

It's the small things in life: Chicken or chickpeas?

Teacher notes

The issue

There are billions of people alive on Earth and we all need feeding. Protein-rich food is important for health and well-being. Meat and other animal products are important sources of protein for many people, but the animals we eat need to feed on plants or other animal products to grow big enough for us to eat. Since animals do not convert 100% of the protein in the plants they eat into meat that we can eat, this process is not efficient – protein is being wasted.

Should we all eat chickpeas – and other plant products high in protein – in place of chicken or other meat? Is some meat produced more efficiently than others? Would eating insects be a more efficient way of providing the protein-rich food that people enjoy?

Introduction

This investigation ties in with curriculum requirements on the **efficiency of biomass transfers between trophic levels** and on **sustainability**.

Students are provided with four different sets of data about the efficiency with which animals convert food into meat and about the sustainability of meat production. These are:

- a comparison between the nutritional values of chicken and chickpeas
- a bar chart showing the food conversion rates of a number of different organisms, including salmon, insects, broiler and free-range hens, pigs, sheep and cows (more data available from DEFRA, <http://sciencesearch.defra.gov.uk/Default.aspx?Module=More&Location=None&ProjectID=16595>)
- information on sustainable beef and lamb farming by Rothamsted Research scientists on land that would not otherwise be able to produce food for people
- an abstract from a research article on farming insects for protein.

Learning objectives

Understand that the chemicals in ecosystems are continually cycling through the natural world.

Recall and explain the concept of trophic levels and the relative efficiency of protein production from producers and primary consumers.

Understand that some animals produce meat more efficiently than others.

Be able to explain that where land can be used for arable or pasture, more humans can be fed (i.e. more protein can be produced) per unit area by plants, but some land is not suitable for arable and in this case using it as pasture for meat animals may be a good use of the land.

Be able to consider the resources needed for our own diets, and whether they are sustainable.

Activities

Differentiation

There is differentiation by outcome, as well as some differentiation in the activities. For example, the activities accompanying the abstract on cricket farming is an opportunity for more able students to work independently. The content is, however, accessible to all students with differing levels of support.

Answers to questions

1. Bar chart with clearly labelled axes and correct values.
2. Table with sensible pros and cons for plant and animal protein – should include points like relative protein and fat content, but also demonstrate consideration of wider points, for example environmental effects, efficiency of land use, advantages and disadvantages of intensive poultry farming (efficiency of land use vs pollution from waste, cruelty), relative ease and cost of cooking nutritious meals with chicken or chickpeas, or even taste.
3. Farmed salmon.
4. Two reasons, for example: different farmers will feed animals differently (pasture, silage, fodder derived from grain); different individual animals and breeds will convert food more or less efficiently; pasture and bought-in fodder in different areas or in different years will contain different proportions of protein.
5. For example: free-range chickens move about a lot more and thus use more energy from their food for movement than confined chickens, which therefore grow faster and can be slaughtered sooner; feed for intensively reared chickens can be closely monitored and designed for maximum weight gain.
6. Sheep and cows are much less efficient than many other animals at converting food into new animal because they are often farmed on pastureland for at least part of the year rather than reared intensively.
7. Poster with persuasive arguments in favour of changing eating habits towards more efficient types of meat. Also mark on design and use of scientifically correct vocabulary.
8. Milk consists largely of water, so less than a kilogram of food is required to produce a kilogram of milk.
9. Clear explanations, for example:
 - a) growing population, pressure on land use, production of fodder for animals to feed the rich rather than plants that could feed more and poorer people, etc.
 - b) destruction of wildlife habitat and forest needed to absorb CO₂, increase in greenhouse gas emissions, pollution in run-off, etc.
 - c) excessive animal fat and red meat in diet, displacement from the diet of plants that provide essential nutrients and dietary fibre by increased meat consumption, etc.
10. Summary of points made in the video, including choice of land for efficient use, how this reduces environmental detriment of rearing meat, how correct choice of pasture creates relatively more healthy meat.
11. Vocabulary: answers should give examples (e.g. ‘experienced >99% mortality without reaching a harvestable size’ instead of ‘almost all died before they were big enough to eat’); the description of the study as designed to answer a specific, practical question rather than a more general scientific principle. Additional clues in the online version from the journal include the statistics in the complete abstract, and the nature of the journal.
12. Article should demonstrate understanding of the study findings and, if in favour of cricket consumption, should give reasons to counter the findings, either picking up in the final sentence about additional waste streams or finding other advantages such as ease of rearing insects in a small space, or superior taste.