

Data based questions: Nomograms and BMI

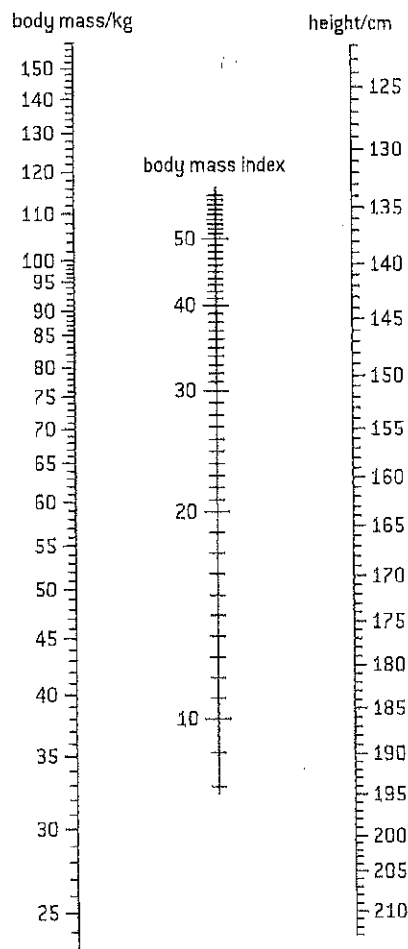
Use figure 11 to answer these questions.

- 1 a) State the body mass index of a man who has a mass of 75 kg and a height of 1.45 metres. [1]
b) Deduce the body mass status of this man. [1]
- 2 a) State the body mass of the person standing on the scales on the previous page. [1]
b) The person has a height of 1.8 metres. Deduce their body mass status. [1]
- 3 a) A woman has a height of 150 cm and a BMI of 40. Calculate the minimum amount of body mass she must lose to reach normal body mass status. Show all of your working. [3]



▲ Figure 10 Jogger

- b) Suggest two ways in which the woman could reduce her body mass. [2]
4. Outline the relationship between height and BMI for a fixed body mass. [1]



▲ Figure 11

Fatty acids

Fatty acids can be saturated, monounsaturated or polyunsaturated.

The basic structure of fatty acids was described in sub-topic 2.1. There is a chain of carbon atoms, with hydrogen atoms linked to them by single covalent bonds. It is therefore a hydrocarbon chain. At one end of the chain is the acid part of the molecule. This is a carboxyl group, which can be represented as -COOH .

The length of the hydrocarbon chain is variable but most of the fatty acids used by living organisms have between 14 and 20 carbon atoms. Another variable feature is the bonding between the carbon atoms. In some fatty

Analysis of data on health risks of lipids

Evaluation of evidence and the methods used to obtain the evidence for health claims made about lipids.

An evaluation is defined in IB as an assessment of implications and limitations. Evidence for health claims comes from scientific research. There are two questions to ask about this research:

- 1 Implications – do the results of the research support the health claim strongly, moderately or not at all?
- 2 Limitations – were the research methods used rigorous, or are there uncertainties about the conclusions because of weaknesses in methodology?

The first question is answered by analysing the results of the research – either experimental results or results of a survey. Analysis is usually easiest if the results are presented as a graph or other type of visual display.

- Is there a correlation between intake of the lipid being investigated and rate of the disease or the health benefit? This might be either a positive or negative correlation.
- How large is the difference between mean (average) rates of the disease with different levels of lipid intake? Small differences may not be significant.

- How widely spread is the data? This is shown by the spread of data points on a scattergraph or the size of error bars on a bar chart. The more widely spread the data, the less likely it is that mean differences are significant.
- If statistical tests have been done on the data, do they show significant differences?

The second question is answered by assessing the methods used. The points below refer to surveys and slightly different questions should be asked to assess controlled experiments.

- How large was the sample size? In surveys it is usually necessary to have thousands of people in a survey to get reliable results.
- How even was the sample in sex, age, state of health and life style? The more even the sample, the less other factors can affect the results.
- If the sample was uneven, were the results adjusted to eliminate the effects of other factors?
- Were the measurements of lipid intake and disease rates reliable? Sometimes people in a survey do not report their intake accurately and diseases are sometimes misdiagnosed.

Data-based questions: Evaluating evidence from a health survey

The Nurses' Health Survey is a highly respected survey into the health consequences of many factors. It began in 1976 with 121,700 female nurses in the USA and Canada, who completed a lengthy questionnaire about their lifestyle factors and medical history. Follow-up questionnaires have been completed every two years since then.

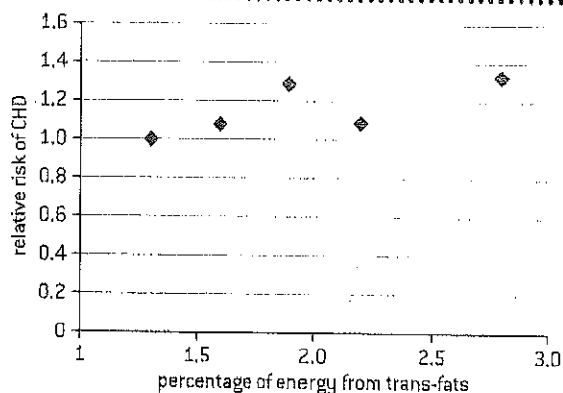
Details of the methods used to assess diet and diagnose coronary heart disease can be found by reading a research paper in the *American Journal of Epidemiology*, which is freely available on the internet: Oh, K, Hu, FB, Manson, JE, Stampfer, MJ and Willett, WC. (2005) Dietary Fat Intake and Risk of Coronary Heart Disease in Women: 20 Years of Follow-up of the Nurses'

Health Study. *American Journal of Epidemiology*, 161:672–679. doi:10.1093/aje/kwi085

To assess the effects of trans-fats on rates of CHD, the participants in the survey were divided into five groups according to their trans-fat intake. Quintile 1 was the 20% of participants with the lowest intake and quintile 5 was the 20% with the highest intake. The average intake of trans-fats for each quintile was calculated, as a percentage of dietary energy intake. The relative risk of CHD was found for each quintile, with Quintile 1 assigned a risk of 1. The risk was adjusted for differences between the quintiles in age, body mass index, smoking, alcohol intake, parental

history of CHD, intake of other foods that affect CHD rates and various other factors. Figure 18 is a graph showing the percentage of energy from trans-fats for each of the five quintiles and the adjusted relative risk of CHD. The effect of trans-fat intake on relative risk of CHD is statistically significant with a confidence level of 99%.

- 1 Suggest reasons for using only female nurses in this survey. [3]
- 2 State the trend shown in the graph. [1]
- 3 The mean age of nurses in the five quintiles was not the same. Explain the reasons for adjusting the results to compensate for the effects of age differences. [2]
- 4 Calculate the chance, based on the statistical tests, of the differences in CHD risk being due to factors other than trans-fat intake. [2]
- 5 Discuss evidence from the graph that other factors were having some effect on rates of CHD. [2]



▲ Figure 18

Data-based questions: Saturated fats and coronary heart disease

Populations ranked by % calories as saturated fat		E. Finland	W. Finland	Zutphen	USA	Slavonia	Belgrade	Crevalcor	Zrenjanin	Dalmatia	Crete	Montegiorgio	Veitka	Rome	Corfu	Ishibuka	Tanushimaru
% Calories as saturated fat		22	19	19	18	14	12	10	10	9	9	9	9	8	7	3	3
Death rate/100,000 yr ⁻¹	CHD	992	351	420	574	214	288	248	152	86	9	150	80	290	144	66	88
	All causes	1727	1318	1175	1088	1477	509	1241	1101	758	543	1080	1078	1027	764	1248	1006

▲ Table 2

- 1 a) Plot a scattergraph of the data in table 2. [5]
b) Outline the trend shown by the scattergraph. [2]
- 2 Compare the results for:
 - a) East and West Finland; [2]
 - b) Crete and Montegiorgio. [2]
- 3 Evaluate the evidence from this survey for saturated fats as a cause of coronary heart disease. [4]

is liquid at body temperature, it can also act as a shock absorber. This is the reason for adipose tissue around the kidneys and some other organs.

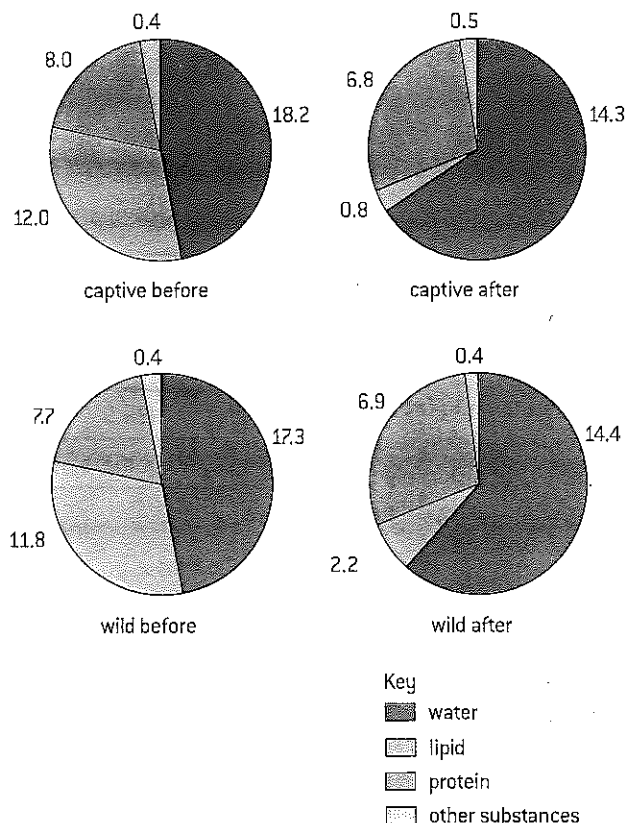
Glycogen is the carbohydrate that is used for energy storage, in the liver and in some muscles. Although lipids are ideal for long-term storage of energy, glycogen is used for short-term storage. This is because glycogen

can be broken down to glucose rapidly and then transported easily by the blood to where it is needed. Fats in adipose tissue cannot be mobilized as rapidly. Glucose can be used either in anaerobic or aerobic cell respiration whereas fats and fatty acids can only be used in aerobic respiration. The liver stores up to 150 grams of glycogen and some muscles store up to 2% glycogen by mass.

Data-based questions: Emperor penguins

During the Antarctic winter female Emperor penguins live and feed at sea, but males have to stay on the ice to incubate the single egg the female has laid. Throughout this time the males eat no food. After 16 weeks the eggs hatch and the females return. While the males are incubating the eggs they stand in tightly packed groups of about 3,000 birds. To investigate the reasons for standing in groups, 10 male birds were taken from a colony at Pointe Geologie in Antarctica. They had already survived 4 weeks without food. They were kept for 14 more weeks without food in fenced enclosures where they could not form groups. All other conditions were kept the same as in the wild colony. The mean air temperature was -16.4°C . The composition of the captive and the wild birds' bodies was measured before and after the 14-week period of the experiment. The results in kilograms are shown in figure 8.

- Calculate the total mass loss for each group of birds. [2]
 - wild
 - captive
- Compare the changes in lipid content of the captive birds with those of the birds living free in the colony. [2]
- Besides being used as an energy source, state another function of lipid which might be important for penguin survival. [1]



▲ Figure 8



