The effect of sodium acetate ingestion on acid-base balance and resting metabolism in man.

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The consumption of a high-protein diet has been shown to have an acidifying effect on blood acid-base status, primarily due to the metabolism of sulphur containing amino acids (Greenhaff et al., 1988). In contrast, it has been clearly established that long-term adherence to a vegetarian diet has an alkalinising effect on urinary acid-base status (Ball and Maughan, 1997). While the ingestion of the sodium salts of weak organic acids has been shown to produce a mild metabolic alkalosis the metabolic consequences of the changes in acid-base status have been relatively ignored (Ball and Maughan, 1993). We hypothesised that the administration of the sodium salt of acetic acid would suppress fat metabolism despite the favourable shift in acid-base balance towards increasing lipolysis. In two separate studies we have investigated the effect of sodium acetate ingestion on acid-base balance and resting metabolism. In the first study 6 healthy individuals volunteered to ingest a bolus dose (2 mmol/kg body mass) of either sodium acetate or sodium citrate and over the following 90 min the changes in acid-base status were measured using arterialised-venous blood samples and substrate utilisation from samples of expired air. In a second study the use of labelled ^{13}C acetate provided a means of calculating the amount of ingested acetate that was oxidised at rest. In this study 8 healthy volunteers ingested either sodium acetate or sodium bicarbonate ($NaHCO_3$) at a dose of 2 mmol/kg b.m. and over the following 180 min the acid-base and metabolic effects of ingesting the sodium salts were measured. In both studies we found that the ingestion of the sodium salts induced a mild metabolic alkalosis. However, dependent upon the sodium salt that was administered the metabolic effect differed significantly. Ingestion of sodium citrate had no effect on resting substrate utilisation but following sodium acetate ingestion (2 mmol/kg b.m) there was a 30% decrease in fat utilisation that appeared to be accounted for by the oxidation of acetate. The ingestion of an equimolar dose of $NaHCO_3$ induced a metabolic alkalosis which had the effect of increasing fat utilisation. Using the ^{13}C labelled acetate it was found that 80% of ingested acetate was oxidised over the 180 min period but in contrast to the first study there was no significant effect of acetate ingestion on fat oxidation when compared with the pre-ingestion value. Fat utilisation was, however, significantly lower in the sodium acetate trial when compared to that following $NaHCO_3$ ingestion.

References

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