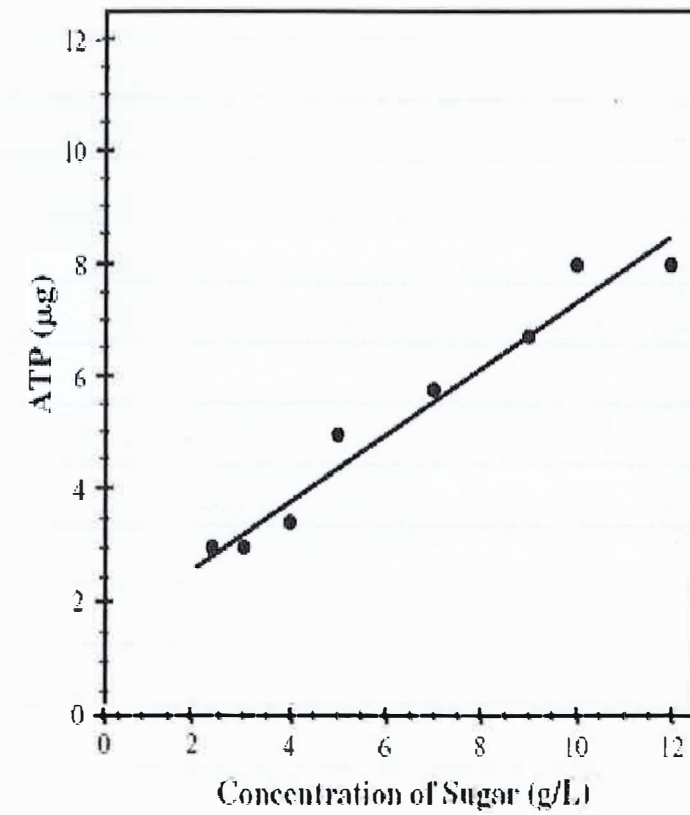


DATA  
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1

An investigation of the effect of sugar on the rate of respiration of muscle cells. Respiration is the reaction between glucose and oxygen to produce carbon dioxide and water. It is an essential reaction for life as it releases energy for use by the cell. The energy is released in a chemical form as ATP (Adenosine TriPhosphate) molecules.

Effect of Sugar on ATP Production in Muscle Cells



Independent variable - Concentration of Sugar

Dependent variable - ATP production

Units - grams/Litre, g/L

- ~~µ~~ micrograms, µg ( $1 \times 10^{-6}$  g, or 0.000001g)

NB There is a second "trend", ATP production is ~~above~~ ~~zero~~ predicted to be above zero at a conc of sugar of 0 g/L (this is y axis intercept). Not actually a "trend" but an interesting prediction from the trend/relationships should be used as a second "insightful interpretation" at the end of the paragraph on the trend.

Only 1 method of determining uncertainty was used - others not possible.

### Identifying Trends and Relationships

As the concentration of sugar increases, the production of ATP increases. The trend line is linear, showing a constant increase in ATP production as concentration increases. The relationship describing the trend line is:

$$\text{ATP} = 0.62 \times \text{sugar concentration} + 1.5$$

The lowest concentration of sugar of 2.5 g/L produced only 3  $\mu\text{g}$  of ATP. The highest concentration of sugar of 12 g/L produced a much higher 8  $\mu\text{g}$  of ATP. This means the respiration in a mitochondrion is very dependent on the concentration of sugar available to it.

### Identifying Uncertainty and Limitations

There is only a small amount of uncertainty in the data. The data points are reasonably close to the trend line and therefore the data forms a consistent trend.

One limitation within the data is the range of sugar concentration. ATP production is not likely to continually increase at very high sugar concentrations. There is a natural limit to how much work a muscle can do, even at very high sugar levels. In other words, it is very likely that the trend line changes at very high sugar levels, and will reduce to a slope of zero (horizontal line). The experiment should have identified the sugar concentrations where this effect occurs.



should explain the source of this error, but since we do not know the method, it is very difficult to do so.

should discuss "low sugar" scenario.

## Conclusion

Muscle performance is proportionally dependant on the sugar concentration in the blood. The trend line is linear, showing ATP (energy) production constantly increases with sugar concentration. The relationship is best described by:

$$\text{ATP production} = 0.62 \times [\text{sugar}] + 1.5$$

This suggests that increasing sugar consumption prior to athletic events should lead to an improved performance by athletes.

The data also suggests the ATP production exists even at zero sugar concentration. ATP production was predicted at 1.5  $\mu\text{g/l}$  at 0.0  $\text{g/L}$  of sugar. This means there may be an alternative pathway for making ATP in muscle tissue.

## Evaluation of Reliability and Validity

The data appears reliable. There was no stated uncertainty in the data, however the data did form a consistent pattern and closely matched a linear trend. The uncertainty present appears to be a result of random experimental error.

The conclusions reached have a significant degree of validity, but are limited in their application to real life scenarios. Ideally the investigation should have identified the very high sugar concentrations where ATP stops increasing. This would assist athletes by allowing them to more accurately judge sugar intake.