



Water intake and hydration physiology during childhood



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Water intake and hydration physiology during childhood

Introduction

Childhood is a decisive period for overall development throughout the lifespan (*WHO, 2009*). It is well established that a child's diet plays an important role in determining growth and health in adult life (*Tanner, 1981*). Healthy hydration is an important part of a balanced diet, whereas current studies seem to indicate that the fluid intake of children is often suboptimal compared to established reference values (*Kant et al., 2010, Kavouras et al., 2011, Stahl et al., 2007, Stookey et al., 2011*).

In most studies, from birth to adolescence, childhood can be divided into three age ranges: infants (0-2 years), children (3-12 years) and adolescents (13-17 years).

The purpose of this document is to present the current scientific evidence on hydration in children. Physiological development during childhood is very complex; hence water physiology and needs vary according to age. This document provides an overview of the current knowledge about hydration physiology and water intake in children and points out main differences compared with adults. It addresses water physiology, the importance of adequate hydration for health, guidelines and fluid consumption in children as well as current practices and efforts to increase water intake when suboptimal.

I. Characteristics of water physiology from infancy to adolescence

Over the lifespan, numerous changes occur in the physiology and metabolism of the human body. Hence, body needs for energy, nutrients and water change from infancy to adulthood, with the highest requirements relative to body mass observed during infancy and adolescence to support growth and physiological development.

Water physiology changes rapidly in the first years of life, and then more slowly to progressively reach adult physiology by adolescence.

I.1. Body water content

Water is the major component of the human body. On average, it represents 60% of an adult's body weight (Watson *et al.*, 1980).

Moreover, due to difference in body composition, children have higher body water content relative to body mass than adults. On average, water represents 75% of the body mass in infants in the first 6 months of life (Altman, 1961). Then it decreases rapidly between 6 months and 2 years and at a slower rate during childhood. It reaches an adult level by the age of puberty (>12 years). It is also after 12 years old that gender differences appear: water as a percentage of total body weight decreases at a faster rate in girls, due to the fact that in general, women have a higher percentage of body fat than men (Figure 1) (Altman, 1961, Novak, 1989).

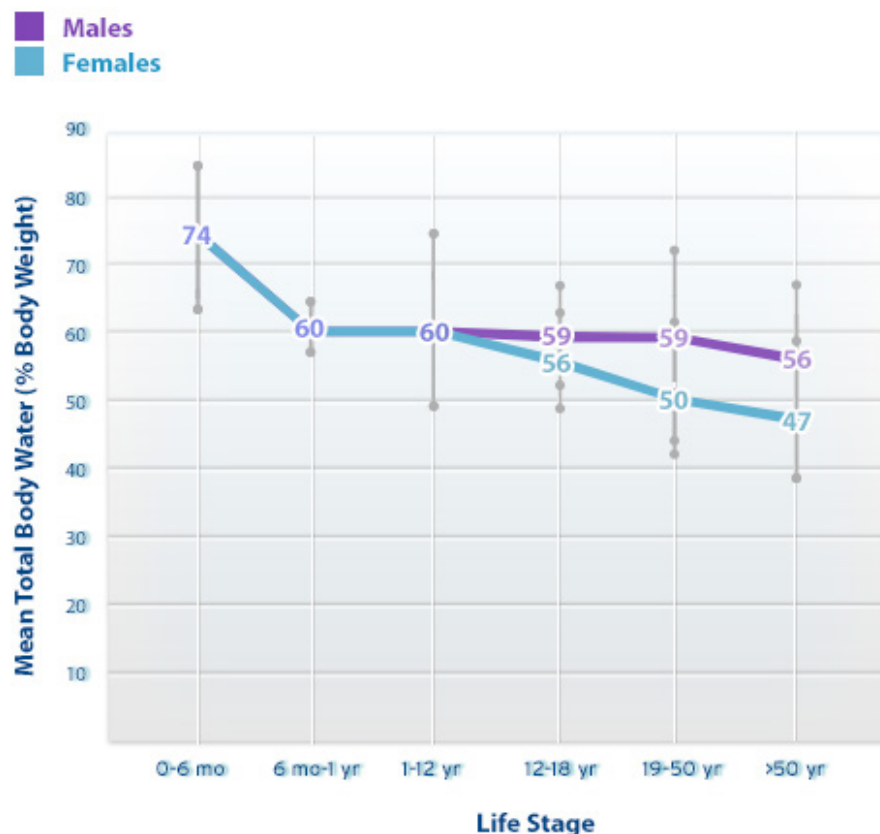


Figure 1. Mean total body water as a percentage of body weight per age group in males and females. (adapted from Altman, 1961).

Nonetheless, total body water varies, depending on individual body composition: lean body mass is approximately 73% while fat mass has a significantly lower body water (10%) (Péronnet *et al.*, 2012, Altman, 1961).

I.2. Body water balance

Body water balance is defined as the equilibrium between body water gains and body water losses.

I.2.1. Main water losses in children

Under normal conditions, body water is mostly lost through urine and skin, and to a lesser extent, from lungs and faeces.

- **Urinary water losses**

Body metabolism produces waste which has to be eliminated, in major part through urine. The urinary tract, which comprises the kidneys, ureters, bladder and urethra, produces, stores and excretes urine (**Figure 2**).

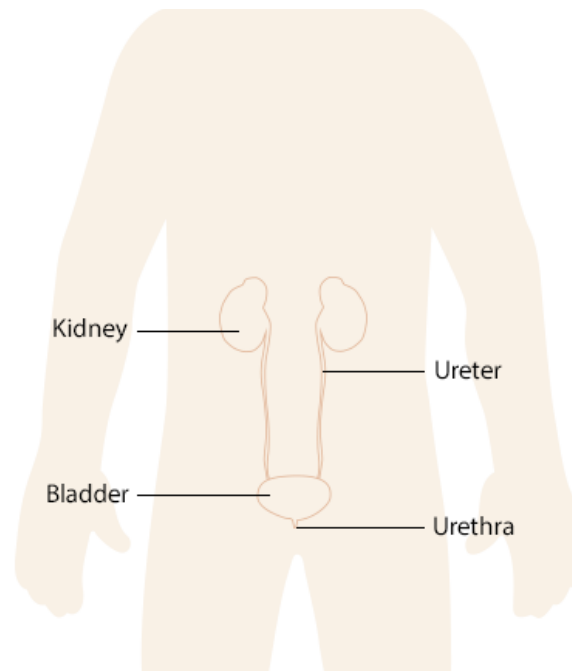


Figure 2. The urinary tract.

Average urinary volume ranges from 1 to 2 L/d in adults (*Manz et al., 2003*), but there is a gradual reduction of urinary volume with decreasing fluid intake. In children, average urinary volume is between 600 and 1300 mL/d and increases with age to progressively reach adult values (*Alexy et al., 2012*). With age, a decrease in urinary volume relative to body weight has been reported in children from 4 to 14 years old (*Ebner et al., 2002*).

- **Skin and lung water losses**

Skin water losses occur through both sweating and insensible water loss. Sweating is an active mechanism that relies on excretion of water and other components via the sweat glands. In contrast, insensible water loss is solute-free and refers to evaporation of water from the respiratory tract and from passive skin diffusion. Water loss from sweating is low under moderate ambient temperature and a sedentary state (*EFSA, 2010*).

Body surface area to body mass ratio is different between children and adults. It is twice as high in young children (1-2 years old) as in adults. The difference levels out by adolescence, when children have almost reached their adult size (*Silvaggio et al., 1993*). This explains why until adolescence, children lose more water relative to body mass from the skin at rest and under thermoneutral conditions compared to adults.

I.2.2. Water gains

Water gains come from water contained in ingested fluid and food, as well as metabolic water (water produced by the organism during nutrient oxidation) (Shirreffs, 2003, Benelam et al., 2010). This last aspect will be addressed in part III.1.

I.3. Body water balance regulation

I.3.1. Regulation by kidneys

Both in children and adults, kidneys are vital organs responsible for regulating the volume and composition of the extracellular fluid via complex neuroendocrine pathways (Andreoli et al., 2000): they are the main organs for the maintenance of electrolyte balance but also water balance. They function as selective filters eliminating metabolic endproducts, and adjusting levels of excreted substance, electrolytes and water in order to maintain a constant blood composition, thanks to reabsorption and secretion mechanisms.

Kidneys are able to reabsorb or eliminate water depending on body needs. To achieve this function, they are influenced by several hormones, especially antidiuretic hormone (ADH), but also aldosterone and natriuretic factors. ADH (antidiuretic hormone, also known as vasopressin) is a water-conserving hormone: it increases water permeability and thereby facilitates the reabsorption of water into the kidney capillaries. ADH is also involved in the mechanism that induces the sensation of thirst (Groff et al., 1995) (Figure 3).

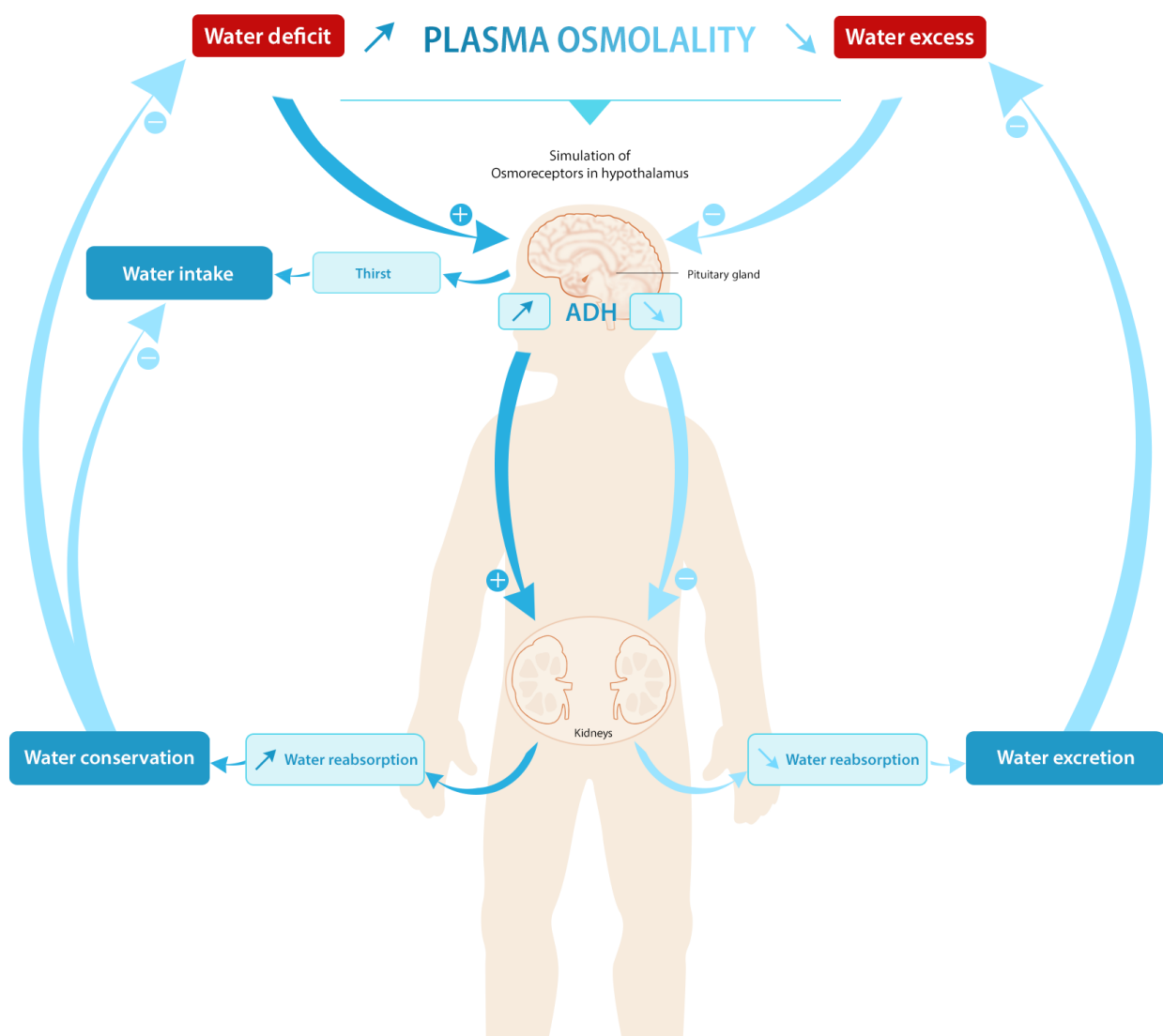


Figure 3. Regulation of body water balance by ADH and the kidney.

As a consequence, renal fluid output can vary widely to maintain total body water depending mainly on salt and water load. However there are limits to both conservation and excretion: Kidneys can regulate urine osmolality within a large range: from 50 mosm/L to 900-1400 mosm/L in adults (*Isaacson, 1959, Mertz, 1963*).

In children, renal function reaches maturity at about 2 years old, with comparable glomerular filtration rate and urine concentrating and diluting capacity to adults. (*Brenner et al., 2008, Gearhart et al., 2009*). However, voiding volume and frequency are only fully mature by adolescence (*Ellsworth et al., 2005, Gearhart et al., 2009*).

I.3.2. Thirst mechanism

When water losses exceed water intake, the body enters a state of hypohydration. Besides the kidneys, thirst also plays a role in restoring water balance by stimulating the desire to drink. Thirst is a sensation influenced by both physiological (cellular tonicity, extracellular volume, stomach distension, ADH blood volume...) and behavioral factors (meals, preferences, availability of beverage...). However, as for adults, thirst and voluntary drinking do not always guarantee adequate hydration (*Rowland, 2008, Rowland, 2011*). Indeed, some trials have reported that, when dehydrated and left to their own choice, children and adolescents do not drink enough to ensure the complete replacement of water loss (*Bar-Or et al., 1980, Rivera-Brown et al., 1999, Santana et al., 1995*).

I.3.3. Thermoregulation

Water plays an essential role in the body's process of temperature control. Evaporation of sweat from the skin is an effective cooling system and represents the main route of heat loss in adults (*Delamarche et al., 1990*).

In contrast to adults, children lose more heat from convection (dry heat loss) than evaporation (*Delamarche et al., 1990*). This can be explained by two major physiological differences. First, children have a larger body surface area to body mass ratio and dry heat exchange depends on surface area (*Sinclair et al., 2007*). It also results from immature sweating mechanisms (*Rowland, 2008*). Until puberty, children have considerably lower sweating rates than adults, especially boys compared to men (*Rowland, 2011*).

Despite these differences, equivalent thermoregulation outcomes in children and adults exercising in the heat have been observed when adequately hydrated (*Inbar et al., 2004, Rivera-Brown et al., 2006, Rowland et al., 2008*). However, in similar situations with water deprivation, limited data suggest that body temperature rises more quickly in children than in adults (*Bar-Or et al., 1980*).

Thus, pre-pubertal children lose less water than adults during exercise and/or in the heat but their body temperature regulation may be more sensitive to dehydration than adults.

In summary

Overall, physiological differences in infants, children and adolescents in comparison to adults relate to body water content, insensible water losses, sweat rate and kidney function for children below two years old (Figure 4). They are attenuated throughout childhood and become similar to adults by adolescence.

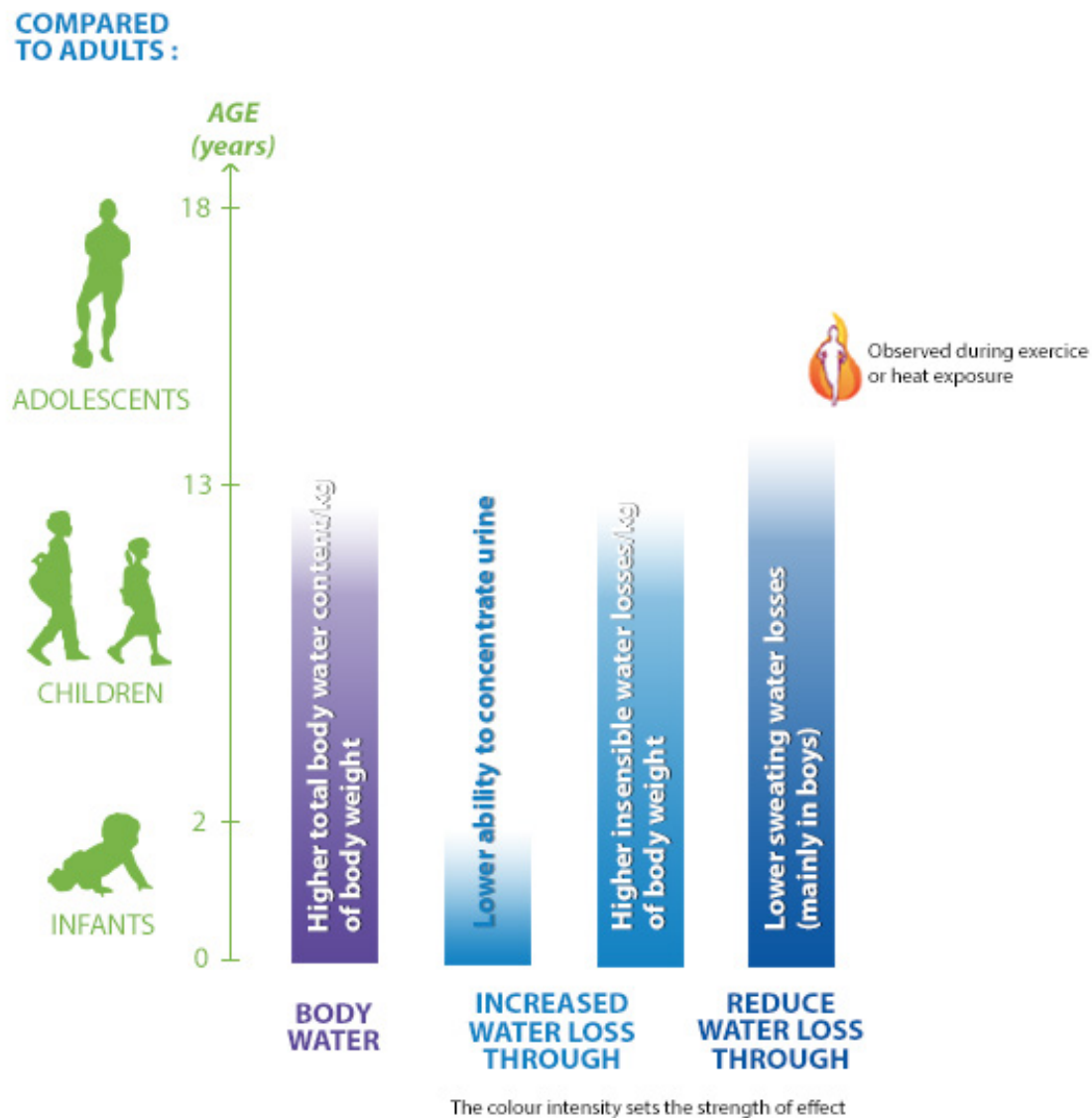


Figure 4. Characteristics of water physiology from infancy to adolescence.

KEY MESSAGES

Physiological characteristics of hydration in children

Water physiology changes rapidly in the first years of life, and then more slowly to progressively reach an adult model.

-

Children and particularly infants, have higher body water content relative to body mass than adults.

-

Until they reach their adult size, children lose more water from the skin at rest and under thermoneutral conditions compared to adults.

-

Until adolescence, children and particularly infants have a higher water turnover relative to body mass than adults, especially during the first few weeks of life.

-

Children have higher water requirements per unit of body weight compared to adults, in part due to greater insensible water losses from skin diffusion.

-

Kidneys reach maturity at about two years old, with urine concentrating and diluting capacity equivalent to adults.

II. Importance of adequate hydration for children's health

Water is an essential nutrient and the main component of the human body (*Peronnet et al., 2012*). Therefore it seems consistent that hydration status and water consumption can have consequences for children, particularly when considering physical activity and cognitive function.

II.1. Assessing risk of dehydration

Although it has no absolute definition, dehydration is typically defined as either depletion in total body water content due to excessive fluid losses, diminished fluid intake or a combination of both (*Begum et al., 2010*).

Evaluation of the hydration status of an individual consists of the measurement (direct or indirect) of total body water (*Shirreffs, 2003*). While no single method is universally agreed-upon to assess hydration status, a combination of several markers seems to be the most appropriate for the general population. More precisely, urinary biomarkers of hydration status such as 24h- volume, specific gravity, osmolality and color have been shown to vary significantly between adults who drink low (<1.2 L/d) or high (>2.0 L/d) daily fluid volumes (*Perrier et al., 2012*). These results suggest that urinary biomarkers are well suited to detect small differences in hydration status that occur in normal daily life.

Other methods and markers can also be used including blood, salivary indices, dilution techniques, neutron activation analysis and ratings of thirst. Body mass change is often the quickest, simplest, and most accurate technique to use when substantial water losses are expected over a short period of time, such as during an exercise session. Ultimately, the relevance of the method depends on measurement conditions: in field situations, easy-to-use, safe, portable and inexpensive techniques are more appropriate (*Armstrong, 2007*).

II.2. Hydration status and physical activity

II.2.1. Effects of dehydration during physical activity

During physical activity, dehydration impairs a range of physiologic functions, increasing thermoregulatory and cardiovascular strain (*Murray, 2007*). It leads to impairment of performance and increased risk of exertional heat-illness (muscle heat cramps, fainting, heat exhaustion, life-threatening heatstroke), particularly during sustained physical exercise and in warm/hot conditions (*Council on Sports Medicine and Fitness and Council on School Health, 2011*).

In adult athletes, there is little doubt that dehydration of more than 2% of body mass compromises physiological functions and impairs physical performance (*Sawka et al., 1999*).

The relationship between hydration status and performance decrement in children have been evaluated to a lesser extent. Different studies show that even 1-2% body mass dehydration reduces aerobic performance in prepubertal boys (*Dougherty et al., 2006, Wilk et al., 2002*). Moreover, *Kavouras et al. (2011)* demonstrated that improvement in hydration status through an educational intervention led to significant enhancement in endurance performance in exercising children. Thus, promoting fluid intake in exercising children is certainly important.

II.2.2. Are children affected differently than adults during exercise?

From a mechanistic point of view, because pre-pubertal children have lower sweat rates than adults, they may better retain body water during exercise. However, higher insensible water losses relative to body mass implies greater water requirement per unit of body weight compared to adults. Available data about children's physiological responses and physical performance in the heat are not sufficient to draw definitive conclusions. Furthermore, in contrast to former hypotheses, current research indicates that thermoregulation in the heat may be similar for children and adults despite different dominant thermoregulatory mechanisms. To date, there is no significant evidence that children would be at different risk of dehydration or hyperthermia than adults during physical activity under heat (Rowland, 2008).

In adequately hydrated children, no increased risk of exertional heat-illness has been observed compared to adults (Inbar et al., 2004, Rivera-Brown et al., 2006, Rowland et al., 2008, Shibasaki et al., 1997). But this risk has not been studied in a situation of water deprivation.

II.2.3. Water consumption and physical activity

During physical activity, water needs can increase rapidly: an increase in water consumption is therefore recommended during and after exercise to replace the additional water lost in sweat (American Academy of Pediatrics Committee on Nutrition and Council on Sports Medicine and Fitness, 2011).

According to the clinical report of the American Academy of Pediatrics (AAP) Committee on Nutrition and Council on Sports Medicine and Fitness (2011, pp 1182); *"with children and adolescents, careful consideration is necessary when selecting a beverage to hydrate before, during, or after exercise"*. Generally, for children involved in regular physical activity, consuming water is sufficient to replenish the water lost through sweating during exercise. Water does not increase caloric intake, or kidney solute load. Thus, its consumption is appropriate as part of a healthy lifestyle combining balanced diet with moderate physical activity.

The AAP report also states, *"Children and adolescents should be taught to drink water routinely as an initial beverage of choice as long as daily dietary caloric and other nutrient (e.g., calcium, vitamins) needs are being met. Water is also generally the appropriate first choice for hydration before, during, and after most exercise regimens. Children should have free access to water, particularly during school hours"*.

Additionally, the Institute of Medicine published in 2007 a report in which it recommends healthier eating behaviors for children and adolescents at school. Recommendations include:

- Restrict foods and beverages that are high in added sugar;
- Encourage plain water availability at no cost for students;
- Promote consumption of water without flavoring, additives, or carbonation;
- Limit sports drinks consumption to the use of young athletes engaged in vigorous physical activity.

II.3. Hydration status and cognitive function

II.3.1. What is cognition?

Defining cognitive function is difficult and complex. Cognition deals with every aspect of how humans perceive, remember, think, speak and solve problems (Feist et al., 2009). Thus, cognitive function includes attention, learning, memory, and reasoning, as well as seeing, hearing, and the ability to act. It also relates to state of mood, as every psychological phenomenon is a cognitive phenomenon (Neisser, 1967).

II.3.2. The impact of dehydration on cognitive function in children

Dehydration has been recognized as having a negative effect on cognitive performance, including memory, attention, motor skills and mood in adults (Armstrong, 2012, Edmonds, 2012, Ganio et al., 2011, Pross et al., 2012).

Although data in children are limited, impaired memory has been observed with mild levels of dehydration (1-2% body weight) (*Bar-David et al., 2005, Fadda et al., 2008*). Similarly, a recent study suggested that brain structure and function could be affected acutely by dehydration in adolescents in situation of dehydration (*Kempton et al., 2011*).

II.3.3. Beneficial effect of increasing water intake

Consistent results show that 7 to 9-year-old children performed better on tasks of visual attention and visual memory when drinking 200-400 mL of additional water before test (*Benton et al., 2009, Edmonds et al., 2009a, Edmonds et al., 2009b*). However, the initial hydration status of the children was not assessed. Further research is needed to confirm these first results showing that increased water intake improves cognitive function in children.

As children spend the majority of their day at school, often staying for afterschool activities, encouraging water availability during and after school can contribute to higher water consumption.

In summary

Overall, the importance of adequate hydration is clear: staying well-hydrated, by maintaining proper water balance within the body, is an important issue for physically active children and to support their cognitive functions (Figure 5).

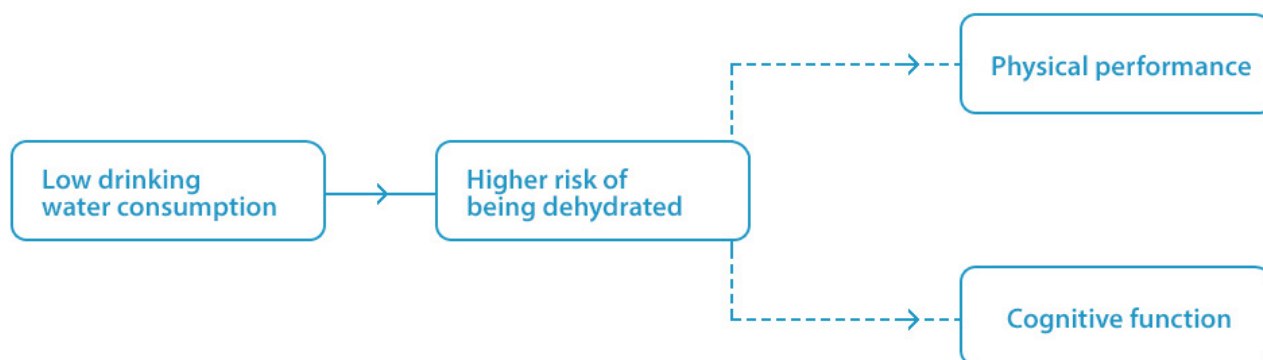


Figure 5. Preliminary evidence suggests two important consequences of low drinking water consumption.

KEY MESSAGES

Healthy hydration for physical activity

During physical activity, dehydration beyond 1-2% impairs a range of physiologic functions, increasing thermoregulatory stress and cardiovascular strain.

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Dehydration has a negative effect on effort tolerance and performance during physical activity.

-

For children involved in regular physical activity, consuming water is sufficient to replenish the water lost through sweating.

-

Water is generally the adequate first drink for hydration before, during, and after exercise.
(American Academy of Pediatrics Committee on Nutrition and Council on Sports Medicine and Fitness, 2011).

Healthy hydration for cognitive function

Mild levels of dehydration (1-2% body weight) impair cognitive function.

-

Increasing plain water consumption in children may support visual attention and memory.

III. The challenge of hydration in children

III.1. Total water intakes and fluid consumption in children

III.1.1. Guidelines for total water intake

Guidelines for total water intake have been established by many regional and global authorities (EFSA, IoM, WHO). However, in contrast to other nutrients, there is insufficient research into the amount of water required to prevent disease or improve health. As a result, neither upper nor lower consumption thresholds have been linked to a specific benefit or risk. Several methods have been used to set adequate water intakes. Most are based on intake surveys and theoretical calculations, and there is therefore a great amount of variability in worldwide reference values (**Table 1**).

In the USA and Canada, adequate intakes of water in children are based on the median water intake from NHANES III data (Third National Health and Nutrition Examination Survey) (*IoM, 2004*).

The most recent official guidelines for total water intakes have been published by the European Food Safety Authority (EFSA) in 2010. In children, adequate intakes are based on observed intakes in studies in which the contribution of water from food could be evaluated, adjusted to reach an available water amount of 1 mL/kcal ingested and take into account the variations between individuals.

Based on guidelines, children have specific water needs until puberty, compared to adults (**Table 1**). By pre-adolescence, boys have higher recommended intake than girls.

USA & Canada (IoM 2004)			Europe (EFSA 2010)		World (WHO 2003, 2005)	
1-2 yrs	1.3 L/d		1.1-1.2 L/d		1 L/d	
2-3 yrs			1.3 L/d			
4-8 yrs	1.7 L/d		1.6 L/d		Females 2.2 L/d Males 2.9 L/d	
9-13 yrs	Girls 2.1 L/d	Boys 2.4 L/d	Girls 1.9 L/d	Boys 2.1 L/d		
14-18 yrs	Girls 2.3 L/d	Boys 3.3 L/d	Females 2 L/d Males 2.5 L/d			
Adults (>18 yrs)	Females 2.7 L/d	Males 3.7 L/d				

Table 1. Reference values for total water intake (food + fluid) per age group.

These references for total water intake include both water from food plus water from beverages of all kind, including drinking and mineral water. For adults, it is considered that the contribution of food to total water intake represents about 20% (*EFSA, 2010*). No evaluation has been completed for children so far.

The EFSA has not set maximal safety intake levels, due to the ability of kidney in healthy individuals to excrete excessive water intakes, up to 0.6-1liter of urine per hour for adults (*Noakes et al., 2001*).

III.1.2. Fluid consumption in children

Available data suggest that children do not drink enough and do not meet the daily recommended intake. According to observational data from NHANES (USA), in children and adolescents between 4-19 years of age the mean daily total water intake is lower than the IOM adequate intake (beverage and food moisture) (Kant *et al.*, 2010). Results from the DONALD study (Germany) indicate that 49% of boys and 29% of girls between 4-11 year of age were considered not sufficiently hydrated (Stahl *et al.*, 2007). Moreover, while contribution of plain water (from 22% in 2-5 years old to 33% in adolescents) to water intake increases with age, main contributors of to water intake are beverages, i.e. all types of fluid except drinking water. Beverages account for 52% in 2-5 years old and 47% in adolescents).

A recent study has revealed that among healthy children (9-11 years old), 75% of the children did not drink water before going to school. Naturally, urine osmolality was elevated in those who did not drink anything before school. However, what was more surprising was that urine osmolality was also elevated in children who drank large volumes of beverages other than water (Stookey *et al.*, 2011). Drinking water fulfills hydration requirements without increasing solute load presented to the kidney and hence elevated urine osmolality. These data suggest that schoolchildren may be at risk of suboptimal water intake relative to IOM, EFSA or WHO guidelines.

III.2. Improved water intake: a corner-stone of childhood lifestyle programs

III.2.1. The promising effect of water intake on overweight prevention

Childhood obesity is a global epidemic. In 2010, 43 million children (35 million in developing countries) were considered overweight and obese (Figure 6) and 92 million were at risk of overweight (de Onis *et al.*, 2010). The worldwide prevalence of overweight and obesity increased by 60% between 1990 and 2010 (de Onis *et al.*, 2010) and in some countries (in the US in particular) the proportion of overweight children has tripled since 1980 (WHO, 2006).

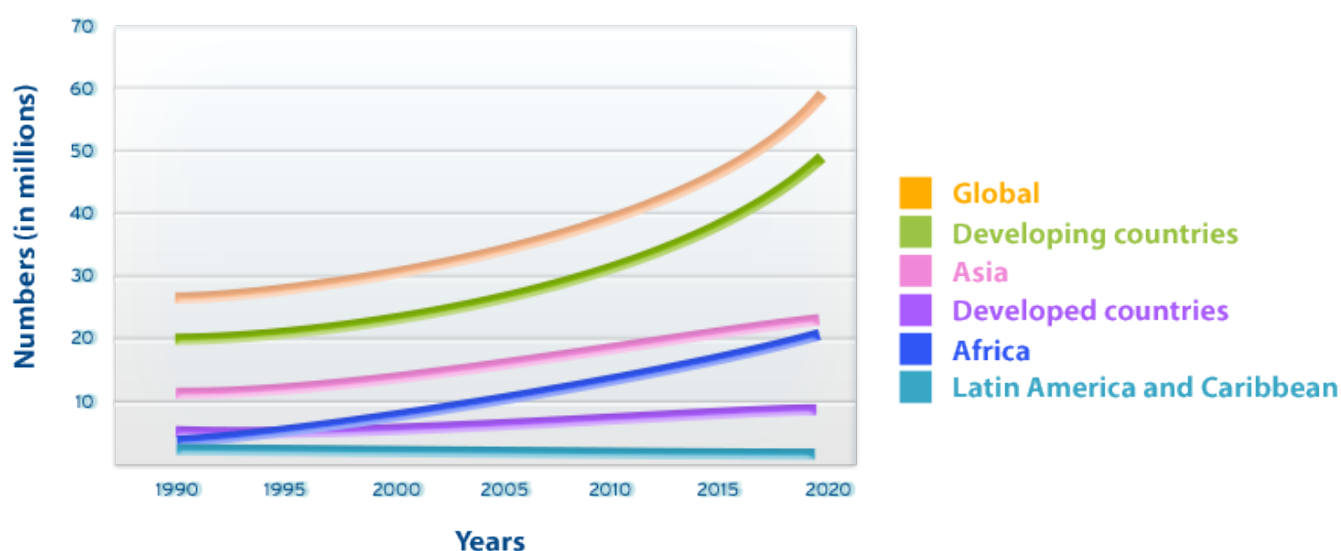


Figure 6. Numbers (in millions) of overweight and obese children aged 0 to 5 years old: 1990-2020.
(adapted from de Onis *et al.*, 2010).

Weight gain in childhood is a real concern because it is a strong determinant of adult obesity (de Onis *et al.*, 2010, Guo *et al.*, 1999, Symonds *et al.*, 2011).

Healthy eating is one of the key actions for obesity prevention, and healthy fluid consumption is part of a balanced diet. Water ingestion is commonly believed to reduce energy intake, however few studies have investigated the direct effect of water on weight management in children.

Recently, a study has shown that the promotion of healthy hydration in elementary schools, by increasing water accessibility through water fountains and providing lessons to promote water consumption, was an efficient strategy to lower the risk of being overweight by 31% in the interventional group (*Muckelbauer et al., 2009*).

A study of overweight children reported that consuming 10 mL/kg cold water can temporarily increase resting energy expenditure for at least one hour after consumption. While the observed metabolic increase was short-term and temporary, the authors extrapolated that if children would consume the recommended daily amount of water, this increase in energy expenditure would represent a weight loss of 1.2 kg per year (*Dubnov-Raz et al., 2011*). Given that data is limited, more research would be required to establish whether this strategy would be effective in real life conditions.

These first results suggest that increasing water consumption may have a positive impact on weight management in children. Then, if it proves to be an effective action, drinking water programs may contribute to weight management in children. Public health authorities are putting more and more emphasis on the importance of a healthy diet and physical activity in preventing of overweight and obesity in children and adolescents.

III.2.2. A priority action for a healthier lifestyle in children

In response to the growing burden of obesity, policy frameworks are introduced, particularly with respect to health promotion for children. They are based on modification of lifestyle practices such as physical activity, as well as encouraging a balanced diet, including recommendation to favor drinking water over other beverages. Some examples are presented below:

In 2004, The Global Strategy on Diet, Physical Activity and Health was adopted by the WHO. In this context, more recently a set of tools to guide member states while setting their national action plan was published. Increasing the consumption of water in children has been identified as a priority area for action in the field of preventing childhood obesity (*WHO, 2012*).

- Among its guidelines, the Institute of Medicine (2007, pp 5) also encourages water as a healthier alternative at school: "Schools should make plain, unflavored water available for free throughout the school day, either in the form of bottled water or from water fountains".
- Similarly in France, the National Plan for Nutrition and Health (PNNS, 2008) recommends: "Water can be consumed without restraint during and between meals. To stay healthy, water is the only drink necessary. Water is the best drink that quenches thirst without adding calories".
- In the vein of this ambition, programs are being lead internationally. For example, the Food and Nutrition Service, part of US Department of Agriculture (2010), recently launched an initiative aimed at tackling childhood obesity. Although it is too early to conclude whether it is effective, the "Let's Move" program supports simple actions, such as recommendations for healthy eating pattern in school and at home, better food labeling, and increased daily physical activity for children. Among the healthier alternatives proposed, the one to make better beverage choices, choosing water instead of sugar-sweetened beverages.

Finally, findings from recent randomized controlled trials show that consuming noncaloric instead of caloric beverages diminishes weight gain in children and adolescents (*de Ruyter et al., 2012, Ebbeling et al., 2012*).

III.2.3. Action worldwide: example of a long-term development program

Childhood lifestyle programs recognize the importance of good hydration with water preferably by including it as part of key lifestyle measures. Some have already shown encouraging results.

The EPODE program (Ensemble Prévenons l'Obésité des Enfants – *Together Let's Prevent Childhood Obesity*) is a program of local interventions to prevent childhood obesity. Its objective is to develop in different countries a methodology to prevent obesity. This program involves all stakeholders of a community to encourage families to adopt a healthy lifestyle (balanced diet and physical activity). Among others, promoting healthier fluid intakes in children and adolescent is included in the prevention actions. A pilot study launched in 1992 in two French towns showed that the prevalence of overweight in children between 5 and 12 years old was significantly lower in both pilot towns compared to control ones, respectively 8.8% vs. 17.8% (Romon *et al.*, 2008). Since its official launch in 2004, the program has been broadly implemented within France. Moreover, the model has also been adopted in 5 other countries (Table 2).

Country	Program	Lauching date
France	EPODE, currently VIF (Vivons en Forme)	2004
Belgium	VIASANO (Healthy Life)	2006
Spain	THAO (Children's Health)	2006
Greece	PAIDEIATROFI (Educating Children to a Balanced Nutrion)	2008
Australia	OPAL (Obesity Prevention And Lifestyle)	2009
Mexico	5 PASOS (5 Steps for your Health)	2010

Table 2. EPODE long-term programs developed throughout the world.

The latter two programs have developed specific actions to promote healthy fluid intake. The OPAL theme "*Water: The Original Cool Drink*" aims to encourage children to replace sweetened drink consumption with plain tap water.

There is a consistent agreement among public health authorities and scientific societies regarding water and other types of fluid intakes. Water is a healthy choice at any time and the only fluid the body needs. It has no calories, no sugars and no additives. In consequence, water should be the preferred beverage for hydration.

KEY MESSAGES

In children, most of the guidelines for total water intake are based on intake surveys and theoretical calculations, and there is therefore variability in worldwide reference values.

-

Based on guidelines, children have specific water needs until adolescence, which are different from those of adults.

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Childhood obesity is increasing worldwide and represents a major issue because weight gain in childhood is a strong determinant of adult obesity.

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Water is a healthy choice at any time. It has no calories, no sugars and no additives. In consequence, water is recommended as the beverage of choice by numerous professional organisations.

-

Improving water intake is increasingly considered as a priority action for healthier lifestyle in children.

As a conclusion...

- Water physiology changes rapidly in the first years of life, and then more slowly to progressively reach adult physiology by adolescence.
- Despite physiological differences, children and adolescents have a thermoregulatory capacity comparable to adults.
- Kidneys reach maturity at about two years old, with urine concentrating and diluting capacity equivalent to adults.
- Mild dehydration (1-2% body weight) has a negative effect on effort tolerance and performance during physical activity, as well as on cognitive functions.
- Water is a healthy choice at any time. It has no calories, contains no sugars and no additives. As a consequence, improving water intake is increasingly considered as a priority action for healthier lifestyle in children.

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