



#### Key statements

- ▶ On average, children, adolescents and young adults drink more than two glasses of beverages containing sugars per day.
- ▶ With increasing age, adults consume fewer beverages containing sugars.
- ▶ Boys and men in all age groups consume more beverages with sugar than girls and women of the same age.
- ▶ People of low socio-economic status consume more sugary beverages than people of medium or high socio-economic status.

## Fizzy drinks, juices etc. - The consumption of beverages containing sugars in Germany

Sufficient fluid intake is important for the preservation of health. It plays an essential role in maintaining vital metabolic processes and bodily functions (Biesalski et al. 2010). Individual fluid requirement depends on factors such as age, time of year and physical activity levels (Biesalski et al. 2010). To meet this requirement, there is a wide and constantly changing range of beverages available. However, from a nutritional physiological point of view not every product can be recommended as a thirst quencher.

In this context, the consumption of soft drinks (for definition see box below), fruit juices and fruit nectars, which have been grouped here under the term »beverages containing sugars«, are the subject of critical debate among others because of their high calorie content (DGE 2011; Libuda et al. 2008a).

While fruit juices generally only contain the fruit's own sugars and still boast a majority of the nutrients from the original fruit, fruit nectars and soft drinks have significantly fewer essential nutrients and a mostly elevated energy content through industrially added sugar. In spite of the fact that the German Nutrition Society (DGE) recommends that the daily fluid requirement should be met where possible with water and other low-energy drinks (DGE 2010), the population consumes relatively large amounts of beverages containing sugars.

This is suggested, inter alia, by figures from annual agricultural statistics. These record the quantities of foods available for consumption in Germany per capita per year (»food supply«). According to these figures, the average consumption of soft drinks in 2011 was just under 120 litres per head and therefore only 20 litres below that of bottled mineral water (BMELV 2012).

The data shows in addition that the consumption of soft drinks in the course of recent years has increased, whilst that of juice has fallen (Figure 1). However, at an average of 35 litres of juice per head, Germany in comparison to other EU countries and the USA still occupies top spot in the statistics (BMELV 2012).

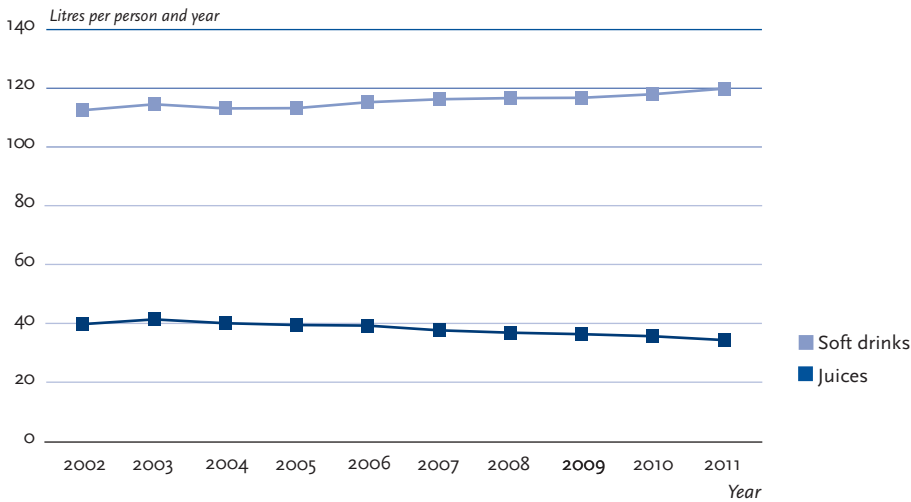
Even data regarding individual consumption of beverages point towards high levels of sugary drinks in Germany. This is shown by data captured by health monitoring undertaken by the Robert Koch Institute, as illustrated in the following. Here the consumption of soft drinks and juices is shown according to sex, age and socio-economic status.

The results allow conclusions to be drawn with regard to the consumer group and possible starting points for preventing elevated consumption of beverages containing sugars.

Figure 1

Consumption of soft drinks\* and juices\*\* in litres per person per year in Germany, 2002–2011

Data source: BMELV 2011, 2012



\* Excludes drinks made of concentrates, syrup and beverage powder incl. tea drinks and postmix-dispensing (catering technology where drink syrup is mixed usually with carbonated water in a pistol just prior to serving)

\*\* Includes fruit nectars and vegetable juices

## The health effects of consuming beverages containing sugars

If sugar-sweetened soft drinks are regularly consumed in addition to the customary diet, the energy intake of the body is increased. This especially appears to be the case if the drinks are consumed between meals (Dubois et al. 2007; Almiron-Roig et al. 2003). The reason for this presumably lies in the lower saturating effect of fluid compared to solid foods. Whilst the consumption of solid foods slows the further intake of food due to the resultant feeling of satiety, this is much less and only shortly the case for fluids because of the rapid transit through the stomach and the intestines (Pan, Hu 2011).

As a consequence, when drinking soft drinks, relatively high number of calories are absorbed that do not satiate for long. If the additional calorie intake is not compensated by forgoing other energy-rich foods or by higher energy expenditure (e.g. through physical activity) this results in a positive energy balance. In the long-term this can increase body weight and the risk of obesity (Flood et al. 2006, Ebbeling et al. 2012, Hauner et al. 2012, de Ruyter et al. 2012). The link between juice consumption and excess weight and/or obesity on the other hand has clearly less frequently been studied. In addition to this, the results are inconsistent (O'Neill et al. 2012, Shang et al. 2012, Alexy et al. 1999).

The risk of type II diabetes mellitus presumably also increases with the consumption of soft drinks (The InterAct consortium 2013, DGE 2011). The sugar in the drinks causes the blood sugar level to increase rapidly which in turn leads to increased levels of insulin in order to lower the blood sugar concentration again.

The increase in insulin production and the cycle of feeling hungry and renewed intake of simple carbohydrates is essentially associated with an increased risk of diabetes (DifE 2004, Goletzke et al. 2013). Hitherto there have been only a few studies on the association between the consumption of juice and an increased risk of developing type II diabetes mellitus. As with obesity, the results are inconsistent (Fagherazzi et al. 2013, Bazzano et al. 2008).

The teeth suffer also from elevated consumption of sugar-containing drinks. The sugar and the acids which are naturally occurring in juices and often added to soft

### Definition of soft drinks

In the guiding principles of the German Food Code (Lebensmittelbuch), soft drinks include: Lemonades, carbonated soft drinks, sparkling fruit spritzers and non-carbonated fruit juice drinks (BMELV 2003). Soft drinks contain water and taste-adding ingredients. They may include sugar, fruit concentrates, flavourings, minerals, vitamins, additives and carbon-dioxide (BMELV 2003).

Soft drinks that do not fall into the above categories represent »own-type beverages«. They are not subject to the guidelines but to superior food legislation laws (e.g. the German Food and Feed Code). Own-type beverages include ice teas, sports drinks, energy drinks or flavoured water (AID 2011).

For the analyses presented here the term »Soft drinks« covered in addition to lemonades, carbonated soft drinks, sparkling fruit spritzers, fruit juice drinks and some own-type beverages. The latter included malt beer, ice teas, sports drinks and energy drinks.

### Assessment of the consumption of soft drinks and juices in KiGGS

In KiGGS ([www.kiggs-studie.de](http://www.kiggs-studie.de)) the questions regarding the consumption of beverages containing sugars for 3 to 10 year olds were answered by the parents, for 11 to 17 year olds by the young persons themselves using a food frequency questionnaire (FFQ). In the KiGGS-FFQ consumption frequencies and amounts of sugared soft drinks (such as cola, lemonade, ice tea and malt beer) were assessed separately from sports and energy drinks.

For the analyses presented here, these have been analysed separately once (Figure 2) and otherwise summarised as the group »soft drinks«. In this group no differentiation was made between reduced-calorie (or diet / light-drinks) and soft drinks containing sugars.

The consumption of fruit and vegetable juices was assessed and analysed combined in KiGGS. The consumption frequency was assessed using the following questions:

- »How often did your child / did you drink sugared soft drinks (e. g. cola, lemonade, ice tea, malt beer) in recent weeks?»
- »How often did your child / did you drink sports or energy drinks in recent weeks?»
- »How often did your child / did you drink fruit juice, fruit nectar or vegetable juice (also diluted) in recent weeks?»

Possible answers: Never, once per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, once per day, 2-3 times per day, 4-5 times per day, more than 5 times per day.

The following questions were asked with regard to serving size:

- »Each time your child / you drinks / drink sugared soft drinks, how much does he or she / do you usually drink?»
- »Each time your child / you drinks / drink sports or energy drinks, how much does he or she / do you usually drink?»
- »Each time your child / you drinks / drink juice, how much does he or she / do you usually drink?»

Possible answers: ¼ glass (or less), ½ glass, 1 glass (200 ml), 2 glasses, 3 glasses (or more).

drinks, attack the tooth enamel and encourage the formation of caries (Armfield et al. 2013, Hasselkvist et al. 2010).

In addition to this, associations between the intake of beverages containing sugars and bone health in adolescents have been observed. Accordingly, the Dortmund Nutritional and Anthropometric Longitudinally Designed (DONALD)-Study determined that the mineral content of the bones diminishes the more soft drinks (caffeinated and non-caffeinated beverages, e. g. lemonades, ice teas, fruit juice drinks, sports drinks, energy drinks) are consumed (Libuda et al. 2008b). The causes of this have not yet been completely clarified. However, some studies suggest that phosphoric acid, which is often added to cola drinks, poses a risk factor for bone health (Wyshak 2000, Tucker et al. 2006).

For some considerable time now, so called diet/light-drinks have been on offer as a low-calorie alternative to sugary soft drinks. In these drinks, sugar is replaced with sugar substitutes (e. g. sorbitol) or sweeteners (e. g. aspartame). These diet/light-drinks are also in the spotlight of

criticism. Here, above all, it is the often excessively sweet flavour that is cited, which possibly creates a general taste preference for sugary foods (Köhnke 2011). Apart from this, the connection between the consumption of diet/light-drinks and the occurrence of type II diabetes mellitus and/or metabolic syndrome and vascular diseases has been the subject of discussion for several years (Fagherazzi et al. 2013, Gardener et al. 2012, Nettleton et al. 2009).

### Juices and soft drinks are popular especially among younger people

Within the framework of the health monitoring activities of the Robert Koch Institute, regular surveys of health data are obtained from children, adolescents and adults. In the baseline study of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), the health status and health-related behaviour of 17,641 girls and boys aged 0 to 17 years was assessed by physical examination and questionnaires between the years 2003 and 2006 ([www.kiggs-studie.de](http://www.kiggs-studie.de)).

In the first phase of the German Health Interview and Examination Survey (DEGS1), 8,152 women and men aged between 18 and 79 years were examined and surveyed between 2008 and 2011 ([www.degs-studie.de](http://www.degs-studie.de)).

### Assessment of the consumption of soft drinks and juices in DEGS1

In DEGS1 ([www.degs-studie.de](http://www.degs-studie.de)) the various types of soft drinks containing sugars were obtained in the food frequency questionnaire (FFQ) using a single question. Fruit and vegetable juices were assessed separately. For the purposes of the analyses presented here, the consumption of both types of juice was analysed once (Figure 2) and in the other analyses only fruit juice consumption was used.

The frequency of beverage consumption was assessed as follows (the beverage groups: Water, fruit tea, diet / light-drinks, tea and coffee were surveyed analogous to these questions):

- »Over the past 4 weeks, how often did you drink sugared soft drinks (e. g. cola, lemonade, ice tea, malt beer, energy drinks)?»
- »How often did you drink fruit juice (such as orange, apple, cherry juice)?»
- »How often did you drink vegetable juice (such as tomato, carrot juice)?»

Possible answers: Never, once per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, once per day, 2-3 times per day, 4-5 times per day, more than 5 times per day.

Portion size was obtained using the following questions:

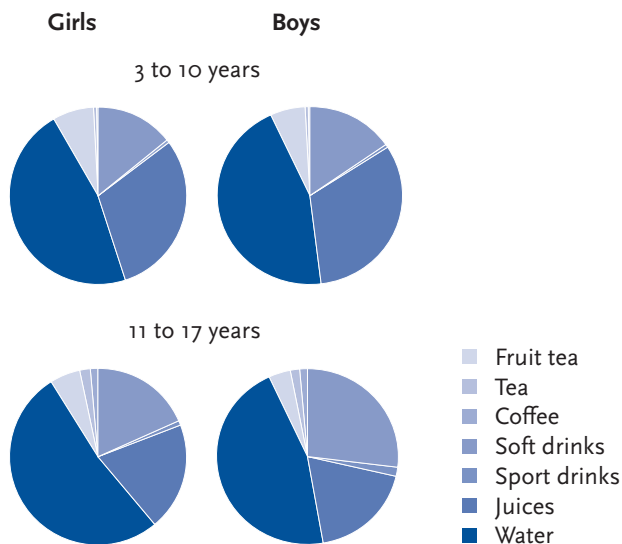
- »Each time you drink sugared soft drinks, how much do you usually drink?»
- »Each time you drink fruit juice, how much do you usually drink?»
- »Each time you drink vegetable juice, how much do you usually drink?»

Possible answers: ½ glass, 1 glass (200 ml), 2 glasses, 3 glasses, 4 glasses (or more).

Diet was assessed in both KiGGS and DEGS1 with the use of a food frequency questionnaire. Here, among other things, beverage consumption »in recent weeks« was taken into account by asking how frequently certain beverages had been consumed and how large the respective quantities were (see box).

Figures 2 and 3 provide an overview of how the mean beverage consumption quantities of the non-alcoholic beverages surveyed in KiGGS and DEGS1 relate to each other. The quantities consumed in the individual beverage groups were calculated by multiplying the consumption frequencies (in the preceding four weeks) with the serving sizes and mean values determined. Their proportional relationships were then displayed at group level.

**Figure 2**  
Beverage consumption\* quantity ratios in children and adolescents  
Data source: KiGGS-Baseline survey

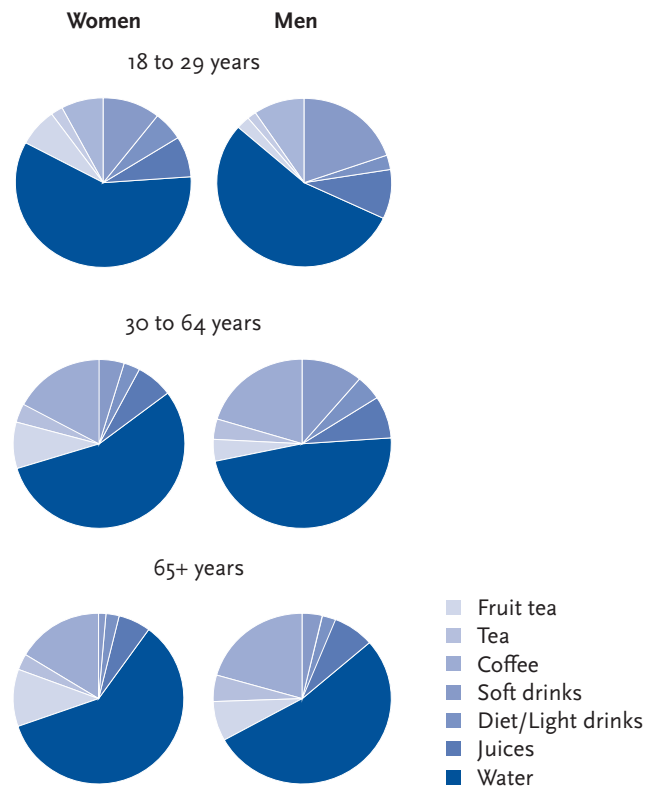


\* Not including milk and alcoholic drinks. The beverage groups: water, fruit tea, diet/light-drinks, tea and coffee were surveyed analogous to the questions in Box 2.

On average, among girls and boys aged between 3 and 10 years almost half of the quantities consumed are made up of juices and soft drinks, although proportionately more juice is consumed. The other half is mainly water and fruit teas. A similar distribution can be seen among boys aged 11 to 17 years. However, the proportion of soft drinks is significantly larger than in the younger age group and the proportion of juices is correspondingly smaller.

Among 11 to 17 year-old girls the proportion of water increases to just over half of the total consumption. The proportion of juices and soft drinks remains almost constant. However, in comparison to younger girls, it was revealed that more soft drinks and less juices are consumed. For girls and boys in this age group, coffee and tea play a subordinate role. In young adulthood (18 to 29 years) women and men drink proportionately more water than

**Figure 3**  
Beverage consumption\* quantity ratios in adults  
Data source: DEGS1



\* Not including milk and alcoholic drinks. The beverage groups: water, fruit tea, diet/light-drinks, tea and coffee were surveyed analogous to the questions in Box 2.

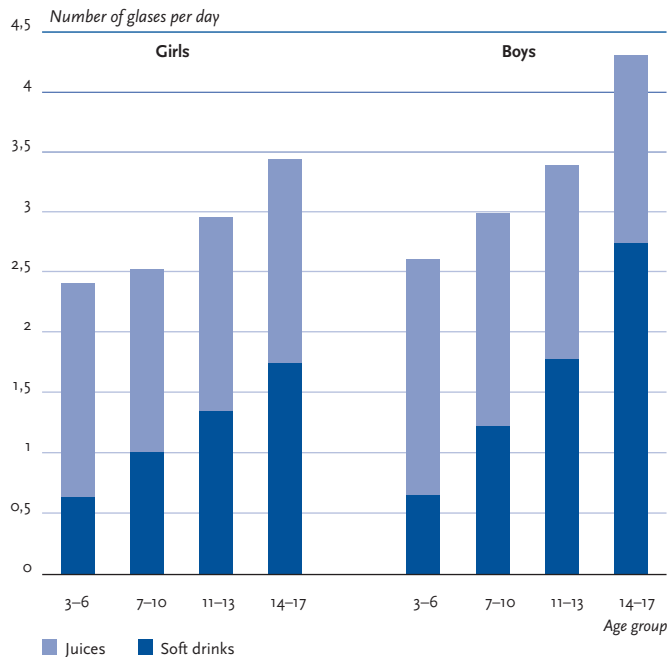
during adolescence. The share of soft drinks and juices is smaller than in the younger age groups. The consumption of coffee increases and is consumed in approximately the same quantities as juice. Among adults of 30 years and older, water also contributes the largest share of average quantities drunk. From this age, juices and soft drinks play a less important role than coffee, tea and fruit tea. They account for less than a quarter of the total volume drunk and among women aged 65 and above, less than an eighth.

### On average, males drink more beverages containing sugars than females

Children and adolescents between the ages of 3 and 17 years consume on average more than two glasses of drinks containing sugars per day (Figure 4). On the whole, boys drink more of these beverages than girls of the same age. Consumption increases in both sexes with age until the highest mean value is reached among 14 to 17 year olds (Girls: 3,4 glasses, Boys: 4,3 glasses).

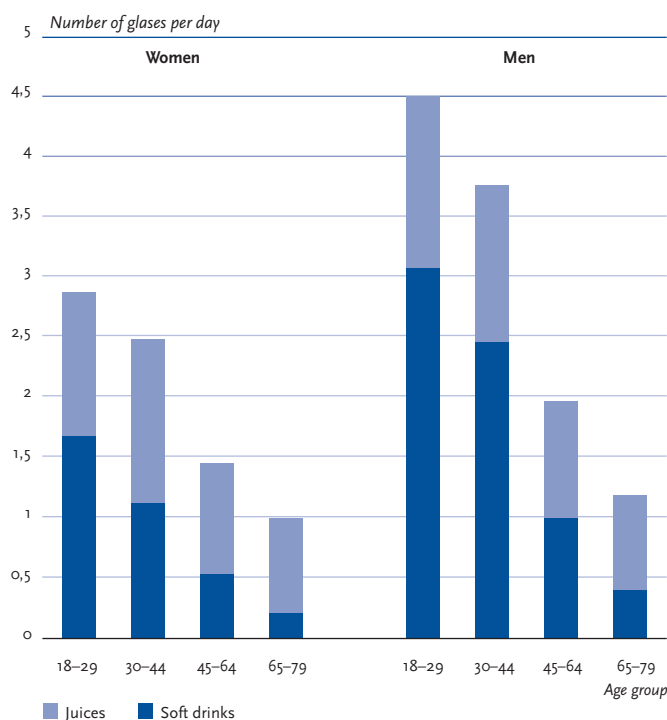
Whilst the proportion of juice consumed on a daily basis among girls remains relatively constant across the age groups, it diminishes slightly among the boys. In contrast, the proportion of soft drinks consumed increases clearly in both sexes. There are also differences between

**Figure 4**  
**Mean number of glasses of juice and soft drinks per day in children and adolescents according to age and sex**  
 Data source: KiGGS-Baseline survey



the sexes in the consumption of juices and soft drinks among adults. According to the results, men between 18 and 79 years of age drink obviously more beverages containing sugars than women of the same age (Figure 5).

**Figure 5**  
**Mean number of glasses of juice and soft drinks per day in adults according to age and sex**  
 Data source: DEGS1



The mean consumption in both sexes is at its highest in the 18 to 29 age group and reduces with increasing age. The largest reduction can be observed in both women and men in the 45 to 64 year age group.

Whereas soft drinks still account for the highest proportion of daily consumption among younger adults, juices contribute progressively more among women from the age of 30 and men over 45 years. In the highest age group, the proportion of juices constitutes the larger part of daily consumption of beverages containing sugars.

In this context an interesting fact is that among adults, juices are more frequently consumed in a diluted state with increasing age (Table 1). Whilst in the 18 to 29 year age group 70 % of both women and men drink their juice undiluted, amongst 65 to 79 year-olds only 51 % of women and 60 % of men continue to do so.

**Table 1**  
**Proportion of fruit juices consumed undiluted as part of total fruit juice consumption in adults (in Percent)**  
 Data source: DEGS1

Age in year	Women	Men
18-29	70,2%	71,1%
30-44	52,8%	63,4%
45-64	55,4%	61,7%
65-69	50,8%	60,0%

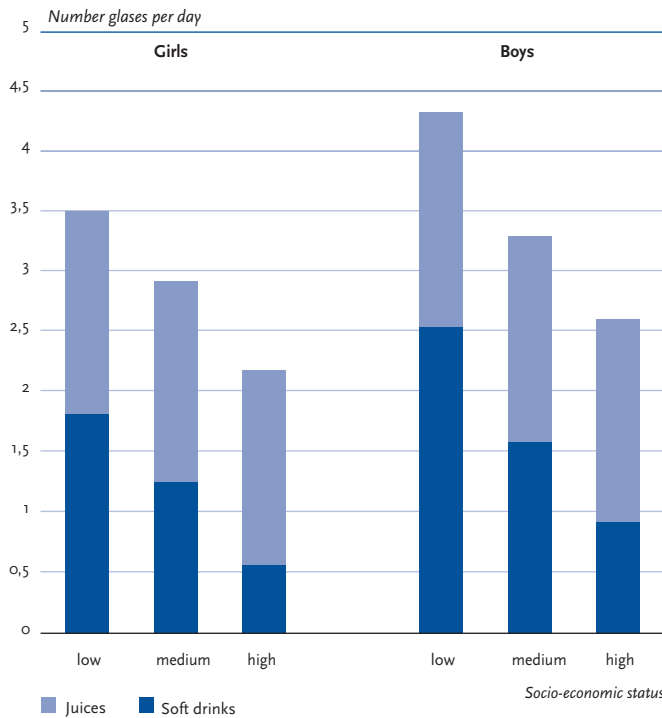
### People of lower socio-economic status more frequently drink beverages containing sugars

Socio-economic status (SES) in both KiGGS and DEGS1 was determined using a three-dimensional index which includes the components of formal education, occupational status and net household income (Lampert et al. 2013; Lampert, Kurth 2007). In children and adolescents the index was measured using the characteristics of the parents.

For children, adolescents and adults there is consistent evidence that regardless of sex, people of lower SES consume juices and soft drinks considerably more frequently than persons of middle and high SES (Figures 6 and 7). This relationship is statistically significant even after adjustment for age.

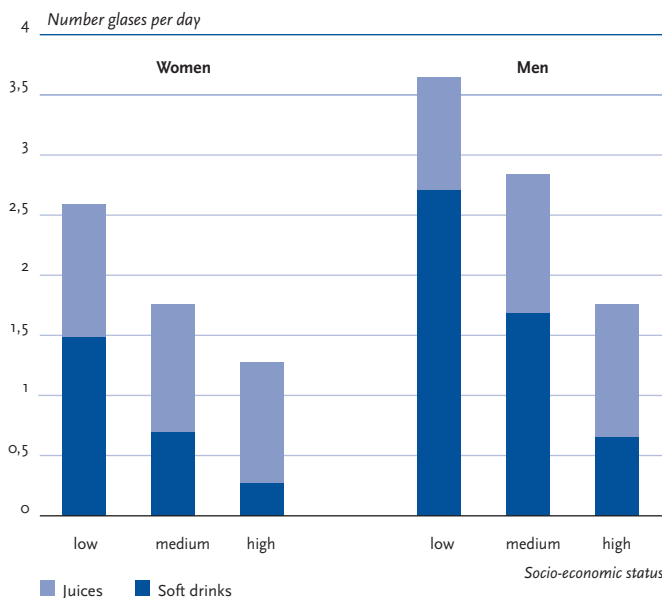
In addition, differences in the choice of beverages can be observed. Children and adolescents of medium and high SES consistently drink more juices than soft drinks. In contrast, among girls and boys of low SES, the proportion of soft drinks make up a share of more than 50 % respectively of the mean consumption of beverages containing sugars per day. Among women in all SES-classes and among men of higher SES, similar results are revealed to those found in children and adolescents.

**Figure 6**  
**Mean number of glasses of juice and soft drinks per day in children and adolescents (3 to 17 years) according to socio-economic status**  
 Data source: KiGGS-Baseline survey



Men of low and medium SES drink significantly more soft drinks than juices. Among men of low SES they have a share of approx. 75 % and among men of medium SES of more than 50 % of daily average consumption of beverages containing sugars.

**Figure 7**  
**Mean number of glasses of juices and soft drinks per day among adults (18 to 79 years) according to socio-economic status**  
 Data source: DEGS1



## Discussion

The German Nutrition Society recommends to cover daily fluid requirement where possible by water and low-energy beverages. The results presented here however suggest that children, adolescents and young adults in particular, frequently resort to sugary alternatives such as soft drinks and juices to quench their thirst.

Adults from the age of 30 tend to drink less of these with increasing age. In a gender-specific context we see that boys and men across all age groups drink more high-energy drinks than girls and women. In addition, results indicate that people of low socio-economic status consume more beverages containing sugars than those of medium or high socio-economic status.

The results are based on questions in a food frequency questionnaire used as part of the health monitoring activities of the RKI (see box on the »Assessment of the consumption of soft drinks and juices«). These do not allow an exact recording of quantities consumed but an approximation is possible. A comparison with results from studies with more detailed and quantitatively differentiated methods such as the Eating study as a KiGGS module (EsKiMo) and the National Nutrition Survey II (NVSII) reveals similar trends.

In EsKiMo, 2,506 girls and boys aged 6 to 17 years were questioned in detail with regard to their nutrition in 2006. For the 6 to 11 year age group, parents together with their child kept food records over three days. With the 12 to 17 year olds a comprehensive, last revised and revised dietary history was conducted with the help of the DISHES assessment tool (Mensink et al. 2007). The EsKiMo-Study observed that boys also consistently consumed more beverages containing sugars than girls. Apart from this, the average total consumption also increased clearly with age, as in the KiGGS-Baseline survey. Whereas girls between the ages of 6 and 9 drank 1.7 glasses and boys 2.1 glasses per day, 15 to 17 year old girls consumed on average 3.7 glasses and boys 5.5 glasses per day (Mensink et al. 2007).

In addition, a similar association between the consumption of sugary soft drinks and socio-economic status was also observed in EsKiMo (Stahl 2008).

The DEGS1 results on beverage consumption among adults correspond with the data of the National Nutrition Survey II (NVS II). NVS II is a representative nutrition survey for Germany, which was conducted between 2005 and 2006 by the Max Rubner Institute (MRI 2008). Results of the 24-hour-recall protocol, among the tools used in NVS II, reveal that men across all age groups consume on average more sweet drinks than women. It was also observed that consumption declines as age increases.

Additionally, the NVS results also reveal higher consumption of soft drinks among persons of low socio-economic status (DGE 2012).

Increased consumption of drinks containing sugars does not necessarily have to lead to an increase in energy balance. However, given simultaneous consumption of

other nutritionally unfavourable foods (without any form of offset, for example through physical activity), this is (very) likely. The fact that simultaneous consumption of unfavourable foods often occurs in adolescents and adults has been shown by the analyses in EsKiMo and the German National Health Interview and Examination Survey 1998, in which the combined intake of foods was investigated as dietary patterns. Accordingly, patterns could be identified for 12 to 17 year old girls and boys where, in addition to beverages containing sugars, sweets and fast foods were frequently also consumed (Richter et al. 2012). In adults, one pattern was identified where a high consumption of sweetened beverages accompanied high consumption of refined cereal products, processed meat and snacks (Heidemann et al. 2011).

The results emphasize that great potential for prevention exists in Germany with regard to the consumption of beverages containing sugars. This is particularly true in respect of children, adolescents and young adults, boys and men, as well as people of low socio-economic status.

Since it can be assumed that food and taste preferences already develop during childhood and adolescence and persist into adulthood (Tuttle 1999, Pudel, Westenhöfer 1998), it should be attempted as early as possible to positively modify drinking behaviours. In addition to home, essential settings for the implementation of prevention measures would above all be child day-care centres and schools. Important for this is both communicating knowledge about healthy drinks (behavioural prevention) and structural measures (conditional prevention). The latter would, for example, include the continual provision of water, unsweetened herbal or fruit teas or heavily diluted sparkling fruit spritzers in educational and care centers.

In addition to a healthy drinking behaviour, a healthy eating behaviour should also be encouraged. This makes sense since it is not just the consumption of individual drinks and foods that have an impact on health but more the combination of all foods eaten and drunk day-to-day.

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**Imprint**

GBE kompakt

**Publisher**

Robert Koch Institute  
Nordufer 20  
13353 Berlin

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**Citation method**

Rabenberg M, Mensink GBM (2013)  
Fizzy drinks, juices etc. - The consumption of beverages  
containing sugar in Germany.  
Published by Robert Koch Institute Berlin.  
GBE kompakt 4(1)  
[www.rki.de/gbe-kompakt](http://www.rki.de/gbe-kompakt) (last revised: 20.08.2013)

ISSN 2191-4974

The Robert Koch Institute is a federal institute within  
the portfolio of the Federal Ministry of Health