

CAMPAÑA PANAMERICANA DE CONSUMO DE LÁCTEOS



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Milk is a nutrient dense foodstuff containing water, carbohydrate, protein, electrolytes and other components that may be beneficial to individuals participating in sport and exercise. In recent years a number of studies have been undertaken to investigate whether there are any benefits to consuming milk as a “sports drink”. The aim of these studies was to examine some possible applications of milk to the sports performer. In particular the effects of milk on exercise capacity and post-exercise recovery have been examined.

The first in this series of experiments investigated the effect of milk on exercise capacity, compared to the ingestion of a commercially-available sports drink and water (Lee et al, 2008). The effects of fluid intake during prolonged exercise have been extensively studied but at present there exists little information on the effects of milk-based drinks on the response to prolonged exercise. Thus, the purpose of this study was to investigate the effects of milk-based drinks on exercise capacity.

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Eight healthy males (age 24 ± 4 y, height 1.76 ± 0.04 m, mass 68.9 ± 9.5 kg, body fat $12.5 \pm 2.4\%$, peak oxygen consumption 4.3 ± 0.6 L/min) exercised to volitional exhaustion at 70% peak oxygen consumption on four occasions. Subjects ingested 1.5 mL/kg body mass of plain water, a carbohydrate-electrolyte solution, low-fat (0.1%) milk, or low-fat (0.1%) milk with added glucose before and every 10 min during exercise. The effect of the drink on exercise capacity and the cardiovascular, metabolic, and thermoregulatory responses to prolonged exercise were examined. The results showed that exercise time to exhaustion was not significantly influenced by the drink ingested ($P=0.19$), but there was a tendency for subjects to exercise longer when the carbohydrate-electrolyte, milk, or milk plus glucose was ingested compared with water (Figure 1). The solution ingested did not influence the cardiovascular, metabolic, or thermoregulatory response to exercise.

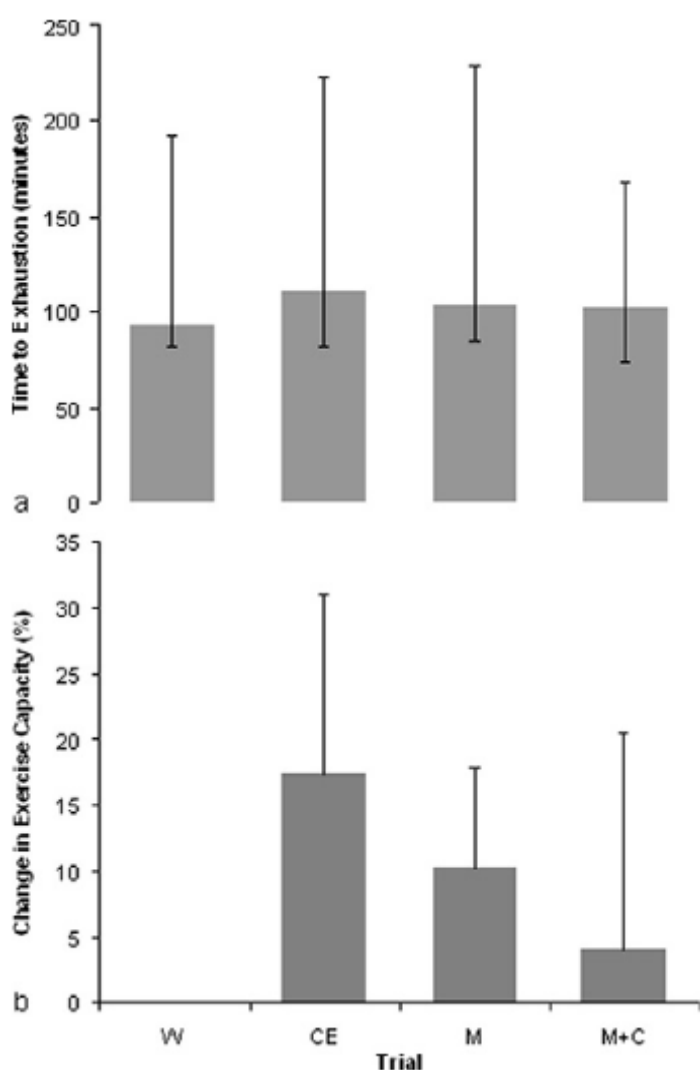


Figure 1

a) Exercise time to exhaustion at 70% peak oxygen consumption per unit time during the experimental trials (median \pm range).

(b) Percentage difference in exercise capacity compared with the W trial.

CE: carbohydrate electrolyte trial;
M: milk trial;
M+C: milk plus carbohydrate trial;
W, water trial.

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Therefore, in conclusion, the results of this study suggest that although the low-fat milk-based fluids did not enhance exercise capacity over that seen with the ingestion of plain water, the effect was comparable to that observed with a carbohydrate-electrolyte “sports drink” beverage.

During exercise sweat loss generally exceeds fluid intake so a hypohydrated state at the end of exercise is normal. When undertaking regular exercise, any fluid deficit that is incurred during one exercise session can potentially compromise the next exercise session if adequate fluid replacement does not occur. Sweat-induced dehydration can have detrimental effects on physiological function and subsequent exercise performance and post-exercise restoration of fluid balance can help minimise this. While it is relatively easy to ensure sweat losses are replaced when exercise is performed infrequently (e.g. once per day or less), when training twice in a day, effective restoration of fluid balance may need special attention. Given the tendency for individuals to fail to match sweat losses during exercise and the relative importance of ensuring the restoration of whole-body fluid balance before the start of a subsequent bout of exercise, post-exercise rehydration has been extensively investigated over the past 15 years. It is clear that the electrolyte content of the drink consumed plays a key factor in the rehydration process, with the fraction of fluid retained directly related to the amount of ingested sodium. There is also some limited evidence that the addition of potassium in the ingested solution can aid the restoration of fluid balance following exercise-induced dehydration. Obligatory urine production, which is necessary to ensure the elimination of non-volatile metabolic waste products, continues even when an individual is in a state of hypohydration. Additionally, the ingestion of large volumes of fluid, in particular solutions with little or no solute content, results in the stimulation of diuresis due to a fall in serum osmolality and a transient increase in plasma volume. Therefore it is clear that the volume of fluid ingested after exercise must be greater than the volume of sweat lost, with evidence suggesting that a volume equal to around 150% of the body mass lost should be consumed to ensure adequate restoration of fluid losses.

Much of the work in this area has focused on the use of experimental solutions prepared in a laboratory, rather than adopting drinks that can be commonly found in the home. Milk is a potential candidate for an effective post-exercise solution, given its naturally high electrolyte content and the presence of carbohydrate in a concentration similar to many commercially available sports drinks.

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Therefore, a study was undertaken to investigate the effectiveness of low-fat milk at restoring whole-body net fluid balance following mild exercise-induced dehydration (Shirreffs et al, 2007). The response to milk ingestion (M) was compared to water (W), a commercially available sports drink (CE) and milk with additional NaCl (M+NaCl). Milk with additional NaCl was investigated because, as described earlier, it has previously been shown that the effectiveness of a drink at achieving fluid retention after exercise-induced dehydration is in direct relationship to the amount of sodium in the drink, at least up to a concentration of 100 mmol/l. Inclusion of the milk with added NaCl allowed us to investigate if the same type of linear relationship is apparent when the drink contains more nutrients and food compounds. The effectiveness of low-fat milk, alone and with an additional 20 mmol/L NaCl, at restoring fluid balance after exercise-induced hypohydration was compared to a sports drink and water. After losing 1.8 ± 0.1 % of their body mass during intermittent exercise in a warm environment, eleven subjects consumed a drink volume equivalent to 150% of their sweat loss. Urine samples were collected before and for 5 h after exercise to assess fluid balance. Urine excretion over the recovery period did not change during the milk trials whereas there was a marked increase in output between 1 and 2 h after drinking water and the sports drink. Cumulative urine output was less after the milk drinks were consumed (611 ± 207 and 550 ± 141 mL for milk and milk with added sodium, respectively, compared to 1184 ± 321 and 1205 ± 142 mL for the water and sports drink; $P < 0.001$). Subjects remained in net positive fluid balance or euhydrated throughout the recovery period after drinking the milk drinks (Figure 2) but returned to net negative fluid balance 1 h after drinking the other drinks.

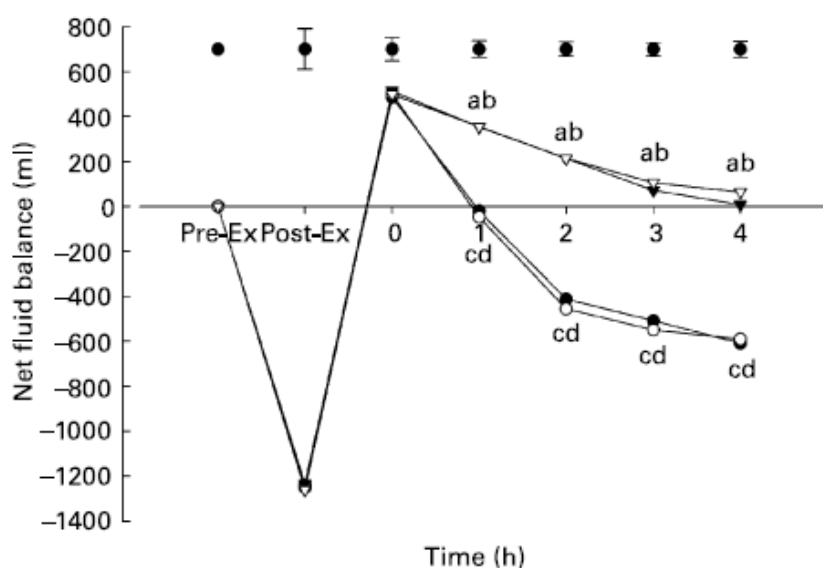


Figure 2

Whole body net fluid balance over the course of the protocol (● trial W; ○ trial CE; ▼ trial M, milk; △ trial M+NaCl. Values are means with group standard errors depicted by vertical bars. a,b,c,d Mean values are significantly different from corresponding values in W, CE, M and M+NaCl trials respectively.

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The results of this study suggest that milk can be an effective post-exercise rehydration drink and can be considered for use after exercise by everyone except those individuals who have lactose intolerance.

Following this and using a similar study protocol, Watson et al (2008) induced a $2.0 \pm 0.1\%$ body mass loss by intermittent exercise in the heat in seven male volunteers who then ingested either a carbohydrate–electrolyte solution (CE) or skimmed milk (M) in a volume equal to 150% of body mass loss. At the end of the 3 h recovery period, subjects were essentially in positive fluid balance on trial M (191 ± 162 mL) and euhydrated on trial CE (135 ± 392 mL) despite being in negative sodium balance on both trials and negative potassium balance on trial CE. This difference of 326 ± 354 mL or 0.4% body mass approached significance ($P=0.051$). Subjects ingested 137 ± 15 and 113 ± 12 g of CHO during the CE and M trials, respectively, as well as 75 ± 8 g of protein during the M trial. At the end of the 3 h recovery period, an exercise capacity test was completed at 61% VO_2 peak in warm ($35.3 \pm 0.5^\circ\text{C}$), humid ($63 \pm 2\%$) conditions. HR ($P=0.020$) and rectal temperature ($P=0.045$) were higher on trial M, but no difference in exercise time to exhaustion was observed between trials (39.6 ± 7.3 min vs. 39.7 ± 8.1 min on trials CE and M, respectively). The results of the present study suggest that milk can be an effective post-exercise rehydration drink, with subjects remaining in net positive fluid balance throughout the recovery period. Despite the effect on fluid retention, exercise capacity was not different between skimmed milk and a commercially available carbohydrate-electrolyte drink 4 h following exercise/heat-induced body mass loss.

Therefore, in each of these studies an interesting finding is that milk performed equally as well, or better than, a commercially-available sports drink formulated specifically and marketed for the sports performer.

References

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