agMOOCs

Energy 3

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Last class so we have seen the requirements of energy and how it is affected by various factors and what are the various means of getting the energy. So this class let us see what are the measurements of energy; how do we measure the energy requirements and what are the various ways we manage the energy balance in our food.

Measurements of energy expenditure

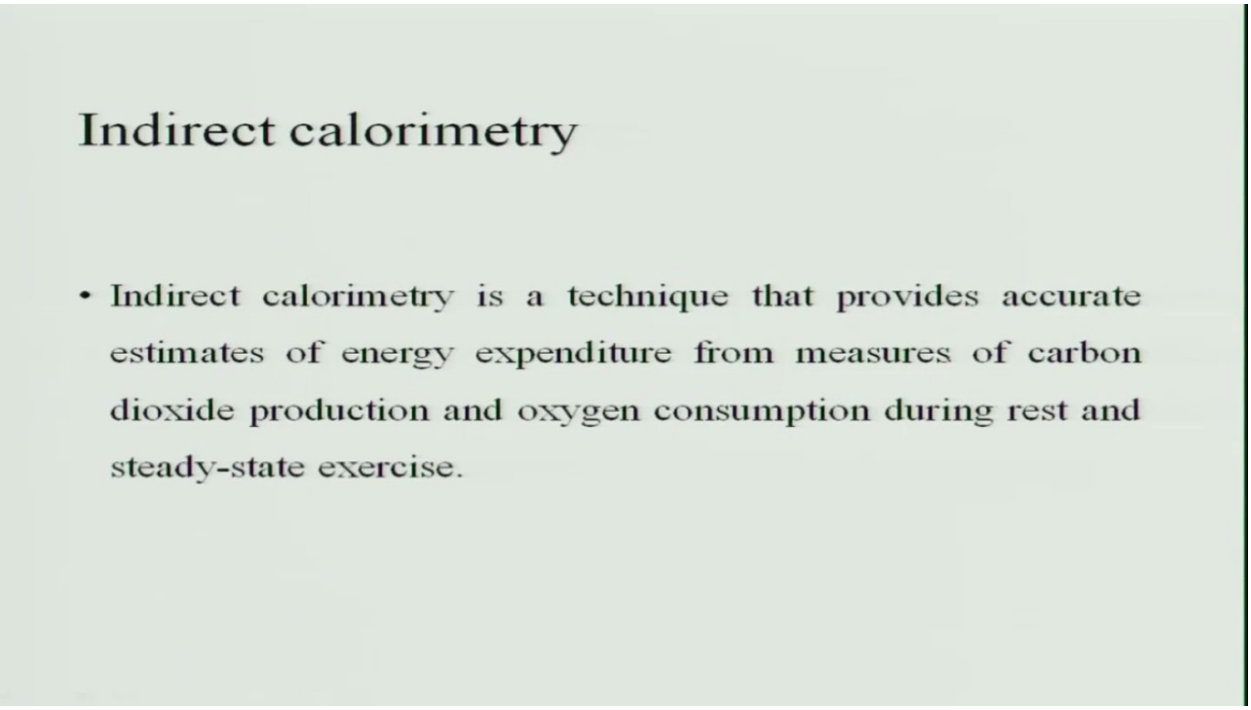
- Direct calorimetry
- Indirect calorimetry
- Factorial estimation
- The double labelled water technique (DLW)
- Heart rate monitoring (HRM)

So measurement of energy requirement or energy expenditure is measured by direct calorimetry, indirect calorimetry, factorial estimation, double label water technique, and heart rate monitoring. So these are the various methods; five methods for measuring the energy requirement.

Direct calorimetry

- Measurement of the heat produced by a reaction, as distinguished from indirect methods, which involve measurement of something other than heat production itself.

Now let us see what is direct calorimetry? It is the measurement of heat that is produced by a reaction as distinguished from indirect methods which involve the measurement of something other than the heat production itself.



Indirect calorimetry; it is a technique that provides accurate estimates of energy expenditure from the measures of carbon dioxide production and oxygen consumption. So both carbon dioxide production and oxygen consumption are taken into consideration during rest and steady-state exercise. So that means when the person is at rest the expenditure of energy is taken by means of taking the oxygen consumption and carbon dioxide production.

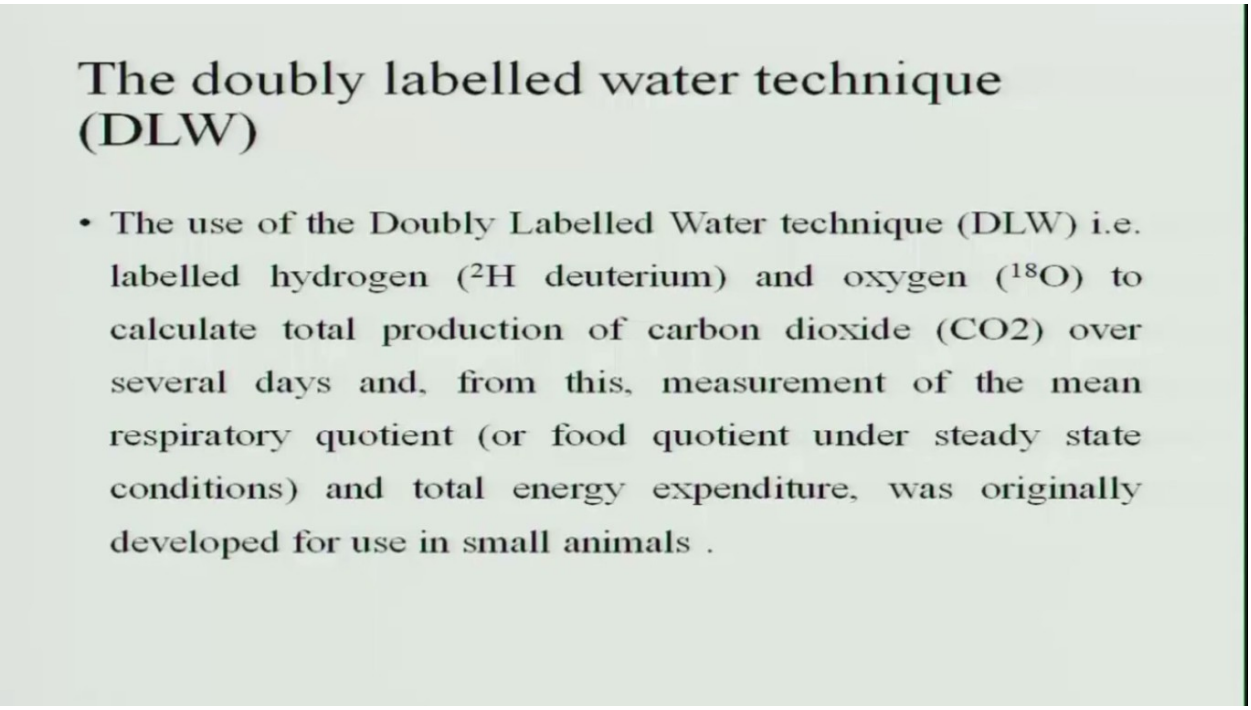
Factorial estimation

- The wide variation observed in the physical activity patterns of adults from different geographic, social and economic groups combined with the variation observed in body size and composition of adults, do not allow the universal application of TEE measured by DLW technique

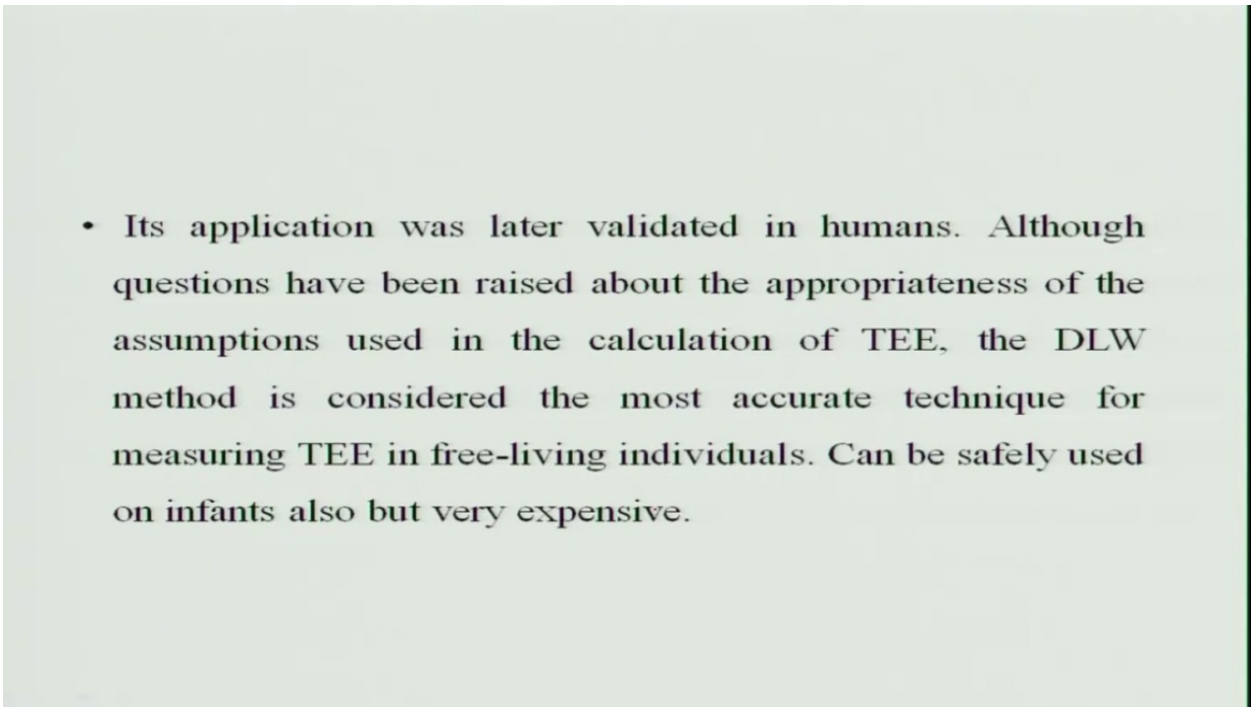
Now factorial estimation is another method where there is a wide variation observed between the physical activity patterns of adults in different geographic, social and economic groups. Combined with body size, composition of adults, and does not allow universal application for the total energy expenditure that is measured by the double label water technique.

- This has become possible with an electronic device that can accurately record minute-to-minute heart rate under free living conditions, for a whole day or more.
- The mean TEE measured with this technique is comparable to mean value obtained using DLW or whole body calorimeter.

So this has become possible with an electronic device that can accurately record minute-to-minute heart rate under the free living conditions for the whole day or more. It means the mean total energy expenditure is measured with this technique when it is comparable to the mean value obtained during the double labeled water technique or whole body calorimeter. So here we can measure every minute what is the amount of energy expenditure for each activity of a person when he is at rest.



Now the doubly labeled water technique it is the doubly labeled water technique using hydrogen that is deuterium and oxygen, 18 oxygen to calculate the total production of carbon dioxide over several days. From this the measurement of mean respiratory quotient or the food quotient under steady state of conditions and the total energy expenditure it was actually developed in small animals and when this was successful this was validated in humans and though many questions were raised but it has become an accurate method. And this can be very safely used in infants. Measurement is very expensive because it is using the deuterium and 18 oxygen.



Now about the energy balance. The energy balance is nothing but the relationship between the energy in that is whatever food we eat or what fluids we drink, the energy that is got from these is energy in; that means we are taking in some energy. And the energy out is the calories that are being used for the various functions of the body and during various physical activities. So this is required for the energy requirements. Adults who tend to maintain energy balance they always keep their body weight is constant. So that means when you have energy in is equal to energy output then the our body weight is always constant and those who lose weight those they spend more energy than the energy intake; that means the energy loss is more compared to the energy intake. They tend to lose their body weight and this has to be over a long period and if the intake of energy is consistently higher than the expenditure over an extended period of time then it results in weight gain, that is overweight or obesity.

Energy balance

- "**Energy balance**" is the relationship between "**energy** in" (food calories taken into the body through food and drink) and "**energy** out" (calories being used in the body for our daily **energy** requirements
- Adults who tend to maintain energy balance keep their body weight constant.
- Those who lose weight spend more energy than intake – negative energy balance
- If the intake of energy is consistently higher than the expenditure over an extended period of time, it results in weight gain.

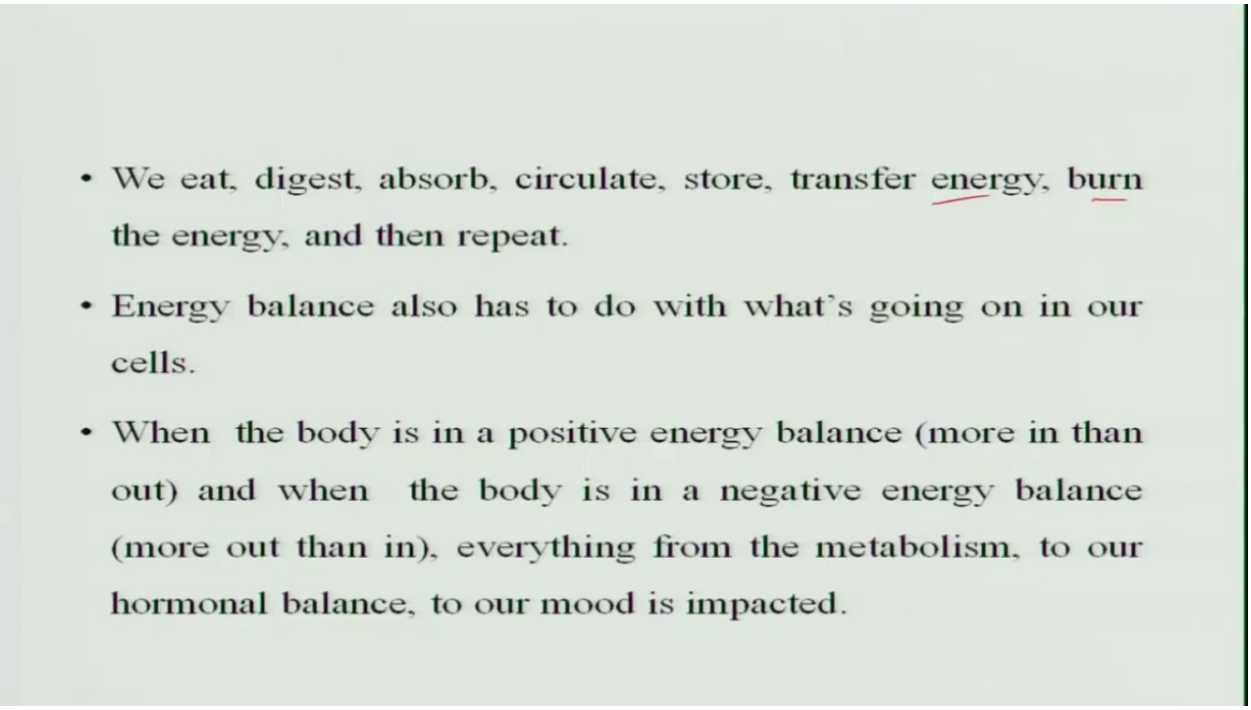
So energy is never really created and destroyed. They are – it is actually transferred between the entities. There is no creation or destruction of energy in the body. It is only a transfer between the entities. So we convert potential energy that is stored within the food into three major destinations that is work, heat, and storage.

Health concern related to energy balance

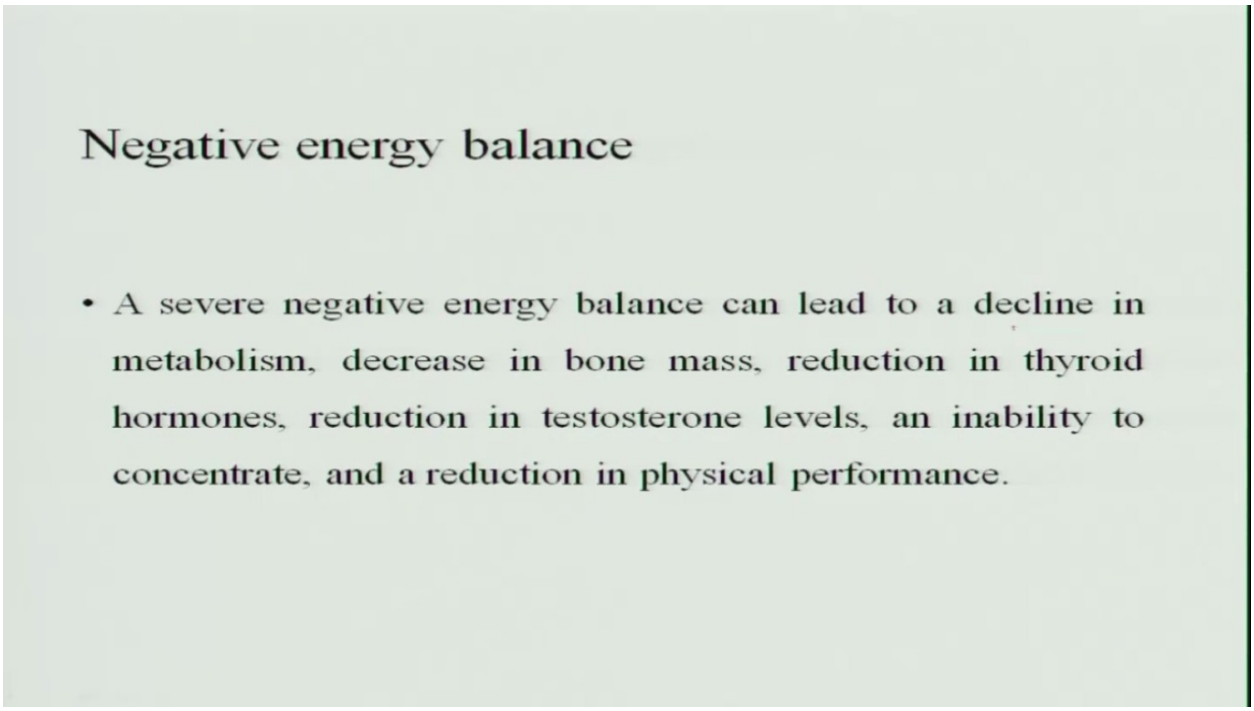
- When it comes to "energy out," the body's energy needs include the amount of energy required for maintenance at rest, physical activity and movement, and for food digestion, absorption, and transport.

- We can estimate our energy needs by measuring the amount of oxygen we consume.

Now health concerns related to energy balance when it comes to energy out the body's energy needs include the amount of energy required for maintenance at physical activity, rest, and movement and also for food digestion absorption and transport. All these require energy for their functions and we can estimate our energy needs by measuring the amount of oxygen we consume that the consumption of oxygen is very important for measuring the energy that is required by an individual.

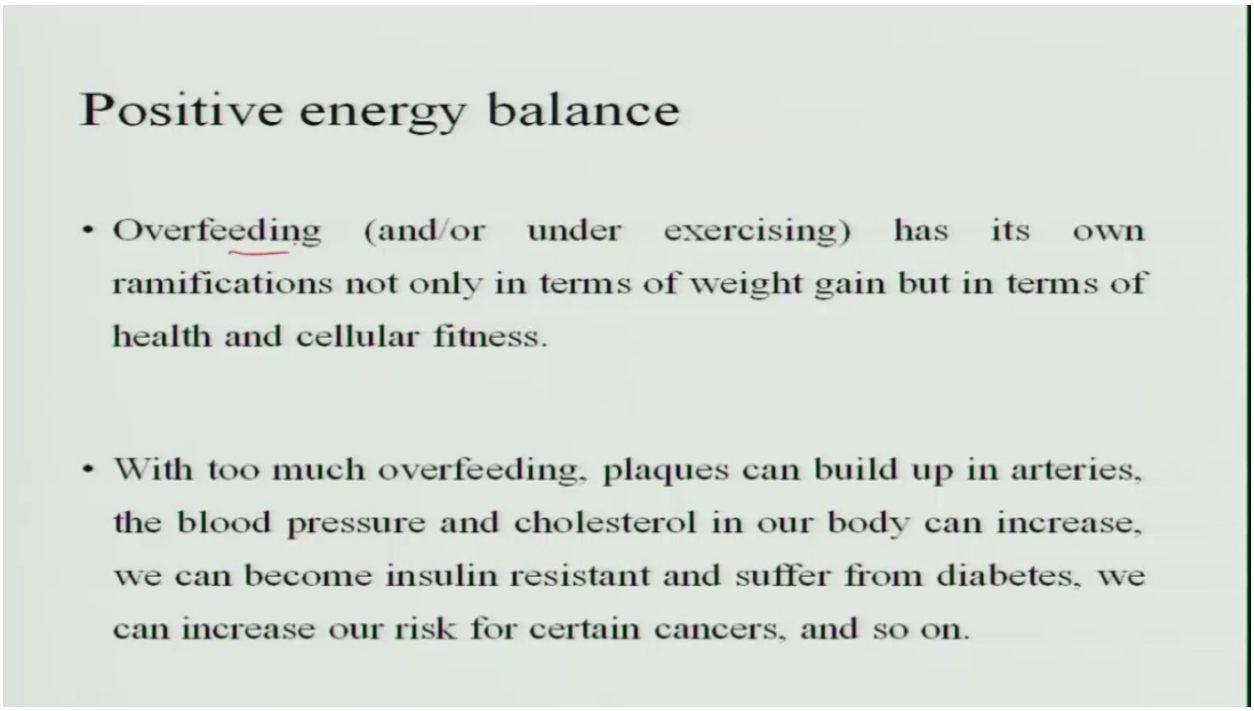


Now we eat, we digest, absorb, circulate, store, transfer energy, and burn the energy and then this process keeps on repeating. So energy balance also has to do with what is going on in our cells. So when the body is in the positive energy balance that is when the intake is more and output is less and when the body is in a negative energy balance that is when the intake is less and output is more. So everything from the metabolism to hormone balance and our mood also has an impact based on the energy balance.



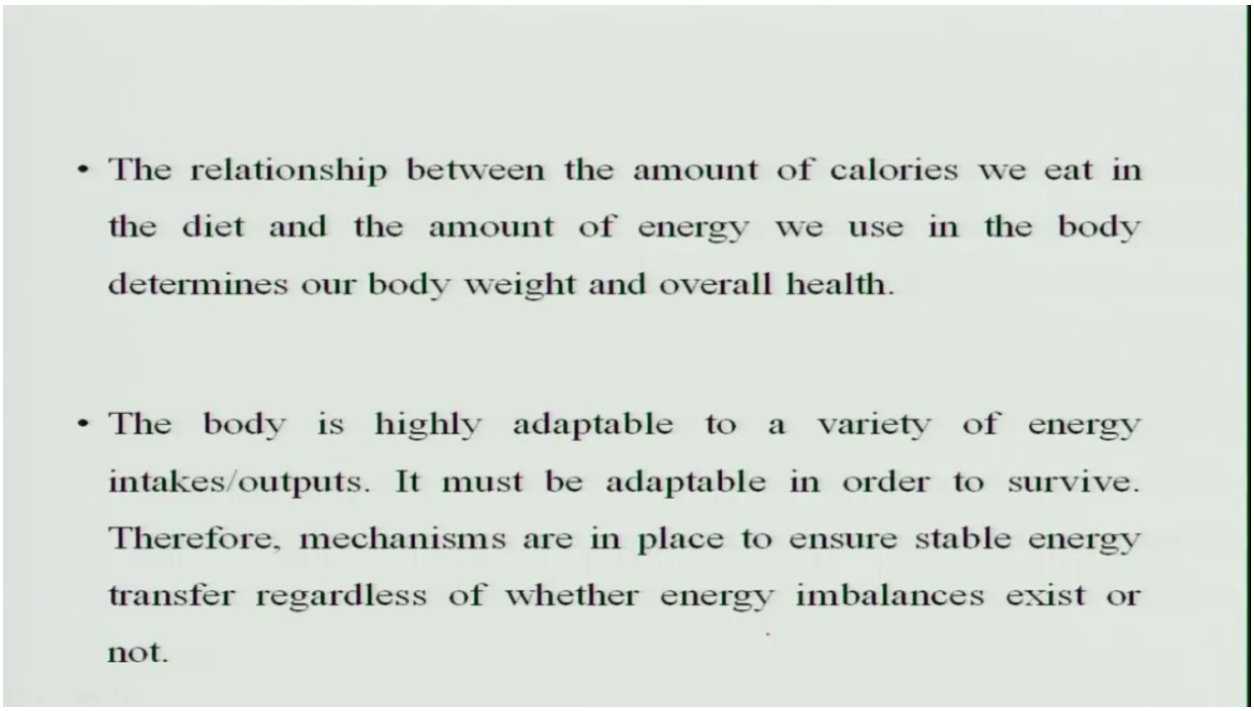
Now negative energy balance. A severe negative energy balance can lead to a decline in metabolism, decrease in the bone mass and reduction in thyroid hormones, reduction in testosterone levels and inability to concentrate and a reduction in physical performance. So all these are affected when the negative energy balance occurs in an individual is actually the brain also needs some energy to function. So therefore that also lacks some functioning.

Negative energy balance does not lead increase in weight or maintaining the weight constantly but it leads to weight loss. So the body detects an energy deficit whenever there is a deficit of energy then the fat reserves are called upon to make the difference. That means the fat that is present in the body is utilized for purpose of energy requirement in the body. The body just knows that it is not getting enough energy so it will start the entire processing in the body will slow down or sometimes shut down. Therefore, all the non survival functions will slow down or shut down so that it can use up the energy for the vital functions.



The positive energy balance is over feeding. You get it through over feeding or sometimes under exercising. So this again has result in weight gain but in terms of health and cellular fitness also there is a lot of affect when there is a positive energy balance. So with too much of over feeding the plaques can build up in the arteries and blood pressure and cholesterol can be changed, I mean there is an increase in the blood pressure. The cholesterol levels in the body increase and we can become insulin resistance so that it leads to diabetes and when we can increase our risk to certain cancers and so on.

So the overfeeding it will – whenever the person is an obese person there is a lot of impact on the cardiovascular diseases, the diabetes and cancer.



So relationship between the amount of calories we eat in the diet and the amount of energy we use in the body. So that determines our body weight and overall health. That means if the energy in is equal to the energy out then our body weight is constant at the same time we maintain a perfect health and the body is highly adaptable to a variety of energy intake and outputs. So it must be adaptable in order to survive. So whenever there is less energy in I told you the fat that is present in the body reserves is used up for energy and therefore the mechanisms in place to ensure stable energy transfer regardless whether the energy imbalances exist or no.

Therefore there are different methods of measuring the energy requirement of a person and based on the energy requirement of a person the recommended dietary allowances for energy are made and we have always to make the balance in energy in terms of intake and expenditure to keep fit and healthy.

Thank you.