



5-A-DAY FOR BETTER HEALTH TRUST POSITION STATEMENT ON FRUIT AND VEGETABLE JUICE

BACKGROUND

The purpose of this document is to provide an understanding of both the regulatory framework and the public health basis for the inclusion of a 200mL serving of carbonated or still fresh fruit/vegetable juice or 100% pure unsweetened fruit/vegetable juice in the 5-a-Day programme.

TECHNICAL INFORMATION ON FRUIT/VEGETABLE JUICE PROCESSING

In order to be fully able to assess fruit/vegetable juices, it is important to not only understand the regulatory environment, but also to have an understanding of the processing undertaken when fruit/vegetable juice is made especially as there is a great deal of misinformation and misinterpretation in this regard. The description below pertains to fruit juice but can also be similarly applied to vegetable juice.

1. Preparation of raw material

Mature, undamaged fruit are selected for washing in clean water, which may in rare cases be chlorinated. Any fruit that is mouldy or under-ripe should be sorted and removed. Fruit is then peeled, either mechanically or using sodium hydroxide and stones or seeds are removed. Enzymatic browning in fruit occurs if exposed to the air for extended periods of time, so cut fruit is generally kept in water treated with a permitted anti-oxidant or lemon juice. Fruit must sometimes be cut to a specific size to fit the liquidiser or pulper.

2. Juice extraction

The method used to extract juice depends on the type of fruit used. Citrus, apple, pear and grape fruit, which are naturally juicy, are mechanically pressed. Some fruit such as melon and papaya are steamed to release the juice. Fruit such as mango, guava, pineapple, strawberry must be pulped to extract the juice. The fruit pieces are pushed through a perforated metal plate that crushes and turns them into a pulp. Some fruit can be pulped in a liquidiser and then filtered to remove the fruit pieces. It is important to understand the difference between a pulp and a puree. Essentially a pulp is produced by 'pulverising' the entire fruit and then removing hard, inedible bits afterwards; while a puree is produced from the 'liquidising' of only edible parts of the fruit.

The juice starts to deteriorate as soon as it is expressed from the fruit as a result of chemical activity (enzyme action) and bacterial spoilage. Extracted fruit juice that is left to stand for long periods out of refrigeration will also start to ferment and discolour. For the best quality product, it is essential to work quickly between the extraction of the juice and the bottling stage.

3. Filtering

Most fruit juices are naturally cloudy or opaque but some consumers prefer a clear product. Filtering is an important process required to clarify the juice. The extracted juice or pulp is filtered through a muslin cloth or a stainless steel filter. In some cases pectic enzymes are used to break down the pectin which clarifies the juice.

4. Preparation of Different Types of Fruit Juices, Nectars & Drinks

All fruit contains sugar, usually around 8 – 12%. The actual levels vary from fruit to fruit and with the stage of ripeness of the fruit. They also vary with geographical location around the world. The addition of sugar to the fruit pulp serves two main purposes and must take into account the amount of sugar already present in the juice. Firstly, deflavoured apple, pear or grape juice is added to fruit pulps like guava, mango etc to obtain a drinkable fruit juice as fruit pulps generally contain so much pulp, that they are too thick to drink. Deflavoured apple, pear and grape is therefore used in combination with these pulps to obtain a liquid. . Deflavoured apple, pear or grape juice is obtained during the process of concentration of the juice due to the fact that the flavour compounds are volatile, they are flashed off during the first steps of concentration. Secondly the deflavoured apple, pear or grape juice may be added as a preference for consumers requiring or expecting a sweeter product. Sucrose is used instead of deflavoured juice to obtain a cheaper beverage i.e. nectar or fruit drink and is usually added to the fruit juice/pulp as a sugar syrup.

The following table shows the minimum sugar content (measured as degrees brix corrected for acid) expected in 100% fruit juice for the different fruit juices at single strength:

FRUIT	BRIX	FRUIT	BRIX	FRUIT	BRIX
Apple	10.5	Guava	8.0	Peach	12.0
Apricot	11.0	Lemon	7.5	Pear	12.0
Granadilla	9.0	Naartjie	8.5	Pineapple	8.5
Grape	12.5	Orange	10.0	Unspecified Fruit	12.0
Grapefruit	8.0				

Juices are sold either pure (unsweetened) or sweetened, and with or without carbon dioxide added. The following provides a brief description of how the various classes of fruit juice & drinks are manufactured:

- **Fresh Fruit Juice:** is usually squeezed from the fruit by physical or mechanical means at the point of sale, since only 2 hours may elapse between extraction and sale or consumption.
- **100% Pure Fruit Juice:** is undiluted, unsweetened fruit juice, puree or concentrate usually extracted from the fruit by mechanical means, to which acidifying agents and carbon dioxide are added and which is heat treated either by pasteurisation or ultra heat treatment (UHT) to preserve the product. It can also be fruit juice made using concentrate through the addition of water and natural essence, natural flavourants or nature identical flavourants to reconstitute the juice to its original standard strength without the addition of sugar.
- **100% Sweetened Fruit Juice:** varying amounts of 100% pure fruit juice (above) is mixed with up to 5% (m/m) of permitted sweeteners.
- **Fruit Nectar:** is a sweet mixture of 20 – 90% fruit pulp or concentrate (prescribed for each fruit), sugar and water or sugar syrup to give a final sugar level of about 7.5 – 12.5%.

- Fruit Squash: contains 24% fruit juice mixed with sugar syrup to give a final sugar concentration of about 40%. Squashes are diluted with water prior to use and, as the bottle is opened, partly used and then stored, it is necessary to add a preservative.

5. Heat Treatment

All the products, except freshly squeezed fruit juice, need to be either pasteurised or undergo ultra heat treatment (UHT) processing to preserve the product. Heat processing denatures enzymes naturally found in the fruit that can lead to spoilage and discolouration, and kills spoilage micro-organisms and pathogens found in fruit. The process may destroy heat-sensitive nutrients like vitamin C and the B vitamins, but these are allowed to be restored to the product with proper labelling thereof.

Modern methods of pasteurization include plate heat-exchangers, tubular heat-exchangers and tunnel pasteurisers. Plate heat exchangers are used for juices with low pulp content i.e. clear apple, pear or grape juice, while tubular heat exchangers are mainly used for pulpy juice i.e. mango, guava, orange etc. Tunnel pasteurisers are used for bottled or canned beverages. Modern technology has resulted in pasteurisation processes with minimum harmful effects on the taste, physical and nutritional attributes of the juice. .

The UHT process requires capital investment to set up and is highly controlled to produce a product of consistent quality.

6. Filling and packaging

The products will then be either hot-filled or cold-filled into clean bottles, cans or Tetrapak cartons and be closed or capped. Carbonation , the addition of carbon dioxide (Co₂), of beverages is introduced to cold filled beverages at the filling stage, after which pasteurisation occurs inside the container.

BACKGROUND TO THE LEGISLATION

AGRICULTURAL PRODUCT STANDARDS ACT 119 OF 1990

Regulations relating to fruit juices are promulgated under the Agricultural Product Standards Act 119 of 1990. The Regulations relating to the classification, packing and marking of fruit juice and drink in the Republic of South Africa (R286) originated on 7 November 1980 under the then Department of Agriculture and Fisheries.

In 1984 an amendment (R641) was published under the new Department of Agriculture detailing specification changes to fruit juice and nectar blends. 1995 saw a further amendment (R1801) which made provision for flavoured drinks. The very last, somewhat insidious point of the amendment, permits the substitution of the word 'drink' for the words 'mineral water' or 'spring water' or 'sport' or 'energy' drink.

These amendments were followed by 3 dispensations:

1. In 1997 a decision was taken to do away with the requirement to label a fruit juice or drink as 'sweetened' or 'unsweetened' or 'artificially sweetened'.
2. In 2005 permission was granted for the use of natural and nature identical flavourants in fruit juices and their blends, in addition to the permitted natural fruit essence of the fruit concerned.

3. In 2009 following complaints regarding the dispensation granted in 1997, which then permitted 100% fruit juices and their blends to be sweetened without any indication thereof, the Department of Agriculture, Forestry and Fisheries decided to revoke the previous dispensation for 'sweetened' and 'artificially sweetened' fruit juices and their blends. This means that they are again required to be labelled as such, while 'unsweetened' fruit juices and their blends no longer have to be labelled as such.

The Agricultural Products Standards Act 119 of 1990 includes a number of definitions which have to be applied by the industry. The 5-a-Day for Better Health TRUST has taken full cognisance of these regulations and definitions when considering fruit juice for inclusion in the 5-a-Day programme.

The following relevant definitions are quoted from the regulations relating to the classification, packing and marking of fruit juice and drink, R286 of 1980, promulgated under the Agricultural Products Standards Act 119 of 1990.

Brix: means the percentage total dissolved solids, which in fruit really refers to the sugars (90% of dissolved solids in fruit are sugars, the other 10% being acids, minerals and other ions)

Concentrated Juice / Juice from Concentrate: the product obtained by the removal of water to yield a product with at least double the standard strength of the fruit concerned.

Cordial: a syrupy concentrated drink which requires a minimum dilution ratio of 1 to 3 to produce a suitable drink after dilution.

Fruit Juice: a drink which is solely or partially prepared from fruit or which in appearance, flavour and taste resembles juice derived from fruit and contains a certain percentage of fruit juice as specified per fruit in the regulations.

Fruit Drink: a drink which is prepared from fruit or which in appearance, flavour and taste resembles juice derived from fruit and contains a certain percentage of fruit juice as specified per fruit in the regulations. This may include fruit flavoured drinks like flavoured mineral or spring water, sports or energy drinks.

Natural Fruit Essence / Aroma: the natural and volatile flavouring substances recovered from the distillate during concentration of the fruit juice concerned.

Natural Juice / Natural Puree / Natural Pulp: the juice, puree or pulp extracted by a mechanical and/or physical process from fruit. This includes juices made from concentrate with the addition of water and fruit essence or flavourants to reconstitute the juice organoleptically, physically and chemically to its natural, original composition at standard strength.

Nectar: an unfermented pulpy (with bits) or non-pulpy (clear) fruit drink obtained by mixing fruit juice, water and permitted sweeteners to produce a product containing a specific amount of fruit juice at standard strength and preserved in a permitted manner

Pulp: the unfermented pulpy fruit juice product obtained by physical or mechanical methods, with seeds removed by screening and preserved in a permitted manner

Puree: the unfermented pulpy fruit juice product obtained by finely grinding / mashing and sieving only the edible portion of the fruit, after removal of the rind, seeds or pips, and preserved in a permitted manner

Ready-to-drink: means the fruit juice or drink is of standard strength, or it has been reconstituted or diluted to produce a product which is standard strength

Reconstituted Fruit Juice: fruit juice of not less than standard strength, which is derived from concentrate to which water has been added, with or without the addition of flavourants

Squash: a cordial which contains at least 6% (v/v) fruit juice at standard strength, after dilution

Standard Strength: means the strength of the natural fruit juice measured in degrees Brix and is specific for each fruit type

In addition to the Agriculture Products Standard Act there are also regulations that have to be applied that fall under the Foodstuffs, Cosmetics and Disinfectants Act 54 of 1972. These regulations include labelling and advertising regulations and also set limits for the use of various additives in fruit juices and nectars.

FOODSTUFFS, COSMETICS & DISINFECTANTS ACT 54 OF 1972

The following are the regulations that set limits for the use of various additives in fruit juices and nectars:

1. R115 of 1986: allows the addition of selected acids, bases and salts to various fruit juices and nectars as follows:

FRUIT	ACID / BASE / SALT
Apricot, Peach, Pear Nectars	Citric & malic acids
Grape Juice and its concentrate	Citric & malic acids; Calcium hydroxide
Labrusca type grape juice, sweetened concentrate	Citric & malic acids
Non-pulpy blackcurrant, apple, guava, mango, orange & lemon nectars and juices	Citric & malic acids
Pineapple juice	Citric & malic acids
Pulpy nectars of small fruit	Citric & malic acids
Fruit juices not otherwise specified, excluding concentrates	Citric & malic acids

2. R965 of 1977: allows the use of ascorbic acid as an antioxidant and a range of preservatives permitted for use in fruit juices and nectars as follows:

FRUIT	PRESERVATIVE / ANTI-OXIDANT
Fresh fruit pulp	Benzoic acid; Pimaricin; Sorbic acid; Sulphur dioxide
Blackcurrant juice	Sulphur dioxide; Pimaricin
Fruit juices not otherwise specified	Benzoic acid; Propyl-p-dyroxyl benzoate; Methyl-p-hydroxy benzoate; Pimaricin; Sorbic acid; Sulphur dioxide
Pineapple juice	Sulphur dioxide; Pimaricin
Fruit juices, fruit nectars, fruit squashes, fruit drinks and flavoured drinks	Erythorbic acid / sodium erythorbate; L-ascorbic acid

3. R1008 of 1996: prohibits the addition of colourants to 100% pure fruit juice and permits selected colourants to be added to guava and tomato juice as follows:

FRUIT	COLOURANT
Tomato and guava juice	Betanine; Carmoisine; Ponceau 4R; Sunset yellow FCF; Tartrazine

4. R500 of 2004: prescribes maximum limits for metals in fruit juices and nectars as follows:

FRUIT	METAL
All liquid foodstuffs	Antimony
Fruit juices and nectars	Arsenic; Copper; Lead; Tin; Zinc

5. R692 of 1997: sets maximum limits for selected microbiological organisms

6. R1145 of 2004: prescribes limits of mycotoxins in apple juice

FRUIT	MYCOTOXIN
Apple	Patulin

7. R3128 of 1991: prescribes that the following sweeteners may be added to foods and drinks:

SUGARS	NON-NUTRITIVE SWEETENERS*
Corn syrup	Acesulfame K
Deflavoured, de-ionised fruit concentrates and juices	Aspartame
Dextrose; Dextrose syrup	Calcium cyclamate; Sodium cyclamate
Fructose; Fructose syrup	Calcium saccharin; Saccharin; Sodium saccharin
Glucose; Glucose syrup	Neotame
Invert sugar	Sucralose
Lactose	Thaumatococin
Maltose; Maltose syrup	
Sucrose; Sucrose syrup	
Isomaltulose	
Xylose	

* These are permitted in specific quantities and require special labelling considerations

INTERPRETATION OF THE FRUIT JUICE LEGISLATION

Considering all these regulations, we can summarise that in general there are 6 different types of fruit juice and drinks, namely:

CLASS NAME	CRITERIA
Fresh Fruit Juice	<ul style="list-style-type: none"> natural juice extracted from fruit contains no additives is preserved only by refrigeration is free from pips, peel or foreign matter is intended for sale and consumption within 2 hours of extraction.
100% Pure (or Unsweetened) Fruit Juice	<ul style="list-style-type: none"> natural juice extracted from fruit preserved in a permitted manner (usually heat treatment) contains no additives except malic & ascorbic acids, carbon dioxide, added nutrients and permitted flavourants or fruit essence must contain 100% undiluted fruit juice.
100% Sweetened Fruit Juice	<ul style="list-style-type: none"> natural juice extracted from fruit contains permitted natural or other sweeteners (<5% m/m) preserved in a permitted manner (usually heat treatment) contains no additives except malic & ascorbic acids, carbon dioxide, added nutrients and permitted flavourants

	<ul style="list-style-type: none"> or fruit essence the amount of 100% undiluted fruit juice used varies depending on the fruit, from 70 – 90%.
Nectar	<ul style="list-style-type: none"> natural juice extracted from fruit contains permitted natural or other sweeteners (<5% m/m) preserved in a permitted manner contains no additives except malic & ascorbic acids, carbon dioxide, added nutrients and permitted flavourants or fruit essence the amount of fruit juice in the ready-to-drink form varies depending on the fruit, from 12.5 – 50%.
Squash	<ul style="list-style-type: none"> natural juice extracted from fruit contains permitted natural or other sweeteners (<5% m/m) preserved in a permitted manner contains no additives except malic & ascorbic acids, carbon dioxide, added nutrients and permitted flavourants or fruit essence must contain a minimum of 24% fruit juice in the undiluted form.
Drink	<ul style="list-style-type: none"> natural juice extracted from fruit contains permitted natural or other sweeteners (<5% m/m) preserved in a permitted manner contains no additives except malic & ascorbic acids, carbon dioxide, added nutrients and permitted flavourants or fruit essence must contain a minimum of 6% fruit juice in the ready-to-drink form.

CARBONATION

It appears that carbonation raises a number of health concerns amongst both the consumer and health professionals, but a detailed scientific literature review shows that these concerns are generally unfounded.

Carbonation occurs when carbon dioxide (CO₂) is dissolved in water or an aqueous solution. This process yields a 'fizz' to the liquid that it has been added to.

Carbon dioxide plays a key role in the body and is produced by every tissue and seems to act on every organ. It regulates body functions in at least 3 ways:

1. It is one of the prime factors in the blood's acid-base balance;
2. It is the main factor controlling respiration;
3. It exerts an essential tonic influence on the heart and the peripheral circulation.

The level of carbon dioxide in the body is regulated by the release of excess molecules through the lungs.

With regards to the amount of carbon dioxide ingested, with the pressures used in commercial beverages, the volume of gas will be 3-5 times the volume of the liquid. As the amount of carbon dioxide dissolved in a beverage is dependent on the pressure and temperature of the beverage, it is difficult to determine the amount ingested. Most of the carbon dioxide in a carbonated beverage does not reach the stomach as much is lost in the fizz when the can or bottle is opened (because of the sudden drop in pressure), and some combines with swallowed air to cause belching.

The small amount of carbon dioxide that does reach the digestive tract is readily and rapidly absorbed through the wall of the gastrointestinal system. The gas ingested influences the alimentary tract through the nervous system and by direct mechanical and chemical means.

Aside from the flavours and sweeteners that might have been added, fizzy beverages have a distinct carbonated taste. It was initially thought that the bubbles popping is what accounted for the tingly taste of carbonation however this has been questioned as carbonated beverages consumed in a pressurized environment, in which no bubbles formed, produce the same taste. Researchers now believe that carbonation is tasted on the tongue by the same receptors that detect sourness. Yet, carbon dioxide doesn't really taste sour and so it would seem that the ultimate perception of carbonation may involve other senses as well, including the mechanical stimulus of the popping bubbles.

The affects of carbonation on various health issues has been examined in the scientific literature and was reviewed by 5-a-Day. In order to structure the review, an initial assessment of the areas of concern associated with carbonation was undertaken amongst a small group of consumers and dietitians.

CARBONATION AND DENTITION

Dental Caries: Occur due to demineralisation of enamel and dentine by organic acids formed by *bacteria* in dental plaque through the anaerobic metabolism of sugars derived from the diet. The term sugars derived from the diet in this instance is defined as 'all mono and disaccharides added to foods by manufacturer, cook or consumer, plus sugars naturally present in honey, fruit juices and syrups.'

Evidence linking diet to dental caries

- Increased caries: Frequency of intake of free sugars and amount of free sugars (convincing)
- No relationship: Whole fresh fruit (probable)
- Decreased Caries: Fluoride exposure (convincing); had cheese and sugar-free chewing gum (probable)

Recommendations:

- Amount of free sugars: Keep consumption below 15 – 20 kg/person/year (equivalent to a daily intake of 40 – 55g or no more than 10% of total energy intake)
- Frequency of free sugars: Limit consumption of foods and/or drinks containing free sugars to a maximum of 4 times per day.
- Oral hygiene: brush teeth with a fluoride toothpaste twice a day.

Dental Erosion: The progressive irreversible loss of dental hard tissue that is chemically etched away from the tooth surface by extrinsic and/or intrinsic acids and/or chelation by a process that does not involve bacteria. The critical pH of enamel is ~5.5 and therefore any drink or food with a lower pH may cause erosion.

Intrinsic acids: from vomiting and regurgitation.

Extrinsic Acids: are from the diet e.g. citric acid, phosphoric acid, ascorbic acid, malic acid, tartaric acid and carbonic acids found in fruits and fruit juices, soft drinks – both carbonated and still, some herbal teas, dry wines and vinegar-containing foods.

Evidence linking diet to dental erosion:

- Increased risk of erosion: Soft drinks and fruit juices (probable); fresh whole fruit (insufficient)

Recommendations:

- The amount and frequency of intake of soft drinks and juices should be limited.

CONCLUSION: Carbonated fruit juice is potentially cariogenic and erosive, not due to carbonation but to the natural sugar content and acidity level. Other carbonated beverages such as sports and energy drinks are potentially as cariogenic/erosive or more so than carbonated fruit juice. Key when including fruit juice in the diet is the frequency of consumption, manner of consumption, quantity and whether included as part of a meal or drunk alone.

5-a-Day limits its fresh fruit/vegetable juice and 100% pure unsweetened fruit/vegetable juice recommendation to one 200mL serving of fruit/vegetable juice (carbonated or non-carbonated, depending on the individuals taste preference) a day and highlights the importance of good dental hygiene practices.

CARBONATION AND BONE HEALTH

The current research shows that:

- The intake of cola, but not of other carbonated soft drinks, is associated with low BMD in women and increased wrist and forearm fracture risk in children. A study in teenage girls also showed an association between carbonated beverage consumption and bone fractures however amongst physically active girls, the cola beverages, in particular, were highly associated with bone fractures.
- The excess calciuria associated with consumption of carbonated beverages is confined to caffeinated beverages. Acidulant type has no acute effect. Because the caffeine effect is known to be compensated for by reduced calciuria later in the day, the net effect of carbonated beverage constituents on calcium economy is negligible.
- The skeletal effects of carbonated beverage consumption are likely due primarily to milk displacement.

CONCLUSION: Although links between carbonated soft drinks and decreased bone mineral density and increased risk of bone fracture have been suggested, it appears that this only applies in the case of colas and not all carbonated beverages. Scientists suggest that the role of carbonated beverages in calcium deficiency and reduced bone mineral density is primarily that of displacing milk and other sources of calcium.

5-a-Day encourages the inclusion of at least 5 servings of a variety of vegetables and fruit each day that can include one 200mL serving of fresh fruit/vegetable juice or 100% pure unsweetened fruit/vegetable juice, as part of a balanced diet that also meets the other guidelines for healthy eating as outlined in the South African Food Based Dietary Guidelines.

SOUTH AFRICAN FOOD BASED DIETARY GUIDELINES

1. Enjoy a variety of foods
2. Be active
3. Drink lots of clean, safe water
4. Make starchy foods the basis of most meals
5. Eat plenty of vegetables and fruit every day
6. Eat dry beans, split peas, lentils and soya regularly
7. Chicken, fish, meat, milk or eggs can be eaten daily
8. Eat fats sparingly
9. Use salt sparingly
10. Use food and drinks containing sugar sparingly and not between meals
11. If you drink alcohol, drink it sensibly

CARBONATION AND CANCER:

One study found a small but significant link between carbonated beverage consumption and laryngeal cancer and another study found that carbonated drinks present a significant risk factor for stomach cancer in middle aged and older Japanese women.

CONCLUSION: Limited research shows that there is a possible link between carbonated beverage consumption and laryngeal and stomach cancer, although the scientific support of such a link appears weak and more research is needed from larger, well designed studies to confirm this.

5-a-Day believes that there is insufficient evidence to support the carbonation and cancer connection and highlights that eating at least 5 servings of a variety of vegetables and fruit, one of which can be a 200mL serving of a carbonated (or non-carbonated) fresh fruit/vegetable juice or 100% pure unsweetened fruit/vegetable juice, is in fact possibly cancer preventative.

CARBONATION AND THE GASTROINTESTINAL SYSTEM:

- Oesophagus: Although one study has shown that carbonated water can decrease lower oesophageal sphincter pressure, studies have not found evidence of carbonated beverages having an effect on gastroesophageal reflux. No association has been found in epidemiologic studies between carbonated beverages and gastroesophageal reflux disease (GERD) or between carbonated soft drinks and oesophageal neoplasms.
- Stomach: Carbonated beverages seem to influence the stomach function by both mechanical and chemical means: Data from various studies underline that the mechanical effect depends on the pressure exerted by gas and fluid volume on the gastric wall. These studies showed that symptoms related to gastric distress appear only with intakes of carbonated fluid greater than 300ml. A chemical effect related to carbon dioxide determines a slight increase in hydrochloric acid, which could influence positively the digestive process or worsen acid related disease. Additional studies are needed to clarify these aspects.
- Lower digestive tract: There is no clear evidence that the carbon dioxide ingested plays any pathophysiological role in the intestinal tract since it is almost totally absorbed before it reaches the lower digestive tract. An intestinal trauma can decrease carbon dioxide absorption by 20%. This is the only condition in which an increased carbon dioxide intake through a beverage might determine a greater presence of carbon dioxide in the intestinal lumen.
- Pancreas, liver and gallbladder: There is no literature showing any relationship between carbonated beverages and liver diseases. An epidemiologic study showed no link between pancreas cancer and past consumption of carbonated beverages. Some studies have investigated the influence of carbonated beverage consumption on gallbladder contractility but such an influence is doubtful.

CONCLUSION: Scientific evidence suggests that the main interactions between carbon dioxide and the gastrointestinal system occur in the oral cavity, the oesophagus and the stomach. The impact of carbonation determines modification in terms of the mouthfeel of beverages and has a minor role in tooth erosion. Some research has showed a weak association between carbonated beverages and gastroesophageal reflux disease; however, the methodology employed was often inadequate and overall, the evidence available is contradictory. Influence on stomach function appears related to both mechanical and chemical effects. Symptoms related to a gastric mechanical distress appear only when drinking more than 300 ml of a carbonated fluid.

5-a-Day allows for the inclusion of a single 200mL serving of carbonated (or non-carbonated) fresh fruit/vegetable juice or 100% pure unsweetened fruit/vegetable juice as part of the total recommended intake of at least 5 servings of a variety of vegetables and fruit. 5-a-Day promotes that at least 3 of an individual's daily servings of vegetables and fruit should come from fresh or frozen.

JUSTIFICATION OF THE 5-A-DAY FOR BETTER HEALTH TRUST RECOMMENDATION REGARDING FRUIT/VEGETABLE JUICES

When determining the criteria for the inclusion of certain fruit/vegetable juices in the 5-a-Day programme, the appropriate South African regulations were one of the items given due consideration, however the decision and criteria set had a broader public health basis.

Following a complete assessment by Professor Esté Vorster, the scientific advisor to the 5-a-Day for Better Health TRUST, it was agreed that 5-a-Day would allow the inclusion of a single 200mL serving of fresh fruit/vegetable juice or 100% pure unsweetened fruit/vegetable juice as one of the 5 or more daily servings of vegetables and fruit in the South African recommendations. 5-a-Day will always promote that at least 3 of the minimum 5 servings of vegetables and fruit should come from fresh or frozen and that a wide variety of vegetables and fruit should be included as part of 5-a-day.

The background information underlying this inclusion is summarized briefly step by step for a better understanding of this recommendation:

1. The global 5-a-Day type programmes aim to promote the consumption of at least 5 servings of fresh (frozen) vegetables and fruit a day for; (i) adequate (balanced) nutrition and (ii) to help prevent many non-communicable diseases (NCDs) of lifestyle such as cardiovascular disease (stroke, hypertension and coronary heart disease), the metabolic syndrome, type 2 diabetes mellitus and the diet-related cancers. Depending on the type of fresh or frozen vegetables or fruit, a serving is usually seen as between 80 and 100 grams, translating to 400 - 500 grams needed daily for a protective effect.
2. The recommendation to the public that vegetables and fruit are protective against NCDs is based on scientific evidence obtained from epidemiological studies in which diet and health relationships have been examined, as well as intervention trials which showed how the variety of nutrients and dietary fibre in vegetables and fruit influence human physiology and metabolism and thus the risk of NCDs.
3. The substances in vegetables and fruit directly responsible for these protective effects are dietary fibre (non-starch polysaccharides), vitamins, minerals, and a variety of non-nutritive plant chemicals with *inter alia* antioxidant properties. But there are also indirect beneficial effects related to the low energy density of vegetables and fruit, especially if they replace high-energy density foods and drinks in the diet. The low energy density is determined by the water and fibre content.
4. In South Africa, the 5-a-Day for Better Health TRUST, approved a recommendation that in the case of processed vegetables and fruit, it must always be stated on the pack (and where ever possible in communications) that *'At least 3 of the 5 daily servings of vegetables and fruit must be fresh or frozen'*. 5-a-Day will only promote that one of the minimum of 5 servings of vegetables and fruit may be in the form of a 200 mL serving of a fresh fruit juice or 100% pure unsweetened fruit or vegetable juice.
5. A fresh fruit juice is generally defined as natural juice extracted from fruit that contains no additives, is preserved only by refrigeration, is free from pips, peel or foreign matter and is intended for sale and consumption within 2 hours of extraction. A 100% pure unsweetened fruit juice is generally defined as undiluted, unsweetened fruit juice or puree usually extracted from the fruit by mechanical means, to which acidifying agents and carbon dioxide are added and which is heat treated either by pasteurisation or ultra heat treatment (UHT) to preserve the product. It can also be fruit juice made using concentrate through the addition of water and natural essence, natural flavourants or nature identical flavourants to reconstitute the juice to its original standard strength without the addition of sugar.

The Agricultural Products Standard Act states that 100% pure unsweetened fruit juice must:

- be the natural juice extracted from fruit
- be preserved in a permitted manner (usually heat treatment)
- contain no additives except malic and ascorbic acids, carbon dioxide, added nutrients and permitted flavourants or fruit essence
- contain 100% undiluted fruit juice.

6. Therefore, the process of ‘manufacturing’ a fruit juice changes the composition and nutritive value of the product when compared to the original fruit. The major change is the removal of the dietary fibre component as part of the pulp, which in effect reduces the energy dilution function of fibre in the original fruit, and indirectly also changes the vitamin and mineral density. If the water ‘additions’, as described above are adhered to, the juice will have a higher energy density.

A higher micronutrient (minerals and vitamins) density can be expected but not guaranteed: Some micronutrients may be removed as part of the pulp while others could be partially destroyed by processing (for example heat exposure may destroy some of the vitamin C).

7. It is important to realise that the fruit juice should be seen as a new product and not as just another version of the fruit(s) it is made from. It is, therefore, not an exact nutrient exchange for the original intact fruit. A 200mL serving of the juice, with its higher energy density and lower dietary fibre content, should therefore, not be seen as replacing 80 to 100 grams of the original fruit, especially when carbohydrate exchanges are calculated in diabetic diets, or energy exchanges in energy-restricted weight-loss diets.
8. The choice of a 200mL as serving size for a fruit/vegetable) juice was based on the above arguments regarding energy and nutrient density properties of intact fruits and their juices, as well as the reality on how these juices are normally or usually consumed. The 200mL translates to a smallish glass of juice, the prudent recommendation most individuals will be able to follow. Recommending a 100mL serving size could be nearer to a carbohydrate exchange value, but would not be a positive, ‘do-able’ recommendation for usual consumption because few people will restrict the volume to half a glass when they drink juice. The higher energy density and low fibre content of fruit juices, dictated the recommendation that a juice should only be regarded as one of the minimum of 5 servings of vegetables and fruit a day, to ensure that sufficient dietary fibre from these sources is consumed.
9. The decision to allow a single 200mL serving of fresh fruit juice and 100% pure unsweetened fruit juice to be carbonated or non-carbonated, is based on the evidence that does not link this level of carbonation to any adverse health effects. The choice of carbonated or non-carbonated is left to individual taste preference.

It is important to recognise that the recommendations made by the 5-a-Day for Better Health TRUST in South Africa are in line with the food-based dietary guideline messages for all individuals over 2 years of age, which aim to be positive, based on the usual dietary habits of all population groups and therefore also practical, culturally sensitive and ‘do-able’.

In conclusion, the 5-a-Day recommendation for carbonated or non-carbonated fresh fruit/vegetable juice and 100% pure unsweetened fruit/vegetable juices should be seen as a general recommendation to improve the health of the population. In the design of diabetic or weight loss diets, in which carbohydrate and energy exchanges are precisely calculated, the type of vegetables and fruit, but also the number of servings and the size of the serving in context of the total diet (other foods such as whole grains and cereals providing additional fibre, the amount of water, etc.) will influence the recommendations for these specialised diets. A registered dietitian has the necessary qualifications to assist in special diet planning.

5-a-Day promotes that at least 3 of the minimum 5-a-Day servings of vegetables and fruit should come from fresh and frozen vegetables and fruit and it is important to include a variety of different vegetables and fruit in the diet.

/ENDS