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Milk : A new sport drinking

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Abstract

Milk is a recovery beverage that enhances recovery and either maintains or improves the athlete's workout is highly desired. Acute consumption of far – free fluid milk after resistance exercise promotes a greater positive protein balance.Milk contains high – quality protein and essential amino acids that maybe particularly beneficial in building and maintaining muscle mass when combined with exercise. Can after exercise can help increase lean muscle, improve body composition and reduce damage from exercise. Drinking milk after resistance exercise has been shown to help with protein metabolism. Athletic men and women who drank milk one hour after a resistance exercise, a significant increase in the measured amino acids (phenylalanine and threonine), which is representative of net muscle protein synthesis.

Keywords: Milk, sport, Drinking

INTRODUCTION

Definition:
Sport drinks are different things to different people.By definition, a drink is a liquid substance and as such, water is a main ingredient .How ever, in a sports drink a variety of nutrients and other substances will be dissolved in the water to make the final consumed product.The main role of sports drinks to provide a large amount of water in addition to other components which could be obtained from foodThe majority of sports drinks generally have a carbohydrate content of 6% to 9% weight/ volume and contain small amounts of electrolytes, such as soflum. the main aim or aims of sports drink consumption do vary according to the exercise situation, but are likely to be one or more of the following: to stimulate rapid fluid absorption, to supply carbohydrate as a substrate for use during exercise

To speed rehydration
To reduce the physiological stress of exercise, and to promote recovery after exercise.It is certainly the case that hypohydration of only 1% of body mass has a measurable effect on the thermoregulatory response to exercise. Sever dehydration can result in a life threatening situation , and this scenario is rendered more likely when the ambient temperature is high. such extremes of water depletion should not occur in any athlete in the case of sports competition if a conscious effort is made to ensure adequate fluid replacement.However, even if a conscious effort is made to ensure adequate fluid replacement. However, even if the health concerns are ignored, the effects on performance of a fluid decrement should be enough to persuade all individuals to attempt to remain fully hydrated at all times, and particularly to ensure that they begin each bout of exercise in a water replete state.In addition to flavours and colourings , the traditional ingredients of sports drinks are water , carbohydrate, sodium and potassium.

However, even if the health concerns are ignored, the effects on performance of a fluid decrement should be enough to persuade all individuals to attempt to remain fully hydrated at all times, and particularly to ensure that they begin each bout of exercise in a water replete state.However, some commercially available sport drinks do have numerous other non- traditional ingradients including carbohydrate derivatives (fibre , pyruvate , lactate), protein and protein derivatives (intact protein , branched chain amino acids ,individual amino acids, keto-analogues , creatine , carnitine) fats (glycerol , medium chain traicyglycerols, choline), micronutrients (B vitamins, antioxidant vitamins , chromium and venadium, oxygenated fluids) and non- nutritive ingredients (caffeine, bicarbonate buffers , herbs, gingeng , ciwujia , ginkgo biloba, hydroxycitric acid). full details of these can be found in a recent in depth publication on sports drinks(10)

The importance of sports drinks during exercise.

In any exercise task lasting longer than about 30 – 40 minutes, carbohydrate depletion, elevation of body temperature and reductions in the causing fatigue. All of these can be manipulated by the ingestion of fluids, but the most effective drink composition and the optimum amount of fluid will depend on individual circumstances. Water is not the optimum fluid for ingestion during endurance exercise, and there is compelling evidence that drinks containing added substrate and electrolytes are more effective.Increasing the carbohydrate content of drinks will increase the amount of fuel which can be made available (2). where provision of water is the priority, the carbohydrate content of drinks and their total osmolarity should below , thus restricting the rate at which substrate is provided.

The composition of drinks to be taken will thus be influenced by the relative importance of the need to supply fuel and water, which in turn depends on the intensity and duration of the exercise task, on the ambient temperature and humidity, and on the physiological and biochemical characteristics of the individual athlete.
Carbohydrate depletion will result in fatigue and a reduction in the exercise intensity which can be sustained , but is not normally a life – threatening condition. Disturbances in fluid balance and temperature regulation have potentially more serious consequences, and it maybe , therefore, that the emphasis for many participants in endurance events should be on proper maintenance of fluid and electrolyte balance.The optimum type and concentration of sugars to be added to drinks will depend on individual circumstances.high carbohydrate concentrations will delay gastric emptying, thus reducing the amount of fluid that is available for absorption very high concentrations will also result in secretion of water into the intestine and thus temporarily increase the danger of dehydration (12) perhaps because of this effect, high sugar concentrations (>10%) may result in an increased risk of gas tro- intestinal disturbances. Where there is a need to supply an energy source during exercise, however, increasing the sugar content of drinks will increase the delivery of carbohydrate to the site of absorption in the small intestine.

The available evidence indicates that the only electrolyte that should be added to drinks consumed daring exercise is sodium, which is usually added in the form of sodium chloride, but which may also be added as sodium citrate or other salts. The use of citrate rathe than chloride helps stabilise PH and effects taste.sodium will stimulate sugar and water uptake in the small intestine and will help to maintain extracellular fluid volume as well as maintaining the drive to drink by keeping plasma osmolality high (17).

As is clear from table 1, most soft drinks of the cola or lemonade variety contain virtually no sodium (1-2 m.mol.1-1), and drinking water is also essentially sodium- free; sport drinks commonly contain 10-30 mmol 1-1 sodium and oral rehydration solutions intended for use in the treatment of diarrhoea- induced dehydration have higher sodium concentrations;

In the range 30-90 mmol1-1. A high sodium content may be important in stimulating jejunal absorption of glucose and water, but it tends to make drinks unpalatable. Drinks intended for ingestion during or after exercise, when thirsty may be suppressed and large volumes must be consumed , should have a pleasant taste in order to stimulate consumption. Sports drinks must, there for, strike a balance between the twin aims of efficacy and palatability. hyper thormia and hyperna traemia are relatively common in endurance events held in the heat, and often effect the less well prepared participants. It has , however, become clear that a small number of individualsat the end of very prolonged events maybe suffering from hyponatraemia: this maybe associated with either hyperhydration or dehydration.

The total number of reported cases is rather small, and the great majority of these have been associated with ultramarathon or prolonged triatblon events; there are few reports of cases of exercise-associated hyponatraemia where the exercise duration is less than th. many of the drinks consumed in endurance events, whether plain water, soft drinks, or sports beverages have relatively little or no electrolyte content.

Even among the carbohydrate electrolyte drinks intended for consuinption by sports men and women during prolonged exercise, most have a low electrolyte content, with sodium concentrations typically in the range of 10-25 mmol.1-1 This is adequate in most situations, but may not be so when sweat losses and fluid intakes are high. Some supplementation with sodium chloride in amounts beyond those normally found in sport drinks maybe required in extromely prolonged events where large sweat losses can be expected and where it is possible to consume large volumes of fluid. It remains true, however, that electrolyte replacement during exercise is not apriority for most parcitcipants in most sporting events. Extra salting of food is an effective strategy for athletes living and training hard in hot weather conditions.

Performance effects

Many of the published studies investigating the effects of fluid ingestion on exercise performance have failed to include appropriate control trials that allow the separate effects of fluid ingestion on exercise performance or a beneficial effect. In many cases, the absence of a statistically significant effect simply reflects the variability in the assessment methods used and inadequate subject numbers. There seems to be a lessened hyperthermia and cardio vascular drift during prolonged moderate intensity exercise (4,18,1).Which is attributed to fluid replacement during the exercise. A better maintenance of blood glucose, which can be used by the exercsing muscles with a consequent reduction in the need for mobilisation of the limited liver glycogen reserves (9,11) appears to be the major benefit of carbohydrate consumption during exercise. The studies that have reported adverse effects of fluid ingestion on exercise performance have generally been studies in which the fluid ingestion has resulted in gastro – intestinal disturbances .Drinking plain water can improve performance in endurance exercise, but there are further performance improvements when carbohydrate and electrolytes are added.

The study of below et al .(1995).Attempted to distinguish between the effects of carbohydrate provision from the water replacement properties of a drink. sport drinks after exercise:The primary factors influencing the post-exercise rehydration process are the volume and composition of the fluid consumed. The volume consumed will be influenced by many factors, including the palatability of the drink and its effects on the thirst mechanism, although with a conscious effort some people can still drink large quantities of an unpalatable drink. when they are not thirsty.

The ingestion of solid food, and the composition of that food, may also be important factors, but there are many situations where solid food is avoided by some people between exercise sessions or immediately after exercise.

Milk

Milk is a nutrient dense foodstuff containly water, carbohydrate, protein, electrolytes and other components that maybe 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 sport drink especially following both strength and endurance sports. This search saggests that milk is an effective recovery beverage after exercise that results in favourable short-term changes in protein metabolism with possible long- term benefit. Milk consumption acutely increases muscle protem synthesis, lending to an improved not muscle protein balance. Milk intake following resistance training (12 weeks minimum) can lead to greater increases in muscle size and lean mass in both young man and women research on milk intake after endurance exercise is limited, but suggests milk as an effective post – exercise beverage for endurance activities in regards to carbohydrate and fluid recovery. Milk intake after exercise also attenuates muscle damage.

Milk represents a more nutrient dense beverage choice for strength and endurance athletes, compared to more traditional sports drinks. Low- fat milk a safe and effective post exercise beverage for most individuals, except its favourable effects is an exciting area for future investigation .

Take a look at how the unique pack age of nutrients in milk can benefit othletes:

- **Protein** to help build muscle and reduce muscle breakdown
- **Carbohydrates** to refuel muscles (restore muscle glycogen)
- **Electrolytes**, including calcium, potassium and magnesium , to replenish what is lost in sweat .
- **Fluid** to help rehydrate the body
- **Calcium and vitamin** b to strengthen bones
- **B vitamins** to help convert food to energy
- **Nine essential nutrients,** including additional

Nutrients not typically found in tradition al sports drinks

Milk and resistance exercise and training

Resistance sports and resistance training/ exercise are characterized by repeated sets of high intensity contractions of different muscle groups that leads to well characterized adaptions in worked muscles (6) The most consistent adoptions are skeletal muscle hypertrophy (increase in muscle size) and increased strength.

For increases in muscle hypertrophy to occur there must be a chronic increase in muscle protein net balance. Muscle protein net balance represents the difference between muscle protein synthesis and muscle protein breakdown, But the increases in synthesis are greater than the increases in breakdown (4). In terestingly, the result from Philips et al showed that the net balance was still negative , and this was attributed to the participants being in a fasted state (4). Therefore, these observations also emphosise the importance of supplying nutrition following this form of exercise to positively influence protein metabolism.There have been several research studies that have investigated the provision of macronutrients soon after resistance exercise in an attempt to optimize the protein metabolic response. The various studies have looked at the intake of amino acids (12) ,protein (17) carbohydraties (17) (4-16) or mixed macronutrient compounds (15-19) following resistance exercise. More recent research studies have directly investigated the impact of low- fat milk consumption on the acute protein metabolic response following resistance exercise.
One recent study looked at the influence of consuming various milk beverages on the protein metabolic response following a single session of resistance exercise (3) they compared non- fat milk (237g) whole milk (237g) and an amount of non- fat milk with the same a mount of energy(kg) as the whole milk (393g) following a bout of leg resistance exercise.

They measured amino acid net balance across the exercise leg for 5 hours following the exercise. All of the different milk beverages increased the net balance of the measured amino acids. This study did not determine what contributed to the change in net balance change in synthesis, change in breakdown, or both), however, the evidence did show that protein metabolism was improved with milk after other resistance exercise. research has shown that consumption of fat- free milk increases protein net balance through an increased rate of muscle protein synthesis after resistance exercise (21). The increase in protein net balance and muscle protein synthesis was greatest after consuming soo mlof fat- free milk as compared to a soy- protein beverage that contained the same amount of energy and protein as the milk (745 kg) 18.2 g protein , 1/59 fat, and 23g carbohydrate the authors suggested that this might have been due to the differences in digestion of the soy based drink as compared to the milk. The soy based beverage was digested and absorbed much more rapidly leading to a large spike in the blood concentrations of amino acids possibly shuttling them to plasma protein and urea synthesis (21).Whereas with the fat- free milk the elevation in blood amino acids was more sustained, providing a more prolonged delivery of amino acids to the worked muscles for protein synthesis.

Collectively, based on current scientific research it well established that milk beverages when consumed soon after resistance exercise, can lead to enhanced improvements in protein metabolism such acute improvements in protein net balance and synthesis could possibly lead to more enhanced or more rapid chronic adaptions that occur with resistance training if repeated after every training session.

A number of research studies have investigated the long term influence of milk consumption after resistance training.Another study shown that influence of the combined effect of resistance training (3 days week for 18 months) and the intake of 400 ml/ day of reduced-fat 1%ultrahigh temperature (UHT) milk in middle aged and oldermen (18). they did not observe any benefits to combining the milk intake with training as compared to training or milk intake alone. This is in contrast to the previously discussed training studies (5,6), but there were a number of notable differences between these various studies.

Firstly , the studies investigated very different populations (young , university aged rs. Middle aged and older). However, there is growing evidence that despite the age of an individual resistance training can lead to beneficial adaptations in skeletal muscle (19) secondly, the training programs were not consistent and varied in intensity and exercise performed. However, all were effective in inducing increases instrength. Finally, the volume and type of milk consumed in the studies was different. Kukuljan et al. provide 2 ×200 ml of Uht1%milk,consumed 200 ml in the morning and 200 ml in the evening , while the hartman et al. and josse et al studies provided 2×500 ml of skim milk immediately after the exercise.These differences suggest that the time of the intake of milk after training maybe critical in facilitating the beneficial effects previously described, and or the volume of milk consumed may also be influential

Another study, the effectiveness of low. Fat milk at promoting the restoration of wholo- body net fluid balance after exercise induced dehydration was investigated. The results suggest that milk is more effective at replacing sweat losses and maintaining euhydration than plain water or a commercially available sports drink following exercise induced dehydration by approaimately 2% of initial body mass. However, there was no further benefit gained by adding an additional 20 mmol 1 NaCl to the milk.

The ingestion of water and carbohydrate -electrolyte solution resulted in a marked diuresis during the zh following. drinking but, this response was not apparent during the M and M+ Na + rials. Consequently ,at the end of the 4h recovery period a 600 ml difference in whole body net fluid balance was apparent between the milk trails and the w and CE trails. It is likely that a difference of this magnitude would not be sufficient to influence exercise performed in temporate conditions.

The electrolyte content of the test drinks may be largely responsible for the differences seen, it is likely that the milk emptied from the stomach at a slower rate than the water and sports drink. This sin turn, may have implications for subsequent fluid balance milk has a higher energy density than both water and the sports drink, largely due to the presence of protein and fat in addition to the carbohydrate (energy density has been shown to be one of the most important variables that regulate the rate at which important to ensure that fluid losses accrued during exercise are replaced prior to the performance of a subsequent exercise bout.(10).

Another research has shown that milk ingestion stimulates net muscle protein synthesis following resistance exercise milk ingestion stimulated net uptake of phenylatanine and threonine representing net muscle protein synthesis following resistance exercise. Net muscle protein balance changed from negative to positive indicating muscle anabolism following milk ingestion.

Table 1. Composition and energy content of experimental drinks*

(Mean values and standard deviations)

	Water		CE		Milk		Milk + Na	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Carbohydrate (g/l)	0		60±		50±		50±	
Fat (g/l)	0		0		3		3	
Protein (g/l)	0		0		36		36	
Energy density (kJ/l)	0		1020		1480		1480	
Sodium (mmol/l)	0.3	0.5	23.0	0.7	38.6	1.7	58.0	1.5
Potassium (mmol/l)	0.0	0.0	2/0	0.0	45.2	1.7	47.0	2.5
Chloride (mmol/l	0	0	1	0	35	1	55	2
Osmolality (mosmol/kg)	0	0	283	2	299	3	354	4

CE, carbohydrate–electrolyte sports drink (Powerade); Milk þ Na, milk with added NaCl.
**Macronutrient content and energy density were obtained from the manufacturers and the Dairy Council, UK. Drink electrolyte content and osmolality were measured in the laboratory.*
†Glucose and maltodextrin.
‡ Lactose.

The impact of individual nutrients especially amino acids (6, 14/22), proteins (21) and carbohydrates (5/14) and the combination of these nutrients (5,14) on the response of net muscle protein balance following resistance exercise has been examined previously. Net muscle protein balance maybe increased by increasing muscles protein synthesis or decreasing protein breakdown.

The increase in insulin in response to milk ingestion also may have contributed to the increase in net muscle protein synthesis by deceasing muscle protein breakdown (4) thus, It is not difficult to accept that net muscle protein synthesis resulting from ingestion of milk following resistance exercise stems from both increased muscle protein synthesis and decreased muscle protein breakdown.

Milk and endurance exercise and training

In genera endurance is one of the basic components of physical fitness.As a results most athletes have to possess some degree of muscular and cardiorespiratory endurance to perform in their respective sports. Muscular endurance is the ability of a muscle or group of muscles to repeatadly develop or maintain force without fatiguing. cardiorespiratory endurance is the ability of the cardiovascular and respiratory systems to deliver blood and oxygen to working muscles to perform continuous exercise.

From a sport nutrition, there are three different situations when nutrition is considered for endurance based activities, before exercise, during exercise and after exercise .

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.

A study was undertaken to investigate the effectiveness of low- fat milk at restoring whole- body net fluid balance following mild exercise- induced dehydration (20) 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.The result 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.(20).

During endurance exercise, dietary intake of milk leads to similar responses in many physiological variable as compared to the intake of carbohydrate based sports drinks. Increased concentration of essential amino acids (15) which is not unexpected based.

On the protein content of milk. That leads to a reduction in whole body protein breakdown and protein synthesis and a simultaneous increase in protein oxidation following exercise when milk is consumed during prolonged exercise (15). The decline in whole body protein synthesis might be related to preferential oxidation of the ingested protein during the exercise possibly decreasing amino availability for synthesis after the exercise (21).Participants do report greater feeling (8).of to mach fullness with milk as compared to water or carbohydrate based beverages (22). Increase in stomach fullness suggest that the rate of fluid intake may have been greater than gastric emptying (8). Rates of gastric emptying have been shown to decline with increased energy density of the fluid consumed (10).

At the time, the critical recovery beverage following an endurance exercise BOUT was carbohydrate-based with some electrolytes tossed in for good measure fast forward to 2010 chocolate milk, the most popular flavord milk, has found a niche in the recovery routines of many different athletes and teams .Indead, milk- chocolate milk in particular can be found alongside other sports beverages in coolers in training farilites and at training (7).

While the positive effects of milk, as well as its isolated proteins are well documented in combination with strength traning.The role of milk in the diet of or as supplement for individuals involved in endurance and aerobic- based sports has received more attention in the scientific community over recent year.The importance of consuming carbohydrates following endurance exercise remains. Paramount for glycogen replenishment.However, the potential for protein to contribute to the recovery process following endurance exercise has emerged as a viable component of recovery nutrition protocols.Chocolat milks high- quality protein is an excellent source of essential amino acids to support muscle protein synthesis, and its carbohydrate contributes to glycogen replenishment (7).

Briefly, current scientific literature suggests that low- fat milk is an effective as commercially available sports drinks at recovery for performance.

REFERENCES

[1]- Bosch A .N .,Dennis S.C., Noakes T.D.: *J. Appl. Physiol* . 76:2364-2372,**1994**.
[2]- BIoLo, G., B. D. WILLIAMS, R. Y. FlEMING and R. R. WoLFE. *Diabetes* 48 : 949 – 957,**1999**.
[3]- Elloit, T. A., et al, *Med Sci Sport Exerc*, **2006**. 38(4) : p 667 – 74.
[4]-Hamilton M.T., Gonzalez –Alonso J., montoin S.J., COTLE E. F. : *J. Appl. Physiol* . 71:871-877, **1991**.
[5]- Hartman, J. W., et al. *Am Clin Nutr*, **2007**. 86(2) : p 313 – 81.
[6]- Joss, A. R., et al., *Med Sci Sport Exerc*, **2010**. 42(6) : p. 1122 – 30.
[7]- kukuljan, S., et al., *J.Appl.Physial* , **2009**. 707 (6) L P.18 64-73.
[8]- Lee, J. K., et al. *Nutrition*, **2008**. 24(4) : p 340 – 7.
[9]- Maughan, R. J., J. B. Leiper, and G. E. Vist, *Exp physiol*, **2004**. 89(1) : p. 101 – 8.
[10]-Maughan R.J., Murray R. : Sports Drinks ; Basic science and practical Aspacts CRS Press LI c, Boca R-anton , FL , USA , **2001**.
[11]-Mc Conell G, Snow RJ, Proietto J, Hargreaves M. *J Appl physio* **1999**; 87 : 1083 – 6.
[12]- McHugh, P. R. and T. H. Moran, *Am J Physiol*. **1979**. 236(5) : p R 254 – 60.
[13]-Merson S. J., Shirreff S. M., Leiper J. B., Maughan R. J: Changes in blood plasma and red cell volume after ingestion of hypotonic and hypertonic solutions. Proc. Nutr. Soc (In the Press), **2002**.
[14]- Melov, S. et al., Resistance exercise reverses aging in human skeletal muscle. PLOS One. 2007. 2(5) : p E 465.
[15]- Miller, S. L., et al. *Int J Sport Nutr Exerc Metab*, **2002**. 12(4) : p 384 – 97.
[16]- Miller S. L., et al., *Int J Sport Nutr Metab*, **2007**. 17(5) : p 456 – 67.
[17]- Montain S.J., Coyle E.F.: *j. Appl. Physiol* .73:1340-1350,**1992a**
[18]-Noakes T. D., Goodwin N., Rayner B. L., Branker T., Taylor R. K. N: *Med. Sci. Sport Exer*. 17 : 370 – 375. **1985**.
[19]-Pritvhett KL, Bishop PA, Pritchett RC, Green JM, Katica C. *Appl Phys Nutr & Metab* **2009**; 34(6):1017-1022.

[20]- Roy, B. D., et al., *J Appl physiol*, **1997**. 82 : p 1882 – 1888.
[21]-Roy, B. D., et al., *Med Sci Sports Exerc*, **2000**. 32(8) : p 1412 – 1418.
[22]- shirreff , S.M., P. Watson , and R.J. Maughan, *Br J Nutr* , **2007** . 9811): P.173-80.
[23]- Vist GE & Maughan RJ(**1995**). *J physiol* 486, 523 – 531.
[24]- Wilkinson, S. B., et al., *Am J Clin Nutr*,. **2007**. 85(4) : p 1031 – 40.