Long term weight loss - science or guesswork ?

Why the scales are selling you short

"The most serious epidemic ever is insidiously engulfing the world"
Walter Willett, chair, Department of Nutrition, Harvard University

Losing weight is easy right!

Eat Less - Move More, Simple!

So why do we get it wrong so often? Hopefully this ebook may shed some light on the darkness.

We hope you find it interesting and informative and we welcome all feedback.

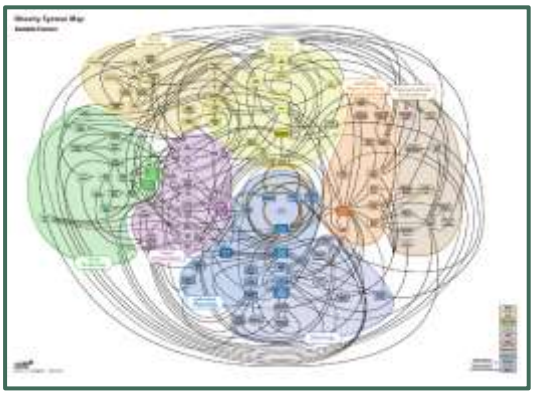
METS Team 2016

Contents

Section One - Living in a fat world

The next time you visit your local shopping centre or the town mall, sit down and observe for five minutes the people wandering past. While watching your fellow shoppers, consider the latest health statistics that report more than 60 per cent of all adults in most developed countries are overweight or obese. You may also notice many of the children you see are also overweight. From your observations, you may conclude that these statistics are an accurate, yet sad reflection of our current population.

If you were sitting in the same position at the same shopping centre thirty of forty years previously, your observations would be vastly different. There would have been significantly less overweight adults and the sight of an obese child would have been a rare, rather than a regular sight. Why has there been such a rapid change in our size in this time? You could choose a shopping centre in virtually any city in the world and find the same thing. Obesity is truly a global problem and current statistics suggest it is only getting worse.



The reasons for this international fat epidemic are many, with no one factor solely responsible. Governments, researchers, and health practitioners around the world are feverishly working to be the first to discover a common cause to this world-wide problem. Geneticists are searching for the magic gene, pharmaceutical companies are spending hundreds of millions to perfect a weight loss pill and nutritional companies are promoting a never-ending supply of weight loss superfoods foods and supplements.

The simple answer to our obesity epidemic however, lies in identifying all of the key pieces to this puzzle and how these pieces interact. Just like the jig saw, you cannot look at a single piece in isolation because it is often the way all the pieces fit together that provides the completed picture.

Whilst many factors have been identified that may cause weight gain including;

1. Eating too much particularly fats and sugar
2. Liquid calories from soft drinks and alcohol
3. Not performing enough exercise
4. Certain hormone problems, e.g. abnormal thyroid function

There are several factors that are often ignored when addressing our weighty problems.

Before identifying some of the missing puzzle pieces however, it is worthwhile examining some of the common theories and explanations for weight gain leading to obesity. While these theories are generally accepted by the wider community, they are based on certain assumptions that may not be very accurate today.

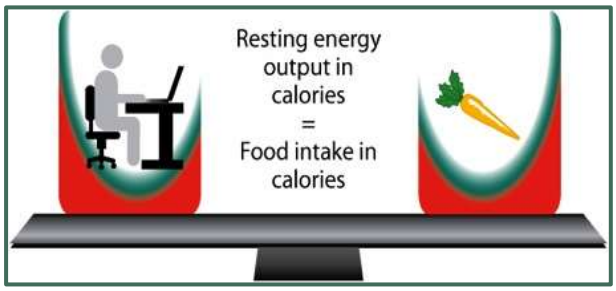
Why do we Have an Obesity Problem?

The problem of obesity is not new to humans. Looking through history, there are many examples of different cultures and populations literally eating themselves to death. That is, over-eating leads to obesity resulting in higher mortality rates.
Archaeological studies of excavated Egyptian tombs have shown the cause of death in many instances was advanced stages of coronary heart disease due to the over-consumption of food and alcohol.
While researchers have always been very good at documenting and alerting us to any increase in population obesity rates, very few scientific, objective explanations have been proposed to explain why the increase occurred in the first place. Currently, there are a number of standard explanations used to explain our weighty problems.

Popular Explanations for our Obesity Crisis

Explanation One: Poor Energy Balance

The most popular explanation proposed for any weight management problem is given as poor energy balance. That is, it is assumed that people whom are overweight are simply eating too many calories compared to the number of calories expended per day. This is also known by the acronym CICO, or calories in – calories out.



The term "poor" or "negative energy balance" is derived from the ***Energy Balance Equation*** that states; "Weight control is achieved by ensuring that the amount of food (energy) eaten is equal to the amount of energy used".

Assuming this equation is correct, there are three possible scenarios that may occur;

Stable Weight	Energy In = Energy Out
Weight Gain	Energy In > Energy Out
Weight Loss	Energy In < Energy Out

Health professionals and fitness experts prescribing weight loss programs have used, and continue to use, these three equations to provide people with weight loss advice.

How many times have you heard or read statements such as;

"Losing weight is as easy as eating less and exercising more"

"Eating less calories will guarantee weight loss"

"You can eat whatever you like if you exercise regularly"

It all sounds very easy doesn't it. However, as anybody who has actually tried to lose weight, you will know it is anything but easy. So, what is going on, why are these statements seemingly sensible but completely meaningless?

Assuming weight loss will occur when "you eat less than what you burn" there are three major problems that present when trying to practically use this equation.

Problem One – How much are you eating?
You need an accurate measure of the amount of food eaten (in calories or kilo joules). Let's consider this in the context of a typical Low Fat daily food plan.

Items	**Calories**
Breakfast	
100g of Kellogs Just Right Cereal	371
50ml of normal fat milk	18
2 x slices of wholemeal bread	138
200ml of orange juice	90
Snack	
1 x large banana	121
Lunch	
4 x slices of wholemeal bread	275
1 can of tuna (100g)	200
2 x tomatoes	20
1 x 100g of fruit low fat yoghurt	95
Snack	
Apple	52
Dinner	
100g of skinless chicken	290
50g of steamed white rice	65
50g of broccoli	20
50g of cauliflower	20
50g of carrot	20
300ml of red wine	215
3x 350ml coffee (Flat White)	672
Total:	**2682 calories**

Imagine this is what you ate yesterday. To correctly use the energy balance equation, you must accurately calculate the number of calories associated with each and every item of food or drink consumed. The food or energy intake (calories consumed throughout a day) can only be measured by counting calories. This generally means weighing every gram of food and millilitre of fluid consumed to provide a good estimate of calorie intake per day. This process is very time consuming and a person needs to be highly motivated to perform this calorie counting process after every meal.

Problem Two - Can you trust the calories you are counting?
It has been shown the accuracy of calorie counting varies considerably, unfortunately the calorie values you see on packaging are often not accurate, moreover when the food is eaten, varying amounts (depending on which nutrients) are absorbed and used for energy.

Then we have the question as to what happens to these calories when the food is cooked, for instance oven baking a potato can increase the available energy by more than 80%, and even the humble egg will increase the energy availability by 30% when boiled.

Next we have the human problem, firstly most of us are not very good at accurately measuring food load and therefore tend to guesstimate the calorie load.

Finally, we are all unique and, especially so are our gut bacteria. Some people can absorb up to 150 calories more just based on a particular gut bacterium.

Problem Three – How can you determine how many calories you expend in a day?
This aspect of this equation, measuring the number of calories expended each day is more difficult for the general population to assess.

There are many different factors that affect daily calorie output and the only accurate method of measuring calorie expenditure is through a scientific process called calorimetry. This process involves connecting the subject to a series of analysers that can measure the breathing gases at rest. Typically, this technology is complex and expensive and is usually limited to research or intensive care applications.

Very few people undertake this calorimetry testing procedure to accurately measure their individual fuel output. Instead, various mathematical formulas have been developed from population studies to estimate a person's daily energy requirement. These equations typically use combinations of Age, Sex, Height and Weight to create their estimations and they can vary in accuracy by as much as 60% from measured results. The earliest of these equations is called Harris Benedict and although it was developed in 1919 it is still the most widely used today. This outdated formula, not surprisingly, provides a very inaccurate "guesstimate" of the energy expended each day.

This chart gives an estimate of calorie needs for specific age and gender groups. Calorie ranges are based on age and physical activity level.

CALORIES			
Activity Level:	Sedentary	Moderate	Active
FEMALES			
19-30 years	1,800-2000	2,000-2,200	2,400
31-50 years	1,800	2,000	2,200
51-60 years	1,600	1,800	2,200
61+ years	1,600	1,800	2,000
MALES			
19-30 years	2,400-2,600	2,600-2,800	3,000
31-50 years	2,200-2,400	2,400-2,600	2,800-3,000
51-60 years	2,200	2,400	2,600-2,800
61-65 years	2,000	2,400	2,600

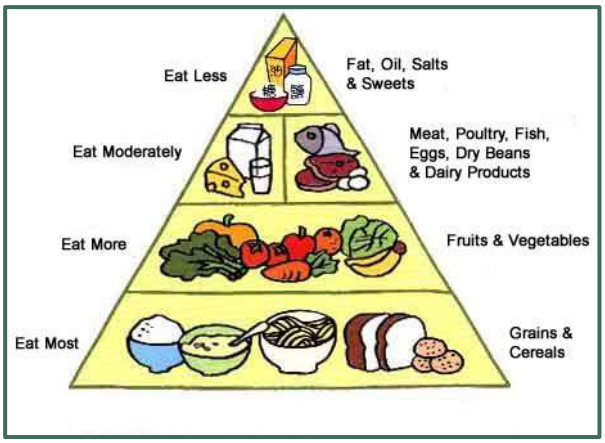
Therefore, using the Energy Balance Equation to lose weight relies on individuals accurately calorie counting each day (problematic at best) and on a "guesstimate" of their energy expended using a very outdated American formula.

Perhaps, this provides the first clue as to our current lack of success in managing weight. However, if losing weight was as easy as following the Energy Balance Equation, why are there so many overweight people in the world that exercise regularly and eat very little? These people certainly appear to be eating fewer calories than they are expending but STILL not losing body fat.

To further support this view, findings of a National Nutrition survey from 1995 published by the Australian Bureau of Statistics reported that ***"Overweight or obese Australians actually consumed less calories than their normal weight counterparts"***.

EXPLANATION TWO: WE ARE EATING TOO MUCH FAT

Health authorities in most Western countries have been on a low-fat crusade since the 1970's in a belief that the levels of obesity and other chronic diseases such as heart disease and diabetes can be directly related to fat consumption.

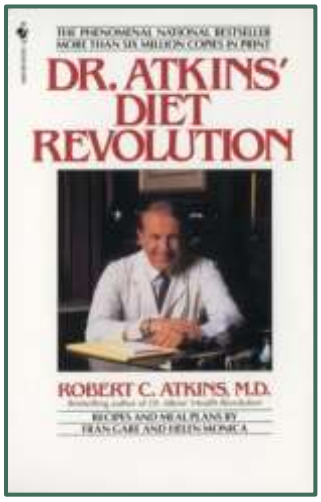


This belief stems mainly from the energy content of fat compared to other nutrients. For example, the amount of energy provided in one gram of fat (9 calories) is more than double the amount of energy found in either one gram of protein (4.2 calories) or carbohydrate (4 calories). Further, fat was used liberally by many families prior to the 1970's when rates of heart disease began to rise and was therefore seen as a contributing factor to elevated blood fat levels and coronary heart disease.

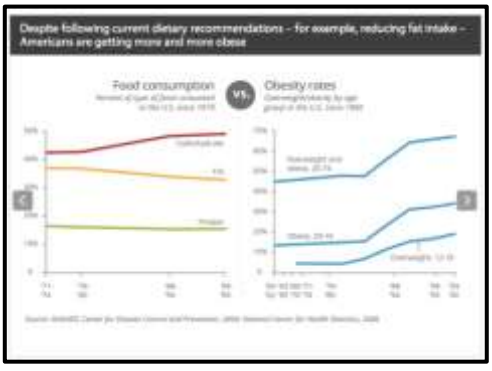
From an energy balance and weight control perspective, this theory assumed that if large amounts of fat were consumed, it would be difficult to expend enough calories to remain at or to lose weight. Conversely, health authorities believed that if less fat was eaten then it would be much easier to lose weight.

This type of thinking spawned the beginning of low fat diets and fat free foods. To encourage the community to adopt this low-fat eating regime, health authorities, nutritionists and food manufacturers presented us with an abundance of advertising material reporting the health benefits of fat free living.

Many eating styles and diets were developed since the 1970's designed to reduce overall fat consumption in the popular belief that body fat levels and general levels of health would improve. Low-fat is still the recommended approach by most health authorities, despite significant evidence of its limited effects.

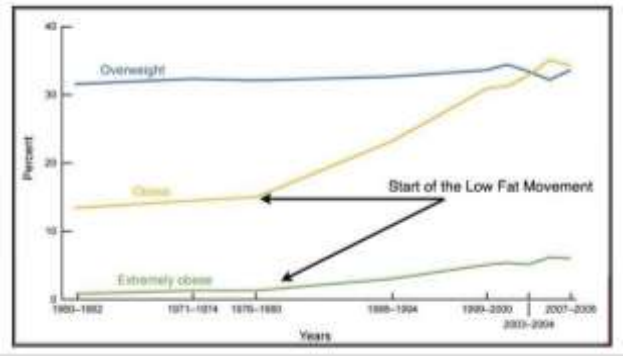


In stark contrast, an alternative style of eating was also being promoted at this time by an American cardiologist, Dr Robert Atkins. His weight loss philosophy was, and continues to be, controversial and at odds with the popular low fat beliefs. Dr Atkins encouraged people to consume large amounts of fat and protein whilst refraining from eating too many carbohydrates. Whilst the Atkins philosophy has caused much consternation and debate over the years, many scientific studies have shown his method to be very effective in achieving short-term weight loss.



So, what do the health statistics show after forty years of low fat advertising? Recent statistics have shown that the long and sustained media campaign against fat consumption has been successful in countries such as Australia. For example, dietary fat consumption in Australia has significantly reduced by

an average 6 per cent from 1983 (when dietary guidelines started in Australia) to 1995 per head of population and has fallen another 1% In the last decade.



But the late Dr Atkin's followers may yet have the last laugh because the current weight statistics indicate that Australians have actually **increased** their weight and body fat levels at a time when dietary fat consumption levels have decreased.

Does this mean that fat is not the major culprit in obesity? Has too much emphasis has been placed on reducing our daily fat consumption levels without investigating other causes of weight gain?

EXPLANATION THREE: WE ARE NOT PERFORMING ENOUGH EXERCISE

Comparing levels of physical activity over the past century, it could be assumed that the calorie expenditure of the general population has generally decreased over the years due to modern-day conveniences and general lifestyle. There are many examples to illustrate a less active lifestyle including;

- The use of motor vehicles and public transportation has reduced the amount of daily walking performed by people.
- Labour saving devices, at work and home.
- The level of crime in some modern cities has compromised outdoor play and recreation that was previously performed by children.
- Modern recreational and entertainment activities involve more sitting and watching than exerting physical energy.
-

However, exercise has long been considered an integral component of weight management, but recent, available evidence suggests that exercise alone is a relatively inefficient way of losing weight.

Whilst some studies have shown significant reductions in energy expenditure others have shown little difference suggesting energy output may only have a small role in energy balance.

Summary

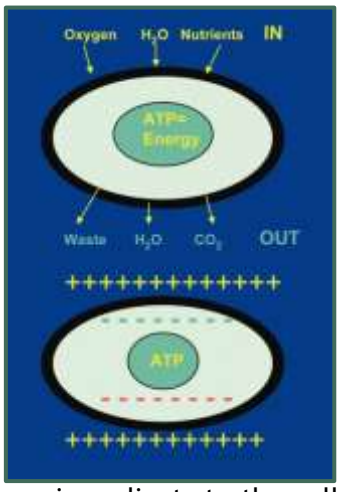
While these three popular explanations for our current obesity problem (poor energy balance, high fat consumption and a lack of exercise) can certainly be contributing factors and therefore, known puzzle pieces they do not provide all the reasons for current levels of overweight and obesity throughout the world.

In fact, there is evidence to suggest that people are consuming less fat and burning more calories (due to different stressors) than ever before over the past century. And if this is the case, why have overweight and obesity levels reached record levels in the last decade?

Section Two - Obesity starts with the cell

When looking at why people become obese, the focus is often on the big picture, too much fat, too much sugar, too much of everything, except exercise. However, this is clearly looking at things from the wrong way around, so perhaps we should start by looking at the cellular level to understand if there are clues here.

The logic for investigating an obesity problem at the cellular level was that the state and condition of the human body, overweight or otherwise is usually a good reflection of what is happening at a cellular level. For example, it is a scientific fact that a person becomes fatter due to their individual fat cells increasing in size.



Another reason for examining the physiology of a cell is that all the body's energy is created within the cell. Therefore, if we accept the definition that overweight and obesity is simply an energy balance problem, the workings of a cell may well be the key to solving the weight loss puzzle.

The illustration highlights several key points about the cell that need to be understood if we are to solve the weight loss puzzle.

Firstly, the inner part of a cell (core or mitochondria) is designed to manufacture energy for the body. This energy can be manufactured from different raw ingredients including **oxygen, glucose and fat.** The amount of energy manufactured will depend on the availability of these ingredients. Secondly, the amount of energy manufactured will depend on the efficiency of supplying these ingredients to the cell. That is, the oxygen, glucose, fat and other nutrients must pass through the cell wall (membrane) to the core of the cell. The speed with which these ingredients pass through the cell membrane will affect the energy output of the cell.

For example, if the supply of oxygen is limited or very slow to pass through the cell wall, the energy manufactured within the mitochondria will be affected causing less energy to be expended. When the body is resting or asleep, a certain amount of energy is required to keep the body functioning healthily. This minimal amount of energy is termed the resting metabolism of the body.

Resting metabolism accounts for between 65-75 per cent of the total energy demand per day for a normal, healthy person. Therefore, to manage weight and energy demands, it is very important for everyone to know and understand their resting metabolism.
I wonder if you can answer these 4 questions;

Do you know your resting metabolic rate and how many calories your body is using per day?
Do you know if your cells are receiving adequate amounts of oxygen to generate energy?
Do you know which fuels (glucose or fat) are being used to generate your energy?
Do you know how much energy (as fat) your body is storing?

All the answers to these questions are fundamental to weight management. To lose weight, **STORED FAT** must be used for energy. In fact Physiologists have long known that fat is the

most important fuel for the body and that at rest we should generate the majority of our energy from stored fat.

Section Three - Diagnosis and management / Guesswork and blame

Not being able to lose weight despite performing daily exercise and eating a low fat diet is a constant source of frustration to many. Losing weight and then regaining YOYO also effects many millions of people on a regular basis.

With most other modern-day illnesses, a diagnosis will be provided by a health practitioner usually after undertaking a battery of tests or investigations.

For example, if a person is having trouble with their eyesight, visual acuity tests and examinations of the eye can be performed by an Optometrist (Eye Specialist) to assist in the diagnosis of the problem.

When performing a general health check-up, your General Practitioner will perform many diagnostic procedures to check your blood pressure, heart rate, blood sugar and cholesterol to assess your level of health.

When you have a weight problem however, what diagnostic procedures are performed and by whom? And which specialist would you visit to determine the cause of your weight problem?

This is the very essence of the obesity problem. Quite simply, there are very few diagnostic options available to the health practitioners and even less Medical Specialists. Consequently, different explanations are given to explain weight gain and obesity and unfortunately are often based on supposition and not a diagnostic test.

As mentioned earlier, poor energy balance, eating too much fat and not performing enough exercise are the most common explanations provided for weight problems BUT no diagnostic testing is performed to identify the actual reasons.

Further, when a person finds it difficult to lose weight after following the advice of a health practitioner, the most common reasons for this failure is poor compliance (the health practitioner knows the diet should work), or “a slow metabolism” meaning that normal rules about how much and what to eat are not applicable to you. Therefore, what tests could be performed that would be useful in diagnosing a weight problem?

Given that metabolism regulates 70-80% of the energy (calories) expended per day, it is logical that the ***first step in investigating a person’s weight problem should be to perform an accurate assessment of their resting metabolism***.

Perhaps our metabolism is slowing as we age and this is in part responsible for obesity epidemic or maybe the body isn’t burning fat as designed.

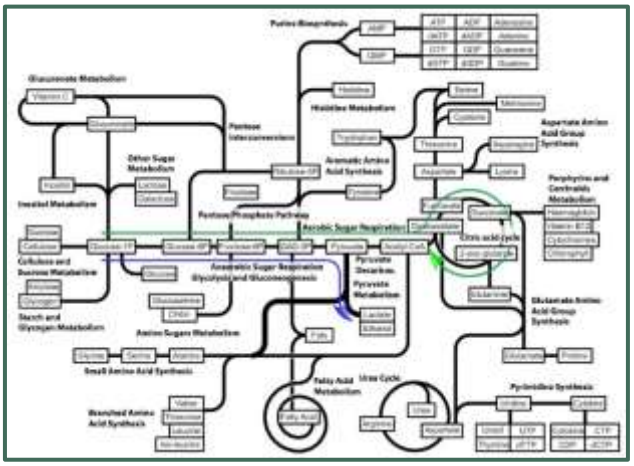
Your metabolism is unique to you and yet it is astonishing to think that metabolism is not investigated thoroughly when a person presents to a Health Practitioner with a weight or energy disorder. Unfortunately, this rarely happens and assumptions are therefore made about your metabolism rather than using diagnostic tests. Imagine if your Doctor just guessed your blood pressure or cholesterol reading instead of measuring your actual scores?

Generally, overweight people are assumed to have a slow metabolism while thin people have a fast metabolism, although as you will see later this is very often not the case. So why does metabolism vary between people and what can be done to improve resting metabolism?

Section Four - Metabolism

The definition of metabolism is usually made quite difficult and complicated by researchers and scientists. The easy definition of Metabolism is best understood by using three nouns.

1. Heat
2. Energy
3. Digestion

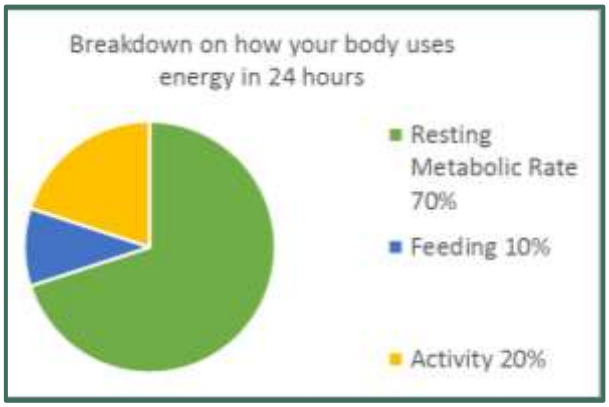


Firstly, metabolism is heat; specifically, the amount of heat produced by the body both at rest (to maintain your core temperature) and during exercise.
Secondly, metabolism is energy; the amount of energy released from the breakdown of food and measured in calories.
Thirdly, metabolism is digestion; the speed of breaking down and digesting food.

THEREFORE, an apt definition of metabolism combining the three nouns is;

"Metabolism is the amount of heat or energy generated in calories from the breakdown of food."

Energy production or metabolism can be classified according to activity status;



1. **Basal Metabolic Rate** – the minimum amount of energy required to sustain vital bodily functions while in a sleeping (basal) state.
2. **Resting Metabolic Rate** – the minimum amount of energy required to maintain normal function while the body is awake and resting.
3. **Thermogenesis**
4. **Activity**
5. **Total Energy Expenditure** – the total amount of energy expended per day. The 3 contributors to total energy expenditure are BMR, activity/exercise and thermogenesis.

Thermogenesis
Different foods are harder to break-down or digest than others which will also affect metabolism. The process of expending energy during digestion is termed ***thermogenesis***.

For example, digesting animal protein such as a beef steak may increase the resting metabolic rate by as much as 25% due to thermogenesis (the effort required in digestion). In comparison, the digestion of processed carbohydrates may increase resting metabolic rate by only 10%.

Measurement
Given that metabolism is an extremely important variable in managing weight and obesity problems, the measurement of metabolism needs to be fully understood by health professionals working with clients that present with weight disorders.

Unit of measurement

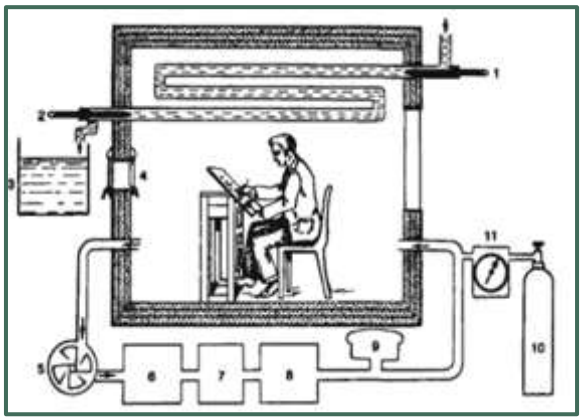
The heat or energy produced by the body is commonly measured in units called ***calories***. A calorie (cal) is defined as the amount of heat energy necessary to raise the temperature of one gram of water one degree from 15 degrees Celcius to 16 degrees Celcius. The unit most commonly used is the kilo-calorie (kcal) which equals 1000 calories.

Therefore, metabolism can be described as the number of calories expended or used by the body when at rest or during physical activity.

Section Five - Testing metabolism

Historical Timeline

It will be a surprise to most people to learn that the measurement of metabolism is not a new concept. In fact, the first recorded testing of human metabolism was by French physiologists and occurred well over a century ago in 1894.

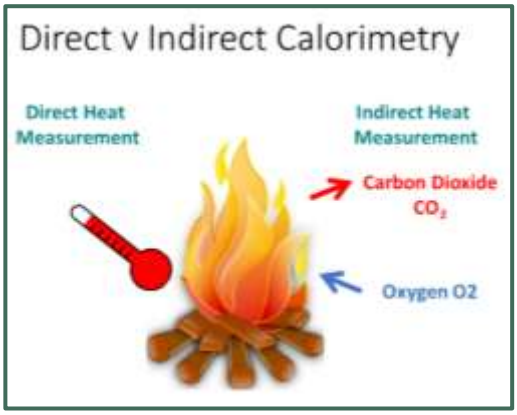


While the testing methods were crude and very time-consuming, the results were relatively accurate and reliable.

In 1894, the metabolism testing procedure involved placing a person in a small, sealed room where temperature changes could be accurately monitored. Any temperature change within the room was deemed to be heat produced by the person. This method of placing a person in a sealed room and measuring their **heat output** was called **direct calorimetry**.

Indirect Calorimetry

While performing direct calorimetry experiments in the early 1900's, physiologists also measured the type and amount of gases inspired and expired by their patients. These physiologists noted that the **amount of oxygen consumed** by patients **closely correlated to their resting energy expenditure.**



That is, if the volume of oxygen consumed by the patient increased, there was a corresponding increase in energy expenditure. As this theory was tested and proven correct, a new method for measuring energy expenditure (metabolism) was created known as **indirect calorimetry.**

This indirect method of measuring a person's consumed oxygen was much easier and faster to perform than direct calorimetry and consequently, became the preferred method for measuring metabolism.

The modern-day calorimeters are fitted with small micro-processors that can measure the energy expended either at rest or during differing intensities of physical activity as shown on the following page. Most importantly they can also measure how much energy is being generated from Fats and Glucose. This is particularly important for metabolic disorders such as Obesity and Diabetes.

The picture shows a woman breathing into a calorimeter via a mouth-piece and tubing with her nose blocked to ensure all her expired gases are sampled and analysed following each breath. This test is conducted in a fasted state and typically takes between 5 and 10 minutes to complete.

Individual variability
Metabolism can vary significantly within the same individual and between different individuals. Some factors that can affect metabolic rate include:

1. **Age** – During early childhood and adolescence growth your metabolism is generally high, and then gradually declines after the age of 30.
2. **Body composition** – Muscle is metabolically active and requires energy. This can account for changes in metabolism seen with age and physical activity.
3. **Gender** – Males tend to be bigger and have more muscle mass than and therefore generally have higher metabolic rates than females.
4. **Body surface area** – Generally, the greater the body surface area and body mass, the higher the metabolic rate.
5. **Hormones** – The endocrine system impacts on the production of energy (discussed in further chapters).

Metabolism can vary significantly within an individual and between different people from day to day. Therefore, metabolism is a major factor in explaining the weight variations between two people who eat and exercise similarly.

Routine assessment
Hopefully, this chapter demonstrates that metabolism is a very important factor in weight management. With the world experiencing an obesity pandemic, why is metabolism testing not routinely performed by Health Practitioners? Some of the main reasons why routine testing does not happen are highlighted below;

Measuring metabolism using the direct calorimetry method was
considered too time consuming for general practice

Calorimetry equipment was, and still is to this day,
considered very expensive by most health practitioners

Metabolism is not well understood by most health practitioners
and there is a lack of qualified personnel in this area

These factors have generally restricted the practice of assessing metabolism to Universities and research laboratories that have the financial and personnel resources to conduct this type of testing.

Predicted Metabolic Rates
Given the limited availability of measurement technologies, and the impracticality of measuring large populations, researchers developed mathematical equations that approximated an individual's metabolic rate.

In 1919, a study was performed by two scientists, Benedict and Harris to assess the RMR of 270 people in the United States of varying ages, height, weight and genders. The metabolic results of these people were then used to develop a normative equation called the Benedict-Harris formula to predict resting energy expenditure. This equation is still used by most professionals/companies working in the weight loss industry.

For example, many dieticians, Weight Watchers and Jenny Craig and even some wearable devices use the Harris-Benedict formula to predict a client's resting energy expenditure before

EXAMPLE OF THE NOMOGRAM FOR PREDICTING RMR (*Cal*/day)

Men= 66 + 13.75(wt in kg) + 5.0(ht in metres) – 6.76(age in years)

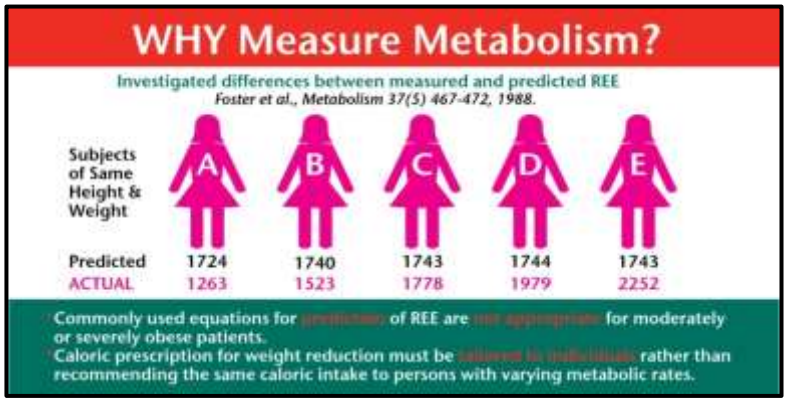
Women = 655 + 9.56(wt in kg) + 1.85(ht) – 4.68(age in years)

designing a calorie-specific eating plan.

Whilst this formula may provide a reasonable estimate of population based resting metabolic rates, the normograms were not designed for individualised measurements and many studies have shown the accuracy of predicting resting energy expenditure correlates poorly with indirect calorimetry particularly in the obese and significantly underweight categories.

In 1988 Foster *et al* published a seminal study in Metabolism, that clearly demonstrated the failure of predictive equations to accurately manage individual energy expenditure.

This study highlighted the importance of using calorimetry to assess energy expenditure rather than relying on predictive equations and in 2001 Foster updated the study to include other predictive equations. The study concluded that only indirect calorimetry should be used for individualised energy measurements.



Today health professionals still rely on these population normograms to estimate resting metabolic rate before designing a calorie-restricted food plan for their clients. If the equation is providing a gross over-estimate of resting metabolism, no wonder their clients are having limited success in losing weight!

Other Factors that influence metabolism

Oxygen Supply

The amount of energy manufactured by the body at rest is directly related to the delivery of oxygen to the cell. If the supply of oxygen is compromised or restricted, then the manufacture of energy will be affected. For example, a person with low iron stores has a lower ability to supply oxygen to the cells and therefore, is often affected by low energy.

Environmental Factors

The amount of heat required to maintain a stable core temperature may vary considerably depending on the environmental conditions. For example, if a person was to travel from a very cold environment to a warm, humid climate, their energy production would vary considerably.

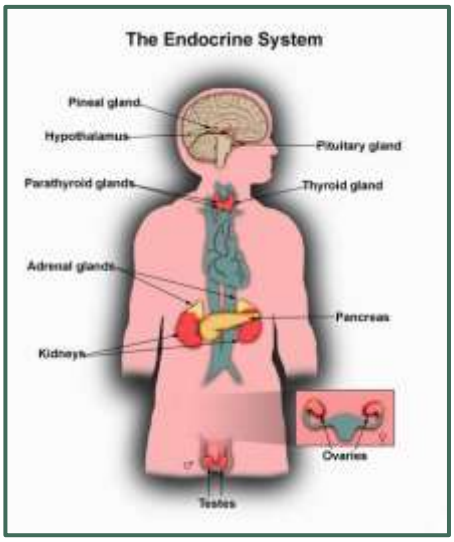
The metabolism formula used to predict energy metabolism DOES NOT allow for variations in oxygen supply caused by respiratory disease, blood disorders, high toxicity or free radical damage to cells

In a cold climate, more heat is required to maintain a constant core temperature as compared to a warm, temperate climate. This may also explain cultural variations in metabolism. That is, people who live continuously in a particular climate, tend to adapt their metabolism to meet the demands of this climate.

The metabolism formula used to predict energy metabolism DOES NOT allow for variations in temperature or culture and therefore, cannot accurately predict for people living in different countries or extreme climates.

Endocrine and Hormonal Control

Metabolism is largely controlled by the body's thermostat (hypothalamus) and two glands found in the body (**the thyroid gland and the pituitary gland**). If either of these two glands are not functioning correctly, resting metabolism will be affected.



Many of the major functions of the body are controlled by chemical messengers called hormones. These various glands within the body release hormones into the bloodstream that send a message to a target organ.

Metabolism is a prime example of a physiological process controlled by hormones. For example, the pituitary gland (shown above) is responsible for controlling metabolism and uses up to six different hormones to control this process.

The metabolism formula used to predict energy metabolism DOES NOT allow for variations in hormones and therefore, cannot accurately predict metabolism for any person with hormonal imbalances.

Summary

Whilst there are many different mathematical equations developed to predict resting metabolism, actual testing using indirect calorimetry techniques would suggest that these equations **may not be reliable** for 60 percent of the Australian population.

To put things another way, if you having difficulty losing weight and/or experience feelings of low energy, there is a high probability (60%) that your metabolism is not performing at the expected level and may be significantly lower than normal.

Therefore, the only way to verify that your metabolism is not working correctly is for your Health Practitioner to accurately measure your metabolic status using calorimetry techniques.

Section Six - Managing your metabolism

Imagine walking into a shop or building that is temperature controlled. That is, no matter how hot or cold the outside temperature, the internal temperature remains constant.
Usually this room temperature is controlled by a thermostat; a device that automatically increases or decreases temperature to maintain a constant level.
The thermostat relies on many temperature sensors located within a room to continuously provide feedback on the room temperature so that adjustments can be easily made if required.

Your metabolism is controlled in a very similar manner to this thermostat system. That is, a constant core temperature of approximately 37 C is generally maintained by the body's thermostat. More or less energy is generated by the body's cells to maintain 37 degrees depending on feedback from internal temperature sensors. However, what happens if a thermostat or the air conditioner develops either mechanical or electrical problems and does not maintain a constant room temperature. In most cases, an air conditioning technician would be called to assess the equipment and to repair the problem.

But what happens if your temperature regulation system (metabolism) becomes faulty? Can you call an "air conditioning technician" or Doctor for a metabolism assessment? The answer is generally **NO**. However, it would be ideal for a person experiencing weight or energy problems to accurately test their metabolism to firstly, confirm that a problem exists and secondly, to determine the cause of their metabolism problem. Instead, a Health Practitioner is more likely to make an assessment based on their client's current medical history and symptoms.

Signs of a metabolic problem
Your metabolism affects far more than your weight and often there are many signs of developing metabolic problems other than changes to the measuring scales.

This table details some of the signs of a distressed or poorly functioning metabolism.

Nourished Metabolism	Stressed Metabolism
Normal Body Temperature	Subnormal Body Temperature
Level Moods	Mood Swings
Handles Stress Well	Inability to Handle Stress
Healthy Hair, Skin & Nails	Dry Skin, Dandruff, Brittle Nails, Psoriasis, Eczema
Excellent Digestion and Healthy Bowel Movements	Poor Digestion, Constipation, Diarrhea, Allergies
Good Sleep Patterns	Erratic Sleep Patterns, Insomnia, Trouble Falling or Staying Asleep
Consistent Energy	Exhaustion, Alternating Between Wired and Tired
Steady Blood Sugar	Blood Sugar Crashes
Balanced Hormones and a Healthy Sex Drive	PMS, Irregular Menstrual Cycles, Low Sex Drive and other Signs of Hormonal Imbalance

SIGNS OF A SLOW METABOLISM

Clinical Signs
If we return to our simple definition of metabolism; **heat, energy and digestion,** the clinical signs of a slow metabolism generally relate to these three factors.

Firstly, a person who does not generate sufficient heat due to a slow metabolism will often complain of feeling the cold, particularly in the hands and the feet.

Secondly, people with a slow metabolism typically present with the symptoms relating to a low energy level;

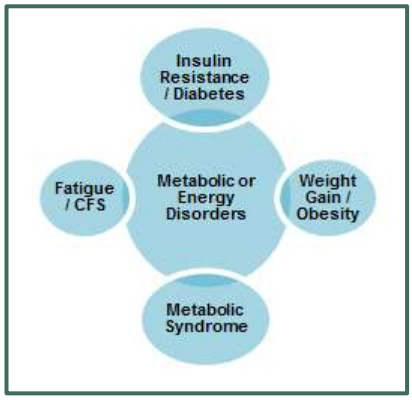
- Abnormal tiredness
- Drowsiness
- Lethargy
- Chronic fatigue
- Exhaustion

Thirdly, a slow metabolism causes a slower digestive rate causing;

- Constipation
- Poor digestion
- Bloating and wind
- Reflux
- Irritable bowel syndrome

Lastly, it is probable that a person with a slow metabolism is likely to have difficulty with their weight unless they are performing daily physical activity.

Diagnosis
As mentioned previously, metabolic function can only be accurately measured using either direct or indirect calorimetry (measurement of heat and expended energy).



Using indirect calorimetry, a resting metabolism that is at least 30 per cent LOWER than the predicted resting metabolism is suggestive of an excessively slow metabolism.

In the past, either the cost of this procedure, a lack of equipment or qualified personnel has meant this test **HAS NOT** been offered by the medical community in diagnosing metabolic disorders.

As an alternative, other diagnostic tests that assess thyroid function were developed by pathology companies to provide an insight into metabolic function. These thyroid function tests are now used routinely by the medical community to assess clients with weight and/or energy problems. To illustrate how widespread this testing has become, the Gratton Institute recently reported that Medicare paid for more than 4.6 million tests in 2015, at a cost of more than $180 million. This was an increase of 26% on the previous year.

Thyroid Function Testing versus Calorimetry Testing
Health practitioners and their clients are often under the false belief that a thyroid test is a measure of metabolism. It should be noted that **thyroid function testing does not provide a measure of resting energy expenditure.**

Instead, this test measures the current function of the thyroid gland and the amount of hormones released by the thyroid to control metabolism.

N.B. The most common thyroid test requested by General Practitioners is of TSH or Thyroid Stimulating Hormone. This hormone is released by the Anterior Pituitary gland as a messenger to the thyroid gland requesting an increase or decrease in metabolic function. Two hormones released by the thyroid gland called triiodothronine (T3) and thyroxine (T4) directly influence the cell's energy production.

Your resting metabolism is controlled by a number of hormones that include the thyroid hormones but these thyroid hormones only contribute 40 - 50 per cent of the total metabolic output.

Therefore, it is not possible to substitute thyroid function testing for calorimetry testing.

Reasons for a Slow Metabolism
From a physiological view, there are three reasons for a slow or low energy production including;
1. Slow or poor oxygen delivery to the cell
2. Lack of available fuel (glucose or fat) in the cell
3. Low levels of metabolism hormones

Firstly, the delivery of oxygen could be compromised by either one of the following factors; poor lung function, low haemoglobin levels or a restricted permeability of oxygen through the cell membrane.

Secondly, a lack of glucose or fat in the cell will limit the capacity of the cell to manufacture energy. For example, a diabetic person generally produces less energy because glucose cannot be used in the fuel burning process.

Thirdly, energy production is controlled by hormones (to be discussed in later chapters) and therefore, any reduction in hormonal release will in turn slow the rate of energy production.

Generally, this hormonal release is controlled by the brain and in some circumstances the brain chooses to slow the metabolic rate to conserve energy. For example, during a long fasting period or prolonged calorie restriction (dieting), energy production will have reduced, resulting in a slow metabolism.

SIGNS OF A FAST METABOLISM

Clinical Signs
Imagine going for a brisk walk in the sunshine for 30 minutes. How do you feel 5 to 10 minutes after completing this walk?

Your skin and extremities should be warm and tingling. You should feel energetic and raring to go. These are often the feelings of a person with a normal to slightly fast metabolism. Warm skinned, high energy levels and regular bowel movements are characteristics of a person with a high metabolic rate. Further, it is likely that a person with a high metabolic rate will have less difficulty controlling their weight than a person with a slow metabolism.

There are occasions however, when a fast metabolism may become detrimental to your health. What are the likely symptoms of a resting metabolism that is too high?
- Inability to maintain body weight
- Excessive heat production and sweating

- Varying degrees of diarrhoea
- Insomnia
- Muscle weakness and fatigue
- Anxiety
- Slight tremor of the hands

Diagnosis
Using indirect calorimetry, a resting metabolism that is more than 30 per cent HIGHER than the predicted resting metabolism is suggestive of an excessively fast metabolism.

Currently, the medical fraternity relies on thyroid function testing to confirm a person has a high metabolic rate. While an overactive thyroid or hyperthyroidism is one of the common causes for a high metabolic rate, it is possible to experience a very high metabolic rate with normal thyroid function. Remember from previous discussions, that metabolism can be affected by many hormones other than the thyroid hormones.

Reasons for a Fast Metabolism
From a physiological view, there are various reasons for a high resting energy production including;
1. High or increased delivery of oxygen to the cells
2. High availability of nutrients
3. Excessive production or availability of metabolic hormones

Firstly, the delivery of oxygen to the cells may be higher than normal due to a number of factors including; elevated oxygen levels in the blood, a deeper inspired volume per breath or a faster breathing rate.

Secondly, energy production generally increases following a meal due to the increased availability of nutrients (fat or glucose) and the heat generated from the digestion of these foods.

Thirdly, a high production of the metabolic hormones such as thyroxine, cortisol, progesterone or growth hormone will initiate a higher than normal production of energy. Different circumstances may occur to trigger a hormonal release and result in a higher metabolic rate. For example, stress will usually cause different hormones to be released and the body produces a higher metabolic rate in response to this stressor.

SUMMARY

Energy balance remains the cornerstone of clinical weight management strategies and yet it is generally accepted that methods to estimate this are very inaccurate. It is not possible to accurately assess energy balance without measuring metabolism and without the ability to provide repeated measurements it is very likely that weight loss interventions will fail. Therefore, metabolism is clearly a key component in solving the obesity or weight management epidemic.

We currently live in an era of technological revolution and this is most apparent within the medical profession. However, many practitioners still rely on guesswork and approximation, and their customers still suffer the consequences of failed results.

When you next visit a health professional or weight loss practitioner, ask if they use Indirect Calorimetry and, if not ask why they continue to use guesswork when solving the weight loss challenges of today. If you would like a list of practitioners that do use Indirect Calorimetry please contact www.metabolichealthsolutions.com.au

The next sections of this book will try to address how an understanding of metabolism and personalised measurement can be used to develop long-term effective health programmes. They will also look at which foods can improve metabolic response and which foods can lead to the development of metabolic disease.

Please stay tuned.