

Beverage Consumption

What and how much should we drink per day?

It remains a question on everyone's lips

The information explosion in the science of nutrition very often creates the impression that available information is contradictory. Consequently, it is no longer easy to distinguish between fact, misinformation and fiction. The Nutrition Information Centre of the University of Stellenbosch (NICUS) was established to act as a reliable and independent source of nutrition information.

In healthy adults fluid intake is regulated by thirst. Water is an essential nutrient for life and is considered as the ideal drink to quench thirst and ensure hydration. Ironically, it is very often ignored as part of our dietary recommendations. Most people are familiar with the general recommendation for adults of 8 glasses of water per day. Yet, estimating water or fluid intake requirements is not easy and individual requirements are highly variable. The National Research Council (NRC) recommends a daily water intake of approximately 1ml/kcal energy expenditure. The 8 glasses of water per day is based on this recommendation and on the average weight of a 70kg male. No single formula fits every individual or every situation and water intake recommendations also depend on other factors such as activity, humidity, climate, body temperature and body composition.

Despite the fact that water is considered as the ideal fluid to drink, many people **choose alternatives** and **prefer** other drinks such as cool drinks, fruit juices, coffee, tea, milk or sport drinks. These beverages may or may not contribute to the daily energy intake of the individuals consuming them depending on their composition. For instance, a glass of ordinary sweetened carbonated cool drink provides at least 418 kJ and a glass of artificially sweetened cool drink less than 5 kJ making the latter by far a better choice for an overweight inactive adult. The increase in the incidence of obesity and lifestyle diseases such as diabetes, obesity and heart disease certainly require of us to create awareness on the importance of better food **and drink** choices as one of the interventions which help attain and maintain a healthy body weight throughout our lives. To make sound choices even more difficult, or rather interesting, is the fact that consumers are faced with a host of products and functional foods/drinks that offer anything from micronutrient enriched water to “cancer fighting teas”, such as green tea, to a host of other products offering “miraculous” health benefits. With the plethora of such beverages, consumers **may often not only need some guidance on sound choices** to quench their thirst, but also on how to include such beverages as part of their daily varied diet.

How much should we drink?

The primary determinant of hydration and fluid intake in humans is thirst. Infants and the elderly, who are respectively known to be unable to communicate their thirst and have a blunted thirst sensation, should receive special attention in relation to daily fluid intake. Water is part of every body cell comprising, on average, 50% of body weight in women and 60% in men. Every system and function in the body depends on water. For example, water aids in the digestion of food, carries nutrients to cells and provides a moist environment for ear, nose and throat tissues. The amount of fluid consumed per day is approximately equivalent to the amount lost. Mild dehydration affects a wide range of cardiovascular and thermoregulating processes and responses. Dehydration of 3-5% of body weight decreases physical strength and performance, and is the primary cause of heat exhaustion. Daily turnover of water is approximately 4% of total body weight and even higher proportions in children. Water losses from the lungs and skin (insensible losses; 500 – 1000 ml/day) are responsible for approximately half of the daily turnover and sensible losses from stools (50 – 100 ml/day) and urine account for the rest of the daily losses. Yet, despite of changes in body composition and function as well as the environment, most healthy people manage to regulate daily water balance well across their lifespan.

The Institute of Medicine (IOM) established the Dietary Reference Intakes for water in 2004 (see the section on recommendations). The committee established the Adequate Intake (AI) for total water to prevent

dehydration. Based on a wide range of normal hydration status of the population, the AI was established according to the median total fluid intake (water, fluid from food and other drinks). The AI's for sedentary men and women (aged 19-50 years) is 3.71 and 2.71 liters per day respectively. Solid food and digestion of food also contributes to this recommendation. Drinking fluids represents approximately 81% of total water intake resulting in a recommended intake of 3.0 l per day for men (~12 glasses of 250 ml) and 2.2 l per day (~9 glasses of 250 ml) for women.

Factors that influence water needs

Total fluid intake depends on physical activity levels, the climate one lives in, one's health status, clothing and various other physiological factors such as pregnancy and breast-feeding.

Exercise or physical activity: During long bouts of intense exercise, it is best to use a sports drink that contains sodium, as this will help replace sodium lost in sweat, provide glucose to prevent fatigue and reduce the risk of developing hyponatremia, which can be life-threatening, when it occurs. Fluid also should be replaced after exercise. Different sports have specific fluid intake recommendations. It is very important to adhere to a recommended schedule of fluid intake in order to ensure an adequate intake before, during and after a strenuous bout of exercise.

Environment: Hot or humid weather increases sweat losses and necessitates additional intake of fluids. Heated indoor air can also increase sweat and skin losses during the winter. Altitudes greater than 2,500 meters may trigger increased urination and more rapid breathing, which may also lead to increased fluid losses.

Illness: Fever can increase water losses by as much as 200ml/day for an increase of each degree C in body temperature. Vomiting and diarrhea can also cause high losses of fluids which may need planned and/or aggressive fluid replacement. In these cases replacement drinks and oral rehydration solutions become very important in preventing dehydration. Other conditions such as bladder infections, urinary tract stones, gout and constipation may also require increased water or fluid intake. Importantly though, not all illnesses increase fluid requirements and conditions such as heart failure, and some disorders of the kidney, liver and the adrenals may require restrictions in fluid intake.

Pregnancy or breast feeding: Although water requirements during pregnancy are usually not markedly increased, an additional 1 liter of fluid may, on average, be necessary during lactation. The Institute of Medicine recommends that pregnant women should drink 2.4 liters (about 10 glasses of 250 ml) of fluids daily and women who breastfeed consume 3.0 liters or at least 2.71 liters and additional fluids according to thirst (about 12 glasses of 250 ml) of fluids a day.

Over hydration or water toxicity: Although uncommon, it is possible to drink too much water. When the kidneys are unable to excrete the excess water, the electrolyte (mineral) content of the blood is diluted, resulting in a condition called hyponatremia (low sodium levels in the blood). Endurance athletes such as marathon runners who drink large amounts of water which does not contain adequate sodium are at higher risk of hyponatremia (very low incidence of one out of 1 000 ultra-endurance athletes).

Signs and symptoms of dehydration:

General signs and symptoms of dehydration include: mild to excessive thirst, fatigue, headache, dry mouth, little or no urination, muscle weakness, dizziness or lightheadedness. Mild dehydration (treated correctly) rarely results in complications but more-severe cases can be life-threatening, especially in the very young and the elderly.

If any **two** of the following signs are present, **severe dehydration** should be diagnosed and treatment should be started immediately:

- lethargy or unconsciousness
- sunken eyes
- skin pinch goes back very slowly (2 seconds or more)
- unable to drink or one drinks poorly

What should we drink?

Water and fluid intake (except milk) is not normally considered as a source of nutrients in the daily diet. In most developed Western societies diets are reported to provide an excess of total energy, which is

associated with obesity and the related profiles of the so-called diseases of lifestyle. Although plain water fulfills almost all the fluid needs of healthy adults, individual preferences, perceived needs, taste, cultural, social and other factors have led to the availability of a great variety of beverages on the market. Some of these beverages may contribute significantly to the total daily energy and the daily intake of other nutrients. Indeed, depending on the frequency and amounts consumed, the intake of energy and/or other nutrients may become inappropriately high.

With regard to inappropriately high energy intake, obesity amongst school children in America has become such a serious health concern that the American Beverage Association and the Alliance for a Healthier Generation have worked together to provide new school beverage guidelines that will reduce the amount of energy present in beverages throughout the school years by providing learners with nutritious, lower-energy containing beverages.

Guidelines for Elementary School learners:

- Bottled water must be available
- Serving sizes should be limited to 240 ml per serving for milk and 100% fruit juice
- Low fat and fat free regular and flavored milk should be limited to 240 ml or 630 kJ per serving
- 100% fruit juice should be limited to 240 ml or 504 kJ per serving

Guidelines for Secondary School learners:

- Bottled water must be available
- Diet or no energy beverages with up to 42 kJ per serving or 240 ml
- Serving sizes should be limited to 360 ml per serving for milk and 100% fruit juice, light juice or sport drinks
- Low fat and fat free regular and flavored milk should be limited to 240 ml or 630 kJ per serving
- 100% fruit juice should be limited to 240 ml or 504 kJ per serving
- Light juices and sports drinks with no more than 277 kJ per serving or 240 ml
- At least 50% of drinks must be water and or low energy or no energy options

The overall aim of these guidelines is to reduce the total energy per each beverage consumed. In this regard, a **Beverage Guidance Panel** was recently assembled in the **United States** to provide guidance on the nutritional benefits and risks of various beverage categories. The panel used the available scientific literature to rate beverages on their potential health benefits or possible risks. The panel rated drinking water as the preferred drink to fulfill daily fluid needs followed by tea, coffee, low fat and fat free milk and drinking yogurts, diet- or artificially-sweetened cool drinks, cool drinks or drinks with some nutritional benefits (fruit or vegetable juices, full cream milk, alcoholic beverages, and sports drinks) and lastly sweetened drinks or nutrient poor drinks.

Definitions of drinks:

Water: Water suitable for human consumption, including ground water, tap water, bottled water

Tea: Rooibos tea, Black tea, Oolong tea, herbal tea with no added sugar or milk (refer to section on milk for intake recommendations)

Coffee: Instant or filtered coffee with no added sugar or milk (refer to section on milk for intake recommendations)

Low fat and fat free milk or drinking yogurt: Pasteurized fresh or heat-treated long life 2% (low fat) or fat free (skim) milk or drinking yogurt (low fat and artificially sweetened)

Diet or artificially sweetened cool drinks: non-alcoholic carbonated or non-carbonated drinks artificially sweetened with no added sugar with negligible energy (kilo joule) content

Sweetened cool drinks: non-alcoholic carbonated or non-carbonated drinks containing sugar and other carbohydrates that provide energy

Fruit Drinks: Sweetened cool drinks with a small percentage of a fruit juice – also referred to as “nectar”

Fruit and vegetable juices: Drinks that are composed only of liquids extracted from one or more fruits or vegetables with no added sweeteners

Sports drinks: Sweetened with glucose polymers and provide small amounts of sodium, chloride and potassium

Water:

Water is highly recommended for daily fluid intake. Despite the focus on hydration and de-hydration in many official reports, some studies have shown that plain water consumption is associated with better diets, better health behaviors, and lower burden for chronic disease. It provides no additional energy, which makes it very ideal for any overweight or inactive adult. It also provides variable amounts of minerals such as calcium,

magnesium, fluoride, depending on its source. The South African Food Based Dietary Guidelines include the following guideline on water consumption: **“Drink Lots Of Clean Safe, Water”**. Despite the significant progress achieved so far in the provision of clean, safe running water to all South Africans, it can by no means be assumed to be a given for a significant percentage of South Africans. Water is a potential source of various pathogens, such as cholera, which emphasizes not only the importance of providing safe water but also the need for the correct handling thereof by the consumers.

Tea, Coffee and Other Caffeine Drinks (unsweetened):

Certain individuals are very sensitive to the effect of caffeine and these individuals seem to be more likely to develop adverse effects from the excessive consumption of caffeine. Pregnancy and aging may increase caffeine sensitivity. Coffee contains more caffeine than tea. Typically, on average, a cup (180 ml) of instant coffee provides 57mg, a cup of filter coffee 75 mg, a cup of tea 36 mg and a can (340 ml) of cola cool drink 35-50 mg of caffeine. A moderate caffeine consumption of not more than 400 mg per day is recommended and not associated with increased risks for heart disease, hypertension, cholesterol or bone disease. During pregnancy caffeine intake should be limited to not more than 300 mg per day. Higher intakes have been associated with miscarriage and low birth weight.

Tea:

Tea provides antioxidants, flavonoids, amino acids and minerals (mainly fluoride). Green tea, Oolong and black teas are all made from the same species of tea plant, but differ in chemical composition arising from the different production and fermentation processes used. Green tea is produced by the steaming and drying of the tea leaves, black tea is produced by the natural fermentation of the tea leaves and Oolong tea is semi fermented. Rooibos tea, honey bush tea and other caffeine free herbal teas also contain a mixture of flavonoids and other phytochemicals that may have health benefits. Evidence is emerging of an association between the consumption of tea and the reduction of heart disease, cancer, dental caries, kidney stones and immunostimulation. More consistent evidence has been reported for the protective role of black tea in cardiovascular disease. The available evidence suggests that the consumption of three or more cups of black tea per day may protect against heart attacks. Other claims and reports on the anticarcinogenic properties of green tea require further investigation.

Coffee:

Most large well controlled trials have not found high intakes of coffee or caffeine associated with a significant increased risk of coronary heart disease or heart attacks. Interestingly several studies have found inverse associations between coffee consumption and the risk for type two diabetes, cirrhosis of the liver, colorectal cancer and reductions in risk of Parkinson disease in men, but not women. Dirpertenes, cafestrol and kahweol, compounds in roasted coffee beans, have been identified as cholesterol raising factors and consequently filtered or instant coffee might be better options for regular consumption. These also provide less caffeine per cup. Irrespective, the importance of these associations may be revised in view of recent evidence indicating that the reported increased risk for myocardial infarction in relation to coffee intake may be genetically determined and confined to those individuals with a slow caffeine metabolism.

Adults should limit their intake of caffeine drinks to no more than 4 cups of coffee per day or 8 cups of tea per day. Preferably, these should be with fat free or low fat milk and no sugar.

Milk and Dairy Products:

Dairy products are by far the richest source of calcium, not only because of their high calcium content, but also because of the absence of factors that may interfere with calcium absorption (such as phytates and oxalates in plant products) and the presence of lactose, which aids calcium absorption. If the exclusion of dairy products, due to whatever reason, results in an insufficient calcium intake, a calcium supplement may well be essential. For children, milk is currently the key dietary source of vitamin D, calcium and riboflavin as well as an excellent source of high quality protein. There is a positive relationship between milk consumption and bone mineral density which is thought to be protective against osteoporosis in later life. Yogurt drinks have lower lactose content and are a good alternative for lactose sensitive individuals. A number of studies have previously documented that calcium in milk may contribute to a reduction in blood pressure. Calcium intake has also been associated with a reduced risk of stroke, and, importantly, calcium intake from non-dairy sources was not associated with such a reduced risk. These findings suggest that, apart from calcium, other milk constituents, such as potassium and magnesium, may also be important in affording such protection. In fact, the available evidence affords a greatest effect to potassium. Although it is difficult to associate any one of these minerals in dairy products, on its own, with the reported protective effect, it should be borne in mind that a balance of calcium, magnesium and potassium is important and that all three minerals are abundant in milk and dairy products. In addition, milk is a low sodium food, which as documented in the DASH II study provides further protection and benefit in blood pressure reduction. The balance of the available evidence indicates that hypertensive individuals are most likely to benefit from

increased low-fat or fat free milk and dairy product consumption within the context of a diet rich in fruits and vegetables.

The results of the Coronary Artery Risk Development in Young Adults (CARDIA) study, a large prospective observational study (3 563 participants, multi center-population-based study of cardiovascular risk factor evaluation in the US including white and black young adults between the age group ranges of 18-24 and 25-30 years) documented that overweight individuals consumed less dairy products than individuals with a normal body weight. The study also reported that increased dairy intake may protect overweight (BMI \geq 25kg/m²) individuals against the development of obesity, elevated blood glucose levels, hypertension and heart disease. The 10-year incidence of Insulin Resistance Syndrome (IRS; also known as the Metabolic Syndrome) was lower by more than two thirds among overweight individuals in the highest category of dairy consumption (\geq than 5 portions per day) compared to those in the lowest category (< than 1.5 portions per day). More recent evidence, however, appears to be less consistent in the extent of the claimed benefits and further research will afford better clinical perspective on these reported relationships.

In summary and at present, dietary patterns characterized by increased dairy consumption, may protect overweight individuals from the development of obesity and IRS, which are key risk factors for type II diabetes and heart disease. In this regard, it is important to note, that trends in dietary intake behaviors over the past few decades have revealed a decreasing intake of dairy products, especially milk, and increasing carbonated drinks consumption and snacking (high fat and refined carbohydrate) among children and adolescents.

Cool Drinks:

Sweetened cool drinks and fruit drinks:

These include carbonated and non-carbonated (still) cool drinks, which are usually sweetened, with high-fructose corn syrup or sucrose and provide very small amounts of other nutrients. Sweetened cool drinks are the least recommended by the US Beverage Guidance Panel. Regular consumption of these drinks has been associated with dental caries, obesity, and type II diabetes. These drinks are energy dense and by the nature of their non-satiating properties, are thought to contribute to an increased daily energy intake and thus obesity. In this regard, recent results from the Nurses Health Study indicate that women consuming one or more servings of sugar sweetened cool drinks per day had a significantly higher risk of developing type II diabetes than those drinking less than one sweetened cool drink per month.

Diet- or Artificially Sweetened Cool Drinks:

These beverages are “preferable”, in terms of energy content at least, to sweetened cool drinks, but less desirable than water, tea or coffee because they provide water, taste and sweetness, but no energy. Individuals who suffer from gastrointestinal discomfort should best avoid carbonated drinks. These beverages should also not replace, meals, water, milk and other nutrient rich drinks in the diets of young children with limited stomach capacity. It should also be borne in mind that artificially sweetened cool drinks are a source of artificial sweeteners, additives and preservatives and should be used in moderation in a varied diet, especially among individuals who claim to be sensitive to any of these ingredients. Additionally, new literature is emerging which suggests that the high sweetness in these drinks may contribute to conditioning for a high preference for sweetness.

Fruit and Vegetable Juices:

Fruit juices (100% juice with no added sugar) provide most of the nutrients of the fruits used, but they are energy dense and may lack in fiber and other nutrients/constituents present in the whole fruit. Consumption of whole fruits is still considered to be best way to achieve satiety and energy balance. A recent study found that consumption of more than 360 ml of fruit juice per day by young children (2 – 5 year old) was associated with short stature and obesity. Parents and caregivers should limit young children's consumption of fruit juice to less than 360 ml per day and should ensure that fruit juice do not replace food or milk in the diets of young children.

Vegetable juices are generally a healthier alternative to fruit juices because they provide less energy. But these juices could be high in salt. Tomato juice and vegetable juice, for instance may contain up to 975 mg of sodium per 375 ml.

Sports Drinks:

Sports drinks contain at least half the energy as in sweetened cool drinks and provide sodium, chloride and potassium. The carbohydrates, water and salts are advantageous in endurance events (strenuous exercise for more than one hour). Inactive adults or children should consume these drinks sparingly.

Recommendations for South Africans (adapted from the South African Food Based Dietary Guidelines and the US Beverage Guidance Panel, 2006):

- **Water** fulfills almost all the fluid needs of healthy adults. Women should drink at least 4 glasses (250ml) and men at least 6 glasses (250 ml) of clean safe water per day. Children should drink water when thirsty and limit their intake of milk to 600 ml per day (From the age of 5 years all children and adults should drink low fat or fat free milk) and fruit juice to 240 ml per day.
 - Drinks should not contribute to more than 14% of total daily energy intake.
 - Schools should encourage children to meet their fluid needs with water and ensure the provision of clean safe water as well as limit the availability of other cool drinks/juices.
- **Sweetened cool drinks**, such as carbonated cool drink drinks should be limited to no more than 240 ml (approximately one standard cup). These drinks should be avoided by diabetics and inactive overweight adults and children.
- **Fruit and vegetable juices** (100% juices) and **sports drinks** should be limited to no more than 240 ml (approximately one standard cup).
- **Diet- or artificially-sweetened cool drinks** could replace sweetened drinks in a varied diet (up to four servings of 240 ml (approximately one standard cup).
- **Unsweetened coffee and tea:** Adults should limit their intake of caffeine drinks to no more than 4 cups of coffee per day or 8 cups of tea per day. Preferably, these should be with fat free or low fat milk and no sugar.
- **Low fat or skim milk or soy beverages (enriched with calcium):** Adults should limit their intake of fat free and low fat milk to 500 ml per day. Low fat milk may only be introduced after 2 years of age in overweight children. After the age of 5 years, it is safe to reduce the child's saturated fat intake in order to follow the prudent guidelines. For individuals who, for whatever reason, choose not to consume dairy products, other dietary sources of calcium should be included in the diet.

For further, personalized and more detailed information, please contact NICUS or a dietitian registered with the Health Professions Council of South Africa.

References from the scientific literature used to compile this document are available on request.

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