midsection or core are activated first, followed by those of the torso and then the limbs. Power is transferred from the ground or other fixed point of leverage through the core up and down the body. Without a strong core, arms and legs cannot exert significant force. The muscles should therefore be trained in the sequence of core first followed by torso and then limbs. Exercises chosen should be compound exercises wherever possible. Isolation exercises common in bodybuilding type workouts do not contribute significantly to functional fitness. Free weight exercises rather than weight machines challenge the primary as well as the stabiliser muscles and are therefore better for overall fitness. Exercise programmes should be fast paced (with little rest between exercises) in order to have an aerobic effect.

Experience tends to indicate that less than 30 minutes a day of exercise is inadequate to sustain an acceptable level of fitness while more than 90

minutes would appear to be excessive. A total of between 3 and 10 hours a week of exercise is therefore indicated. This equates to between 1.8 and six percent of total time.

**Functional exercise** is the term most used to describe the form of exercise that seeks to enhance the bio-motor abilities. Probably, a more descriptive and accurate term would be **Bio-motor training**.

### Equipment for Functional Training

For most of his development man has been a physically active species. Life was characterised by hunting (and fishing), avoiding predators, climbing and other very demanding activities. There certainly was no formal or ritualised form of exercise, daily activities provided all the needed exercise. As a result our muscles have evolved to work best with those movements used in our daily active lives.

Our ancestors did not have any type of equipment dedicated to exercise, all equipment made (such as spears and bows and arrows) were used strictly for survival (acquiring food and defence against predators). Rudimentary exercise equipment started appearing on the scene just over 2000 years ago with the Greeks and Romans and sophisticated exercise machines are a very recent phenomenon. Exercise equipment has therefore only been around for a miniscule part of human evolution.

Exercise equipment which allows man to perform movements that most closely resemble those movements that have evolved over time is best suited to developing overall fitness.

### Recommended Equipment

The following is a list of simple, inexpensive equipment that can provide an excellent chance of attaining a high level of functional fitness with effective

use. It is to be noted that the most important factor in order to achieve the level of fitness desired is knowledge. All the equipment in the world is useless unless one possesses a proper knowledge of exercise science and what constitutes fitness.

*Dumbbells:* Dumbbells have been around almost as long as people have been doing separate physical activity as exercise. Dumbbells are usually in pairs and have the following advantages as relates to resistance activity.

- They provide resistance over a wide range.
- Dumbbells can be held in one or both hands and can provide resistance uni-laterally, bi-laterally or alternating.
- The hands can be pronated, supinated or rotated.
- Dumbbells can be used in any conceivable plane and are therefore adaptable to almost any exercise requiring resistance.

For the most effective resistance exercise programme a number of pairs of dumbbells are required to provide various levels of resistance. This can be achieved by having separate dumbbells of varying weights or one pair of adjustable dumbbells. Recently several innovative designs for adjustable dumbbells have come on the market. These allow quick weight changes that allow exercises to be performed with minimum time between exercises. Among the leading designs are *PowerBlock* and *Bowflex Select-tech*.

*Stability Ball:* Also known as Swiss ball, exercise ball, fitness ball or balance ball. This ball provides an unstable platform and therefore challenges balance in many exercises. It can also be used to perform lying and seated exercises as well as exercises that require back or stomach support. Stability balls are chosen based on the height of the individual and should always be slow-

deflate (or anti-burst). This ensures that the individual will not be injured if the ball is punctured during use.

*Yoga Sticky Mat:* These mats come in various thicknesses from 2 – 8mm and offer cushioning for the body (hands, feet, back etc.) when doing exercises on the floor.

Other low cost exercise equipment that can enhance the quality of a workout include rubber exercise cables (especially good for travelling), medicine balls push-up and pull-up bars, abdominal slings and kettle bells. These pieces are not essential but can provide added variety and when used correctly add to the level of performance for several bio-motor abilities. The equipment listed takes up very little space and can therefore be stored and used in relatively small spaces.

#### *Some Tips for Effective Functional Exercise (Bio-Motor Training).*

All abilities are important. However, as we age, strength and balance tend to assume the greatest importance. Strength can be very important in maintaining independence while balance is critical to prevent falls that can result in hard to heal fractures.

Whenever possible exercises should be done standing rather than seated or lying. Exercises that engage several muscle groups are better than those that target single muscles. Exercises such as squats, chin-ups, push-ups and dead-lifts engage several muscle groups. The best exercises also target as many of the bio-motor abilities as possible, i.e. these exercises are “bio-motor rich”. Some traditional strength training exercises can be modified to increase their bio-motor richness. As examples, the dumbbell press can be done by standing with one foot ahead of the other and lifting the dumbbells alternately. This will increase the balance and coordination components of the exercise.

Over time as an individual gets stronger it is necessary to increase the resistance used in the various exercises. This constant increase in resistance

as strength increases is commonly referred to as progressive resistance and the overall exercise system is known as “*progressive resistance exercise*”. Balance and coordination may also be improved by increasing the difficulty of some exercises by performing them on unstable surfaces (such as balance boards) or by varying the range of the exercise. It is essential that the individual continues to experiment with the various exercises to try to improve the level of proficiency of each bio-motor ability.

## Chapter 4

# Eating for Total Health

Calories in food are derived from the protein, fat and carbohydrates known as the macro-nutrients in the food.

### Protein

Proteins are fundamental components of all living cells and supply the amino acids necessary for repair and growth and also form part of enzymes, hormones and antibodies. Proteins are made up of individual constituents known as amino acids. There are 22 amino acids that play a part in human nutrition. Of these 8 (isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine) cannot be synthesised in the body and must therefore be supplied in the diet. These are known as essential amino acids (EAAs). The others can be made from the essential amino acids. A protein is considered complete if it supplies all 8 essential amino acids in a ratio that the body can use effectively. Some sources of complete protein include meat and poultry, milk, eggs and fish and other seafoods. Plant sources do not as a rule contain complete protein although soy protein contain all the EAAs. The quality of this protein is not as good as protein from animal sources although intense marketing has made it a protein of choice for a large number of people. Two or more incomplete protein sources may be combined to give a protein with the full complement of essential amino acids. The closer the profile of amino acids in a protein and the digestibility of the protein source meet the requirements for human nutrition the greater the quality of the protein source. This is measured in terms of *biological value* (**BV**). The amount of protein required by an individual depends on a number of factors. These include (a) the BV of the protein sources, (b) the lean body mass of the individual and (c) the type and level of activity engaged in by the individual. Protein contributes approximately 4 calories per gram in the diet.

### Fat

Fat is the densest of the macro-nutrients contributing 9 calories per gram. Fats can be saturated (usually solid at room temperature) or unsaturated

(liquid at room temperature). Unsaturated fats can further be divided into mono-unsaturated fats or poly-unsaturated fats. Saturated fats are mainly of animal origin although palm and coconut oils are also high in saturated fats. Most vegetable fats are high in unsaturated fat. Fat performs several functions in the body. Fat is necessary for the transportation and absorption of fat-soluble vitamins. These vitamins are [A](#), [D](#), [E](#), and [K](#). Fat also helps to cushion the body's organs and to maintain the body's temperature. In addition, fat provides a feeling of satiety and improves the texture and feel of a meal.

Essential Fatty Acids (EFAs) are necessary fats that humans cannot synthesize, and must be obtained through diet. EFAs are long-chain polyunsaturated fatty acids derived from linolenic, linoleic, and oleic acids. There are two families of EFAs: Omega-3 and Omega-6. Omega-9 is necessary yet "non-essential" because the body can manufacture a modest amount on its own, provided essential EFAs are present. The number following "Omega-" represents the position of the first double bond, counting from the terminal methyl group on the molecule. Omega-3 fatty acids are derived from Linolenic Acid, Omega-6 from Linoleic Acid, and Omega-9 from Oleic Acid. Omega-3 fatty acids are obtainable from fish oils and from certain vegetable oils notably flaxseed oil. Omega-6 fatty acids are found in many polyunsaturated vegetable oils such as safflower, corn and soybean oils. Omega-9 fatty acids are found in oils such as olive and avocado. Humans are more likely to be deficient in omega-3 fats than any of the others. There is therefore a strong argument for the inclusion of oily fish in the diet or in some level of supplementation.

EFAs support the cardiovascular, reproductive, immune, and nervous systems. The human body needs EFAs to manufacture and repair cell membranes, enabling the cells to obtain optimum nutrition and expel harmful waste products. *A primary function of EFAs is the production of prostaglandins, which regulate body functions such as heart rate, blood pressure, blood clotting, fertility, conception, and play a role in immune function by regulating inflammation and encouraging the body to fight*

*infection.* Essential Fatty Acids are also needed for proper growth in children, particularly for neural development and maturation of sensory systems, with male children having higher needs than females. Fetuses and breast-fed infants also require an adequate supply of EFAs through the mother's dietary intake.

Trans fatty acids, also known as trans fat, are fats that, when ingested, leads to clogging of the arterial wall, a condition known as arteriosclerosis. Trans fats are formed when vegetable oils are hardened into margarine or shortening. It is found in many other foods besides margarine and shortening, however, including fried foods like french fries and fried chicken, doughnuts, cookies, pastries and crackers. In the United States, typical french fries have about 40 percent trans fatty acids and many popular cookies and crackers range from 30 percent to 50 percent trans fatty acids. Doughnuts have about 35 percent to 40 percent trans fatty acids.

Trans fat is known to increase blood levels of low density lipoprotein (LDL), or "bad" cholesterol, while lowering levels of high density lipoprotein (HDL), known as "good" cholesterol. It is also a contributory cause of type 2 diabetes and other serious health problems, and was found to increase the risk of heart disease. Many food companies use trans fat instead of oil because it reduces cost, extends storage life of products and can improve flavor and texture. Foods containing trans fats are to be avoided as much as possible.

### Carbohydrates

Carbohydrates are made up of carbon, hydrogen and oxygen and have the chemical formula  $CH_2O$ . Carbohydrates occur in three general forms. These are mono-saccharides

Glucose

fructose

and galactose

di-saccharides

sucrose (glucose + fructose) – table sugar

lactose (glucose + galactose) – major sugar in milk

maltose (glucose + glucose)

poly-saccharides

starches – found in grains, root crops, vegetables etc.

glycogen – blood sugar

cellulose - fibre

Most dietary carbohydrates are derived from plant sources. One notable exception is milk sugar (lactose).

Although carbohydrates make up the bulk of calories in many diets the human body does not have an absolute requirement for carbohydrates. Even though the brain can use only carbohydrate as an energy source this can be manufactured in the liver from amino acids (from protein) and glycerol (from fat) through a process known as gluconeogenesis. The amount of carbohydrate required by the brain is approximately 130 grams per day. This amounts to only 26 percent of total calories in a 2000 calorie per day diet.

### **The Search for the Perfect Diet**

With all the various diets currently in vogue it is no wonder that people are unsure of how to eat. These diets range from the low fat, high carbohydrate diets (Dr. Dean Ornish) to high protein, high fat, low carbohydrate (Dr. Robert Atkins). Dr. Dean Ornish advocates a diet with the ratio of protein: carbohydrate: fat as 10:80:10. Dr. Atkins on the other hand advocates a diet that is less than 20 percent carbohydrate with the other 80 percent made up (approximately) of equal portions of protein and fat. While these diets present the two extremes there are many that fall in between. In addition, there are diets that focus on the use of certain food groups and the exclusion of others. Several diets that were popular at one time or another have been discredited as being harmful to humans. With all the diets around it is no wonder people are confused. Add to this the various fares put out by many of the popular establishments and we can see that there is a significant problem.

So how are we to determine how we should eat for good health? The primary purpose (some may say the only purpose) of food is to provide adequate

nutritional support for the body's various systems. This should therefore form the basis for the development of any diet plan. In determining an appropriate diet you must first recognise that you are a unique individual and while there may be significant similarities between you and others there are also significant differences. Every diet should therefore be developed individually.

### Calories

The number of calories a person ingests every day depends on such factors as lean body mass, activity level, sex and age. It is also dependent on whether the person is trying to lose weight, gain weight or maintain a constant body weight. There are several web based programmes for calculating daily calorie requirements. These programmes require age, sex, weight (or lean body mass), height and activity level (descriptive).

### Recommended Dietary Allowances

Since its introduction in 1943 **Recommended Dietary Allowances** has become the accepted source of nutrient allowances for healthy people. These Recommended Dietary Allowances (RDAs) are used throughout the food and health fields. Additionally, RDAs serve as the basis for the U.S. Recommended Daily Allowances, the Food and Drug Administration's standards for nutrition labelling of foods.

The RDAs were developed mainly from the standpoint of disease prevention. As a result the levels recommended may not be adequate for optimum nutrition. In addition, when the RDAs were developed, the lifestyle of most people was significantly different to what it is today. One of the major changes is in the area of physical activity. The optimum intake level for a particular nutrient should be the level above which there is no significant additional health benefit. Since each individual is different in terms of age, gender, ethnicity, activity level and physical characteristics (lean body mass, body fat, height, weight etc.) everyone will have different nutritional requirements. In recent times the RDA has been largely replaced by the

***Food Pyramid.*** The original pyramid is made up of five food groups in four layers or tiers. These are located from the top of the pyramid to the bottom as follows (each number forms a separate layer): (1) other, (2) milk and meat, (3) vegetables and fruits and (4) grain. A later version has attempted to refine the pyramid and has six layers as follows from top to bottom: (1) red meat, white rice, white bread potatoes pasta and sweets, (2) alcohol and dairy, (3) fish, poultry, eggs, (4) nuts and legumes, (5) vegetables and fruits and (6) whole grain foods and plant oils. As you go lower down the pyramid the quantity of the food in the diet increases, i.e. the foods at the base of the pyramid should make up a larger percentage of the overall food intake. There are several significant flaws in the Food Pyramid. Several groups of foods are included that play no beneficial role in human nutrition. These include (a) white rice, white flour and bread and sweets and (b) alcohol. In addition, not all plant oils are beneficial and some commonly used ones may even be harmful. The ratio of intake of various oils is also crucial to good health.

### ***Vitamins and Minerals***

There have been several studies indicating that the RDAs for several vitamins and minerals may be inadequate. In his book “Your Personal Vitamin Profile”, Michael Colgan, Ph.D, professor of nutrition has developed a method for determining an individual’s unique vitamin and mineral needs.

### ***Protein, Fat and Carbohydrates***

The RDA for protein is 0.8 g/kg of body weight. For an average 70 kg (154 lb) male this amounts to 56 g protein per day. Several studies have shown that this amount is inadequate to maintain positive nitrogen balance. Positive nitrogen balance is important to maintain muscle mass. Negative nitrogen balance results in progressive muscle loss as the body takes amino acids from the muscles in order to function normally. 56 grams protein per day for a normal male consuming 2000 calories represents just over 11 percent of total calories. Figures of 20-35 percent have been shown to be more feasible.

There is no RDA for fat although it is recommended that intake be restricted to less than 30 percent. If fat sources are chosen carefully the nutritional requirements (for EFAs) can be satisfied with fat representing as little as 10 percent of total calories. The percentage of fat in the diet is therefore satisfied by between 10 and 30 percent of total calories.

The remainder, between 35 and 70 percent of total calories, would therefore be obtained from carbohydrates. The relative amounts for each macronutrient is as follows:

Protein	20-35 percent
Fat	10-30 percent
Carbohydrates	35-70 percent

It is clear that two of the diets mentioned earlier, i.e. Atkins with greater than 30 percent of calories from fat and Ornish with approximately 80 percent of calories from carbohydrates do not satisfy nutritional requirements for macronutrients.

Each individual is different and requires a different mix of the three macronutrients. There have been various methods suggested for determining the exact mix. One such method that has some credibility is ***Metabolic Typing***. In this method each individual is classified as either *Protein Type*, *Carbohydrate Type* or *Mixed Type*. The typing is determined by first filling out a comprehensive *Metabolic Typing Questionnaire*. There is then a suggested diet that meets the criteria set for the particular type. Although this method goes some way towards a solution it is still too general. Determination of the exact diet for an individual requires experimentation with various foods and macronutrient mixes and adjusting until an ideal situation is reached. This could prove to be somewhat difficult and may need expert supervision initially.

## Dietary Fibre

Dietary fibre is a complex mixture of plant materials that are resistant to breakdown (digestion) by the human digestive system. There are two major kinds of dietary fibre, insoluble (cellulose, hemicellulose, lignin) and soluble (gums, mucilages, pectins). Insoluble fibre is most frequently found in whole-grain products. Foods containing soluble fibres are fruits, vegetables, dry beans and peas, and some cereal grains such as oats.

Insoluble fibre promotes normal elimination by providing bulk for stool formation and thus hastening the passage of the stool through the colon. Insoluble fibre also helps to satisfy appetite by creating a feeling of fullness. Some studies indicate that soluble fibres may play a role in reducing the level of cholesterol in the blood. In addition, fibre slows the release of blood sugar into the blood stream and is a good fat loss aid.

The American National Cancer Institute has recommended a daily intake of 20 to 30 grams of fibre with an upper limit of 35 grams. A figure closer to 30 grams appears to give optimum results.

Diets high in refined carbohydrates and low in whole grains, fruits and vegetables also tend to be low in fibre.

## Water

The intake of adequate amounts of water is essential for good health since water plays a pivotal role in

- Regulating body temperature
- Lubricating the joints
- Nutrient transportation
- Removal of various waste materials from the body
- Ensuring proper digestion
- Maintaining healthy skin tone

Water also plays a significant role in promoting fat loss by

- Maintaining and encouraging proper kidney function thus increasing the efficiency of the liver's fat burning ability.
- Acting as an appetite suppressant; drinking plenty of water leads to a feeling of fullness. In fact, F. Batmanghelidj, M.D. in his book "Your Body's Many Cries for Water" states that thirst is often mistaken for hunger. Drinking plenty of water eliminates some of these feelings of hunger. An adequate supply of water is in the region of 1 fl. oz. per kg. of bodyweight.
- Water intake reduces water retention. When the body is deprived of water it is more likely to hold on to what little it has.
- It helps the body function at its optimal level, thus increasing its fat burning ability.

### **Meal Frequency**

There is little consensus on how frequently (or how many meals per day) an individual should have. There is wide variation from those that recommend 5-6 small meals a day to the traditional 3 meals per day to those that require 1 large meal and several small snacks. None of these have been shown to be superior across the board. In fact, there is a school of thought that says that the best frequency is one that you are most comfortable with and that you thrive on best. This is the path I'm personally inclined to take.

### **Some Final Words on Eating Right for Optimum Health**

With all the readily available packaged foods, fast food outlets and intense advertising of food products coupled with the lack of adequate policing by state regulatory agencies, it is no wonder that many have difficulty in determining how and what they should eat in order to have a balanced diet. First there are several factors that one needs to bear in mind. These include

- Avoid refined carbohydrates (white flour and other grains and sugar) as these tend to be devoid of dietary fibre and the most nutritious parts of the original crop and may also contain harmful chemical food additives.

- Avoid artificial sweeteners and other chemical additives (food dyes etc.) These substances do not occur in nature. As a result the body is unaccustomed to dealing with them. There are very likely to cause harmful side effects, unnatural reactions, allergies and more insidious problems that could have severe health consequences.
- Avoid processed meats that are high in fat and may contain harmful chemicals.
- Avoid commercial mayonnaise, salad dressings and other food condiments as these supply little nutrition and are often high in fats and empty calories.
- Avoid excessive alcohol, commercial soft drinks (especially diet soft drinks), sweets and other so called treats.
- Avoid fast foods and other foods high in added fat, salt and sugar.
- Avoid margarines (these are likely to be high in trans-fats) and butter and oils derived from animal sources.
- Eat a diet that is rich in vegetables (especially green and leafy vegetables), legumes, fruits, nuts and seeds.
- Ensure that all other carbohydrates are from natural un-tampered with sources such as whole grains and tubers.
- Get adequate amounts of protein from high quality sources such as fish and other sea-foods, eggs and poultry, lean red meats and non-fat dairy products.
- Get adequate amounts of essential fatty acids from oily fish and fish oils, flaxseed, olive oil and other unprocessed vegetable oils.
- Get adequate amounts of all the other essential nutrients.
- Ensure that your water intake is adequate.
- Develop a sensible meal plan that meets your needs and schedule ensuring that the first meal of the day is a breakfast that is high in fibre, protein, vitamins and minerals. Note that this is the first meal after a long night's fast and needs to supply high quality nutrition. As has been said repeatedly, breakfast is the most important meal of the day. You skip it at your own peril.

Eating healthy should not be as difficult as it is today. However, the food industry, lobbyists, the medical community and other special interest groups have transformed what was once a simple and instinctive activity into one that requires advanced training in such fields as nutrition and pharmacology.

However, if the advice given in the preceding pages is followed it should be relatively easy to obtain all of the nutrients required to support optimum health and physical performance.

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