Food tests

Transcript

The foods we eat contain seven different kinds of nutrient: carbohydrates, fats, proteins, vitamins, minerals, water and fibre.

In this experiment, food samples will be tested for the presence of some of these nutrients.

Seven test-tubes are labelled at the top. The numbers relate to the different food samples.

First, the food samples need to be prepared. 2 centimetres cubed of distilled water are added to test tube zero. This is the control.

A sharp knife is used to cut a piece of bread about 1 cm by 1 cm in size. Care should be taken when using a sharp knife and cutting should always be done on a white tile.

A pestle and mortar is used to break the bread into smaller pieces.

The bread crumbs are transferred to the test tube labelled ‘1’.

About one centimetre cubed of distilled water is added, so that there is roughly the same volume of water as there is food in the sample.

A glass rod is used to gently mix until the bread pieces look roughly evenly distributed in the water. This process breaks open the cells so that the nutrients inside can dissolve in the water to create a liquid food extract, which is easier to test.

The food extract for chicken is prepared in the same way using a 1 cm by 1 cm piece of chicken. The food samples only need to be approximately the same volume.

The pestle and mortar should be washed between uses to prevent cross-contamination of food samples.

The chicken is added to test tube 2.

1 centimetre cubed of distilled water is added.

A clean glass rod is used to mix until the chicken looks roughly evenly distributed in the water.

For the liquid food samples, you do not need to make a liquid food extract because the nutrients are already in solution. Simply add 1 centimetre cubed of each to the correct test tube.

A clean dropping pipette should be used for each sample to avoid cross-contamination.

The food samples are now ready to be tested.

The first test is for the presence of starch. Iodine solution turns from an orange-brown colour to a blue-black colour in the presence of starch.

3 drops of iodine solution are added to each sample.

Each sample is then mixed and the colour of the solution is observed.

Look at the control. It is still an orange-brown colour. This means that there is no starch present. It is a negative result for starch.

Look at the bread sample. The food extract has turned a blue-black. This is a positive result for the presence of starch.

The chicken food extract has not gone a blue-black colour, indicating there is no starch present. Although it’s not possible to see the orange-brown colour of the iodine solution, it is clearly a negative result when compared to the bread sample.

In the tomato sauce, there is a clear blue-black layer. This is where the iodine has come into contact with the starch in the sample.

The oil is a pale orange-brown colour, indicating that starch is not present.

The milk has not turned blue-black, indicating starch is not present. Although it’s not possible to see the orange-brown colour of the iodine solution, it is clearly a negative result.

The orange juice has not turned blue-black. Again, it is clearly a negative result even though the orange-brown colour of the iodine solution is not visible.

The next test is for the presence of protein using Biuret solution. It changes from a blue colour to a purple colour in the presence of protein.

The food samples are prepared in the same way as before, but in a new set of test tubes. About the same volume of Biuret solution as there is food sample, is added. This is about 1 centimetre cubed, or 5 drops.

Each sample is mixed and left at room temperature for 5 minutes to give time for the Biuret solution to react with any protein in the sample. Then the colour of each sample is observed.

Look at the control. The sample is blue, indicating that protein is not present. This is a negative result.

The bread extract does not have a clear blue or purple colour. The blue colour can fade when small concentrations of biuret solution are used, so it is possible that the extract was blue but the colour has faded. When the sample is compared to two positive results, it is possible to see that there is no purple colour in the sample; it is therefore reasonable to conclude that protein is not present.

In sample 2, a clear purple colour can be seen where the Biuret solution has reacted with protein in the chicken food extract.

There is not a clear blue or purple colour present in the tomato sauce sample. When the tube is turned around, it is easier to see a layer of blue-coloured liquid, suggesting there is no protein in the tomato sauce. If more Biuret's solution had been added, a stronger result might have been found.

The sample has not turned purple and there is a very faint blue colour around the edges of the liquid, so protein is not present in the oil.

It is possible to see a very light purple colour in this sample, indicating that protein is present in the milk.

It can help to look at the milk sample before and after adding biuret solution, to confirm that there is a pale purple colour in the sample on the right. This would be even more visible against a white background.

The orange juice has not turned purple. It is possible to see a very faint blue colour in the top of the liquid but more Biuret's solution would to be needed in order to be confident of the negative result.

The next test is for the presence of vitamin C. DCPIP is a blue dye that decolours in the presence of vitamin C; it goes from a blue colour to colourless. The smaller concentration of vitamin C there is in a sample, the greater the volume of DCPIP required to get a positive result.

The food samples are prepared as before, in a new set of test tubes.

5 drops of DCPIP are added to each test-tube. The samples are mixed and the colour of the solutions observed.

Look at the control. The DCPIP is still blue, indicating that vitamin C is not present. The bread and chicken samples are also negative for the presence of vitamin C.

It is more difficult to notice a colour change in the tomato sauce because of the red starting colour. It looks like the DCPIP has started to change colour, suggesting there is some vitamin C present. Or it could just be the effect of the blue being diluted by the red colour. More investigation is needed; adding more DCPIP would lead to a conclusive result.

In the oil sample, the dark blue droplets of DCPIP are still visible, indicating that vitamin C is not present.

The DCPIP in the milk sample has changed from a very dark blue to a much lighter blue. This could suggest that the DCPIP is starting to decolour and there is vitamin C present, or it could be a result of the white milk mixing with the blue DCPIP. More investigation is needed; adding more DCPIP would lead to a conclusive result.

The DCPIP has decolourised, it is no longer blue, indicating a positive result for the presence of vitamin C in the orange juice.

The next test is for the presence of reducing sugars such as glucose. Benedict's solution is used for this test because it changes colour when a reducing sugar is present. A blue colour indicates a negative result. A colour change indicates that a reducing sugar is present; the range of different colours represents different concentrations of reducing sugar.

The food samples are prepared as before. This time, boiling tubes are used instead of test tubes, because the samples will be heated in a water bath later.

As much Benedict's solution as there is sample, is added to each boiling tube.

The samples are gently mixed and then added to a water bath set at 80°Celcius. Benedict's solution requires heat to be activated. Care should be taken when handling very hot water and heating Benedict's solution.

After 2 minutes, each sample is carefully removed from the water bath using a test-tube holder to touch the hot glass. The colours of the solutions are then observed.

Look at the control. The liquid has not changed colour; it is still blue. This indicates that reducing sugar is not present.

The bread sample has changed colour to a pale yellow, indicating a reducing sugar is present.

The chicken sample has changed colour to a very pale purple, suggesting the presence of a reducing sugar. It is possible that the chicken was processed or cooked in a substance that contains sugar.

Although the tomato sauce was red to begin with, there is a clear colour change, indicating that a reducing sugar is present. The brown-red colour suggests that there is a moderate concentration of reducing sugar in the sample.

There is a clear light blue layer, indicating that sugar is not present in the oil.

The pale yellow colour indicates a low concentration of a reducing sugar in the milk.

The dark yellow indicates a low to moderate concentration of a reducing sugar in the orange juice.

As the starting colour of the orange juice is already yellow-orange, it helps to compare the sample side by side to the starting colour, to confirm that there has definitely been a colour change.

The final test is for the presence of fat. This is called the emulsion test. Ethanol is added to each sample, then distilled water is added. If fat is present, a milky white emulsion will form after the distilled water is added. In the absence of fat, the milky white emulsion does not form.

The food samples are prepared in a similar way to before, except this time the bread and chicken are mixed with 1 centimetre cubed of ethanol to create the liquid food extract because fat is insoluble in water.

Ethanol is added to each sample; note that the control in this test is ethanol.

Each sample is mixed and left for two minutes to allow time for any fat present to dissolve in the ethanol.

Distilled water is then added to each sample and the appearance of the solution is observed.

Look at the control, the liquid is colourless, indicating that no fat is present.

It is difficult to tell if there is a positive result for the bread sample because the bread crumbs are white. However, there is a distinct layer of liquid at the top that does not contain any solid. The liquid is a milky white emulsion, suggesting there is fat in the bread.

In the chicken sample, again it is difficult to see due to the presence of the solid white chicken. However, it’s possible to see that there is a layer where there is no solid. The liquid has formed a milky white emulsion, suggesting there is fat in the chicken.

It is possible to see a very pale milky white emulsion on top of the tomato sauce. This suggests a weak positive result.

The oil has a thick, milky white layer, indicating a high concentration of fat is present.

The milk is another difficult sample because the starting colour of the liquid is white. However, there is a distinct layer of differently coloured liquid at the top. This looks very slightly cloudy, suggesting the presence of a very small concentration of fat.

The orange juice sample has not turned a milky white colour, nor is there a distinct layer of milky white emulsion. This indicates that there is no fat in the orange juice.

It is clear that different foods contain different nutrients. Therefore, it is important to include a wide range of different food types in our diet.