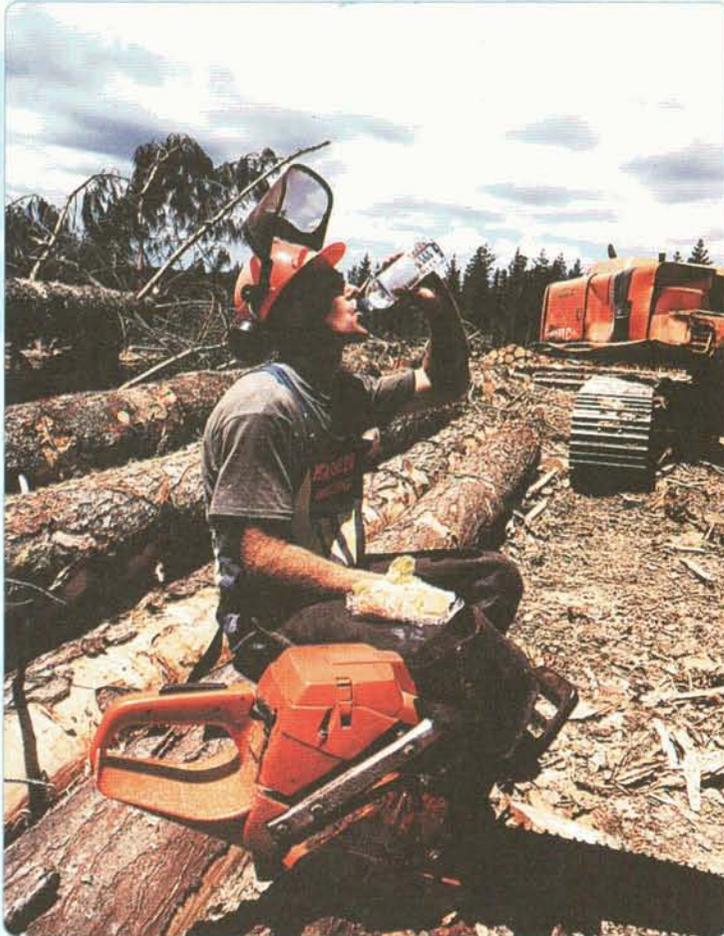


REPORT

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FLUID AND ENERGY FOR FOREST WORKERS

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Summary

This report details the effects of fluid loss on physical and mental performance, and how and why these effects occur. Recommendations are given on the type and the quantity of fluids that should be drunk in order to avoid dehydration and reduce fatigue experienced by forest workers undertaking hard physical work.

Conclusions

- Hard physical work causes sweating which results in fluid loss, particularly on hot days.
- Fluid must be replaced during the day or dehydration will occur.
- Dehydration will result in a reduced capacity for work, early onset of fatigue, reduced concentration, co-ordination, and poor decision making ability.

Recommendations

Avoid suffering the effects of dehydration by regularly drinking a fluid which contains no more than 8% energy (for example, Gatorade, Powerade, Refresh "Active"), at a rate of 0.5 to 1 litre per hour, especially on hot summer days.



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Introduction

Forest work is physically and mentally demanding and is performed in a hazardous environment. To minimise the strain of forest work, it is essential that fitness, health and nutrition are at their best at all times. Of these, your nutrition, and in particular your fluid intake, are the most important. An insufficient fluid intake results in a reduced work capacity and threatens both your health and safety. Drinking regularly before, during and after work is the most effective way to minimise the effects of dehydration during your working day, particularly during hotter days where fluid losses are greater due to increased sweat rates.

Sweating may cause dehydration

During physical activity your active muscles produce heat. This heat must be lost to enable your body's temperature to remain within its normal range. The main method of losing heat is through sweating, which results in the loss of fluid from your body. Working in the heat increases the amount of sweat needed to keep your body's temperature within the normal range, thereby resulting in a greater amount of fluid loss. If this fluid is not fully replaced, dehydration will occur. Dehydration results in the development of physical and mental fatigue which, in turn, impacts badly upon your health, safety and productivity.

Fluid intake must fully replace sweat loss

Drinking only when you feel thirsty will generally result in only 50% of your sweat loss being replaced. If you wait until you are thirsty to start drinking, you are too late, as thirst signals that you are already dehydrated by approximately 2% of your body weight (1.5 to 2 kg). To determine how much you need to drink, you need to have some idea of your sweat rate, that is how much fluid you are losing each hour due to sweating.

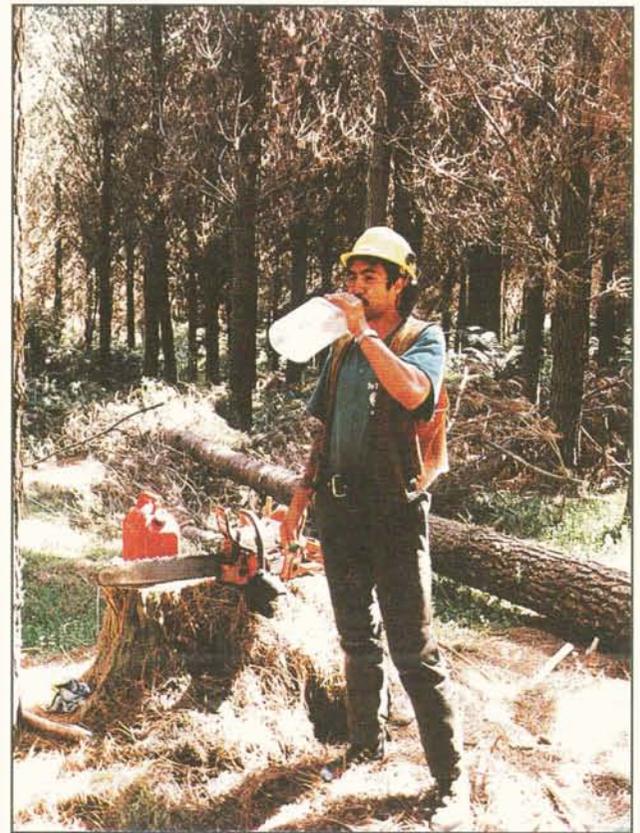


Figure 1 - Refuel the saw - refuel your body

How much do you need to drink?

Although sweat rates vary from one person to the next, they have been reported as low as $\frac{1}{4}$ litre per hour (during light activity in cool and dry conditions), to in excess of three litres per hour (during heavy physical activity in hot and humid conditions). As sweat rates have been unknown in forest work until quite recently, sweat loss has had to be predicted based on average rates for other activities which are similar in type, intensity, and environment. To date, most information has been taken from sporting events. The following are some examples of sweat rates during sporting activity:

Examples of sweat loss during sporting events

	Sweat rate (litres/hour)	Temperature (degrees C)
Rugby	2.2	18-20
Rugby league	2.0	20-24
Cycling	0.6	33-44
Marathon	1.0	20-26

Of these, the **endurance based events of cycling and marathon running** are most similar to forest work in pace and, although the activity is different, they provide some idea of the potential fluid loss for forest workers who perform moderate to heavy physical work for prolonged periods. A sweat rate of approximately 0.5 to 1 litre per hour suggests that to maintain physical and mental work performance (and prevent dehydration) forest workers should aim to drink at least **0.5 litres of fluid per hour**.

Aim to drink 0.5 litres of fluid per hour to ensure dehydration is prevented and in hot conditions this may need to be increased to 1 litre per hour.

The danger of dehydration

Dehydration threatens your health and safety and increases the risk of injury and illness. It is a dangerous condition and every attempt must be made to avoid it. Work performance can be affected with a fluid deficit of as little as 1.5 to 2 litres (or 1% to 2% loss of body weight) causing:

- Increased heart rate and work load
- Reduced capacity for work and earlier onset of physical fatigue
- Reduced heat tolerance
- Feelings of drowsiness, lethargy and irritability
- Reduced concentration and co-ordination
- Reduced mental ability, attention, focus and speed of decision making
- Reduced sweat rate and heat loss with an increase in body temperature

The greater the degree of dehydration, the greater the reduction in physical and mental performance and the higher the risk of injury or illness.

Designing a fluid replacement programme

What to drink?

Because forest work is physically demanding and performed over prolonged periods, muscles need large supplies of fuel to sustain work. Ideally, the fluid you select should ALSO contain energy (carbohydrate) to ensure a continuous supply of fuel is available to your working muscles in order to delay physical fatigue.

A good example of this can be seen with a study which reported that individuals who performed prolonged exercise IMPROVED their performance by:

- 6% if they drank 'WATER' during exercise
- 6% if they ate a 'HIGH ENERGY SNACK' (for example, banana) during exercise
- 12% if they drank a 'FLUID AND ENERGY' drink (for example, Refresh "Active")

Drinking FLUID AND ENERGY (Gatorade, Powerade...) may improve performance twice as much as just drinking water OR just eating on their own

This is because fluids that contain energy are absorbed more quickly and provide a constant supply of energy for muscles to delay physical fatigue and prevent dehydration.

How much fluid and energy?

To prevent dehydration, **0.5 to 1 litre of fluid** should be consumed per hour depending on the conditions (this is based on a sweat rate of 0.5 to 1 litre per hour).

How much energy?

The fluid you select must NOT contain more than 8% energy (carbohydrate). If the fluid contains more than 8% carbohydrate, it can cause stomach upsets, slow down the speed at which it is emptied from your stomach, and slow down the rate of absorption. This makes it less effective at reducing dehydration and fatigue. Examples of suitable drinks are shown in this report.

Replacement of Salt (Sodium)

Small amounts of sodium are lost through sweating and they are replaced easily through your normal diet, as many everyday foods contain salt (for example, bread, cereals). Therefore, there is NO need to take salt tablets to replace sodium losses.

Many fluids also contain sodium as it has been found to improve the taste, motivating you to drink more and plays a role in increasing the speed at which the fluid is absorbed, to hydrate you more quickly. Make sure that you choose a drink that contains only small amounts of sodium. The ideal is $\frac{1}{3}$ to $\frac{1}{4}$ of a teaspoon of sodium per litre of fluid.

The fluid and energy formula for delaying fatigue during work

You should aim to drink 0.5 to 1.0 litre of fluid per hour. The fluid should contain no more than 8% energy (in the form of carbohydrate) and $\frac{1}{4}$ teaspoon of sodium per litre of fluid.

Drinks that contain fluid, energy and sodium

This formula may sound complex but today many of the fluid and energy drinks on the market have been produced using this formula because it has been consistently shown to improve work capacity and delay fatigue. These include:

	Energy %
Gatorade	6
Powerade	8
Exceed	7
Isotar	6.5
Restore (Nutrasport)	7
Replace (Horleys)	7
Active (Cerebos Greggs)	7.5
Sports Plus	7

Drinks that DO NOT fit this formula but are often chosen because they are cheaper and more readily available can be used before and during work if there is no alternative. They are better than nothing but not as effective as those listed above:

	Energy %
Orange juice	7-8
Cordials	10
Water	0

Drinks that ARE NOT effective for fluid and energy replacement before or during work but may be used after work include:

	Energy %
Coke-Cola	11
Diet Coke	0
Milk (whole)	5
Choc-milk	10
Beer	2
Coffee	1
Tea	1

Water

Water is the cheapest and most readily available fluid to drink. However, it does not contain energy and the sodium level is too low to improve taste or absorption. It will help to prevent dehydration but it may not delay fatigue (because there is no energy). If it is all you have then drink it, but during long, physical and hot work there are other drinks that will make it easier for you to last the distance and recover quickly.

Fruit juices and soft drinks

Fruit juice, soft drinks, cordials, Lucozade and concentrates are generally higher than 10 % energy (carbohydrate) which is too concentrated for before or during work. However, they are effective as an AFTER WORK fluid when refuelling your muscles is a priority. This means you can drink coke after work but not before or during!

Caffeine (Tea, Coffee)

Caffeine affects your whole body. Small doses increase alertness and relieve fatigue for a short time, but large doses reduce coordination and cause difficulty in sleeping. More importantly caffeine has a diuretic effect, that is, it increases your urine loss which increases your fluid loss (and risk of dehydration). Tea and coffee without sugar have no energy and are of little value for the forest worker.

Alcohol

Alcohol reduces the availability of energy for muscles during exercise and if consumed prior to work can cause early fatigue. It also causes dehydration and therefore should not be consumed before, during, or immediately after work.

Milk and milk drinks

Milk based drinks are readily available and are good for before or after work as they supply energy as well as protein (for muscle repair), vitamins, and minerals. However, because they contain protein and some fat, they stay in your stomach longer which gives you a full feeling for longer and as a result, you are less likely to drink to replace sweat loss. You SHOULD NOT use milk during work.

Preparation for work

Your breakfast and travelling to work are important times for loading your body with reserves for the day.

- Breakfast foods must contain energy (carbohydrates, for example, cereals, breads, fruit, milk)
- 30 minutes before you start work you should have 2-3 cups of a 'fluid and energy' drink. This fills your stomach, and the fuller your stomach, the faster the fluid will empty and be available for use. This is something you need to 'practise' - start with small amounts and build up.

By taking one large drink immediately before work, you are filling up your tank, then as you drink during the day you just need to top up rather than refill completely! More importantly, if you work

with only a little amount of fluid in your stomach, the fluid you drink will empty slowly. If you work with a large volume of fluid in your stomach, the fluid you drink will empty faster to supply energy and hydrate your body more quickly.

Recovery after work

After a long physical day in the forest your muscles are tired, and your body may be partially dehydrated. Therefore, your priority **immediately after work** (within 30 minutes and before that can of beer!!) is to:

- Reload your muscles with energy
- Refuel your body with fluid

Recommended fluid maintenance programme to delay fatigue

Before Work

- (1) Top up fluid levels for the day, start in credit.
- (2) Drink 2-3 cups of fluid and energy 30 minutes before work.

During work

- (1) Replace sweat loss quickly and prevent a deficit.
- (2) Drink one cup of fluid and energy every time you refuel your chainsaw.

After Work

- (1) Replace muscle energy and sweat loss, balance up and refuel.
- (2) Drink 2 cups of fluid high in energy within 30 minutes of finishing work.

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