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**Comments on Sugars, Fruit Juice and Sugar Sweetened Beverages (SSB's)**

GIFSA wants to submit a motivation, based on scientific evidence, that 100% fruit juice should not be seen as part of "free sugars" as per WHO or "added sugar" as per R146, but as part of intrinsic sugars (as per WHO and R146), together with fruit, vegetables and dairy products and thus not be taxed together with other sugar sweetened beverages.

GIFSA maintains the view that 100% Fruit Juice has more in common with the health aspects of fresh fruit and vegetables, than the similarities it shares with SSB's, provided the serving size is sensible.

**A Healthy Aspects of Fruit Juice**

Starting with the healthy aspects of fruit juice and its similarities with fresh vegetables and fruit, we abstracted notes from "**Fruit juice' health promoting components** (IFU. International Fruit and Vegetable Juice Association. 14, Rue de Turbigo-F 75001 Paris, 2012)" A copy of the original document, with reference can be downloaded from http://www.smarthealthdiet.co.za/twelve-keys/key-9-water-and-lower-kj-beverages

The abstracted text is displayed in italics.

*Fruits and vegetables form a versatile and complex substance group category of foods. The relevant substance groups are carbohydrates, acids, minerals, polyphenols including the colourful anthocyanins, water-soluble vitamins, amino acids, aroma compounds, carotenoids, fibers and other bioactive substances. During processing, they are essentially transferred into the pressed juice or into the puree.*

*100% Fruit juices contain a variety of beneficial micronutrients, including minerals, such as potassium (Dillon, 1995), calcium and magnesium. Many trace elements of fruits are also found in the corresponding fruit juices.* This cannot be said of any SSB.

- *Fruit Juices' Phytochemical Properties.*

  *It has been shown that phytochemicals act through the modulation of signal cascades in the human body, most often starting at the genes level. Based on these interactions, signals are transferred into the cells leading to activation or deactivation of metabolic pathways. (Serafini, 2009; Koltover, 2009; Crozier et al 2009).*

  *It is now accepted that phytochemicals, once ingested, are modified and metabolized in the intestinal tract. Parts of these phytochemicals and their metabolites are absorbed into the blood stream and*

*then modified again in the liver and other organs. Finally, these metabolites act with cells signaling pathways and start a series of cascading reactions promoting physiological changes.*

- *Health Benefits of Fruit Juices*

*The high potassium and low sodium characteristic of most juices help maintain a healthy blood pressure, furthermore the lack or near absence of saturated fat in fruit juices is beneficial for the cardiovascular system (Delichatsios and Welty, 2005). Vitamins play a special role since they are essential for life and most are not produced by the body. Vitamin C (ascorbic acid), naturally present or added to most juices, is necessary for the body to form collagen, cartilage, muscle, and blood vessels, and aids in the absorption of iron. The health benefits of minerals, vitamins, and micronutrients have been well characterized but many of the potentially beneficial properties of juices have been shown to come from phytochemicals, mainly polyphenols, carotenoids and limonoids.*

1. *Cardiovascular Health*

*Fruit juices have been shown to act at the various levels of the processes leading to atherosclerosis. Several years ago, it was shown that fruit juices can increase the level of high density lipoproteins (HDL), the lipids disposed of in the liver (good lipids) and decrease the formation and oxidation of low density lipoproteins (LDL) that are deposited in the blood vessels (bad lipids) (Gorinstein et al, 2004, 2006). Although, preventing the oxidation of LDL may play an important role in the beneficial effects of fruit juices (Aviram et al, 2002), it appears that the effects of fruit juice phytochemicals is complex and involves modulation of cell physiology. Fruit juice components have been shown to act at every level of the blood lipid process from cholesterol synthesis to the formation of lipoproteins (LDL, HDL).*

*Another signaling molecule affected by fruit juices is nitric oxide (NO). The endothelium (inner lining) of blood vessels uses nitric oxide to signal the surrounding smooth muscle to relax, thus resulting in vasodilation and increasing blood flow. These beneficial changes have been noted at various levels of the cardiovascular system including blood pressure (Reshef et al, 2005; Morand et al, 2011a,b).*

2. *Bone Health*

*Bone health is largely the result of an equilibrium between osteoclast cells destroying bone and osteoblasts building it. Several fruit juice phytochemicals, mainly polyphenols and carotenoids, have been shown to have a positive influence on bone health and particularly the bone mineral density of post-menopausal women (Trzeciakiewicz et al, 2009, 2010).*

3. *Brain health, cognition and aging*

*The ability of juice compounds, particularly flavonoids, to cross the barrier protecting the brain (blood brain barrier) is at the origin of the beneficial activity of these compounds (Youdim, 2003). Firstly, they appear to promote cerebral vascular blood flow and secondly, they have been shown to interact with neuronal signaling cascades leading to an inhibition of cell death and to a promotion of neuronal differentiation. As a result, they may prevent deterioration or even improve cognitive performance (Macready et al 2009; Spencer, 2009b; Vafeiadou et al 2009; Harrison and May, 2009).*

4. *Cancer and inflammation*

*Positive results have been associated with most juices, including apple juice (Gerhaeuser 2008, Veeriah et al, 2008) grapes and grape juice (Iriti and Faoro 2009). Anthocyanins from various berry juices (Hochman et al, 2008; Thomasset et al, 2009; Matsunaga, 2010), citrus flavonoids (Benavente-García and Castillo 2008) and limonoids (Poulose et al, 2006) may also have potential anticarcinogenic activities.*

5. *Body weight and insulin resistance*

*Concern has been expressed that fruit juice sugar can contribute to weight gain, especially for children. However, O'Connor et al (2006) reported that on average, US preschool children drank less than 177 ml/day of 100% fruit juice. Similarly, Nicklas et al (2008) reported that the mean daily juice consumption was 4.1 fl oz, which contributed a mean intake of 58 kcal (3.3% of total energy intake). In most cases, the use of the glycemic load (GL) which considers both the glycemic index (GI) and the amount of carbohydrate in a food would be more appropriate. The carbohydrate in carrots, for example, has a high GI, but carrots are low in carbohydrate compared to other foods, so carrots' GL is relatively low (Venn and Green, 2007). Yoshida et al (2007) showed that fruit juice consumption was inversely associated with fasting plasma glucose. A reduction of insulin resistance, oxidative stress and inflammation were reported after ingestion of several fruit juices including grapefruit juice (Yao et al, 2004), grapefruit naringin (Kannappan and Anuradha, 2009), orange juice (Ghanim et al 2007), cranberry juice (Wilson et al, 2008), and blueberry, (DeFuria et al, 2009). These results were recently confirmed by Wu et al (2009) who showed that flavonoids can attenuate the expression of glucose induced inflammatory cytokines.*

*Fruit juices contain essential vitamins and minerals that are known to have many health benefits. Although studies are fragmented and need to be expanded, particularly in the clinical area, juices may play a role in diseases related to chronic inflammation, cancer, heart and bone diseases, problems related to cognition and aging, and possibly insulin resistance. The mode of action of these fruit juice compounds in most cases seems to be by modulating gene activity. Fruit juices, consumed in moderation as part of a balanced diet, offer both: health and disease risk reduction properties. Furthermore, to identify fruit juices as inadvisable in the context of obesity and dental health, would deny the consumer a perfectly healthy and nutritious food, and be completely contrary to the totality of the current scientific evidence. (end of abstract)*

## B. Processing the juice from the fruit

CODEX stipulates that for a beverage to be a "juice" it must be "*prepared by suitable processes, which maintain the essential physical, chemical, organoleptic and nutritional characteristics of the juices of the fruit from which it comes. The juice may be cloudy or clear and may have restored aromatic substances and volatile flavour components, all of which must be obtained by suitable physical means, and all of which must be recovered from the same kind of fruit. Pulp and cells obtained by suitable physical means from the same kind of fruit may be added*".

South Africa's Fruit Juice Regulations refer to fruit juice as "*having the characteristic flavour and colour of the kind of natural juice concerned*"; i.e. provided that this specification shall not apply to unsweetened fruit juice intended as an addition to fruit blends or any drink.

It is unfortunate that a distinction is not drawn between fruit juice concentrate used during the manufacture of 100% fruit juice, as compared to the addition of fruit juice concentrate as a sweetening

agent to certain foodstuffs. In the case of the production of 100% fruit juice, fruit juice is extracted from fruit by mechanical means – this includes pressing, squeezing, grinding and crushing of the fruit. Thick-skinned fruit like citrus fruits are cut in halves prior to pressing, apples are ground and grapes and berries are crushed. It could then be sold either as RTD Not From Concentrate or freshly squeezed juice. But it is mostly concentrated by removing the water. Juice Concentrate is produced using clean, sound fruit, which has been properly ripened, sorted and washed. The fruit is macerated and the juice is extracted, clarified / filtered and concentrated by removing the water. Due to their structure, certain fruits like peaches, papayas and mangoes are inherently difficult to juice. These fruits are processed to pulps or purees. Sieving separates the edible portion from the skin, seeds and other fibrous matter. Guava are typically ground whole to produce the puree which is then passed through a screen to remove the stone cells. Pulps/ purees are also available as single strength or concentrates, where the water has been removed. To make 100% pure fruit juice, which is sold in retail, the fruit juice concentrate is reconstituted to the same concentration and sugar profile as found in the original fruitmerely by adding back the water that was removed during concentration. This differs from when non-reconstituted fruit juice concentrate is added to a foodstuff with the primary objective of adding sweetness.

## C. Glycaemic considerations

Apart from the classification and differentiation between different sugars, it is important to also note that not all sugars have the same glycaemic effect. Sugars differ in terms of its ability to influence blood sugar (glucose) levels. The principles of glycaemic index (GI) and glycaemic load (GL) per serving are key considerations when evaluating different sugars in the diet. GI measures carbohydrate quality – i.e. to what extent a carbohydrate food will affect blood sugar levels. Carbohydrates with a low GI value (55 or less) are absorbed, metabolised and digested slower. This causes a lower and slower rise in blood sugar, helping to sustain energy over a longer period. It also results in the release of less insulin by the beta cells of the pancreas, thereby protecting the consumer from diabetes, minimising fat storage, delaying hunger and preventing over eating due to reactive hypoglycaemia. A good example is fructose (fruit sugar) which has a "very" low GI value at 23 and lactose (milk sugar) which also has a low GI value at 46 compared to sucrose (table sugar), which has a GI of 65, glucose or dextrose which has a GI of 100 and maltose which has a GI of 105.

**Table 1:** Individual sugars in some unsweetened fruit juices (g per 100g) – adapted from Holland *et al,* 1992*

| Fruit Juice type | Glucose | Fructose | Sucrose | Total sugars |
|---|---|---|---|---|
| Apple | 2.6 | 6.3 | 1.1 | 9.9 |
| Grape | 5.5 | 6.2 | trace | 11.7 |
| Grapefruit | 3.0 | 3.3 | 2.0 | 8.3 |
| Orange | 2.8 | 2.9 | 3.1 | 8.8 |
| Pineapple | 2.9 | 2.9 | 4.7 | 10.5 |

** Holland, B., Unwin, I.D. and Buss, D.H. (1992). Fruits and nuts. First supplement to McCance and Widdowson's The Composition of Foods, 5th edn, Royal Society of Chemistry, Cambridge.*

All fruit and 100% pure fruit juice is made up of different amounts of fructose, sucrose and glucose. Added together this makes up the total sugars present in the fruit juice. The tested GI of products are actually very much related to the contribution made by the different sugars, where fruit juices that are

higher in glucose (e.g. grape juice listed above, which is 47% glucose) are relatively higher GI (in this case intermediate GI) than those that contain less glucose (e.g. apple juice listed above, which is only 26% glucose). The latter type of juices are usually low(er) GI. Glucose requires most insulin to be digested, as it raises blood glucose 100%.

**Table 2:** Fruit juices and nectars with a low GI score, ≤55 (The South African Glycemic Index and Load Guide by Gabi Steenkamp and Liesbet Delport, GIFSA, 2016: 2017 – 2019 edition)

| **Description** | **GI** | **GL** | **Serving size** |
|---|---|---|---|
| Peartiser, sparkling pear juice | 25 | 9 | 275 ml |
| Wilde pressed apple juice (Rhodes) | 39 | 10 | 250 ml |
| Appletiser, sparkling apple juice | 41 | 9 | 275 ml |
| Harrismith apple juice (Sir Fruit) | 42 | 10 | 250 ml |
| Wilde pressed ruby grapefruit juice (Rhodes) | 42 | 7 | 250 ml |
| Spiced apple juice (Sir Fruit) | 44 | 9 | 250 ml |
| Wilde pressed orange juice (Rhodes) | 44 | 7 | 250 ml |
| Apple juice (Rhodes) | 45 | 9 | 200 ml |
| Cranberry and ginger juice (Sir Fruit) | 46 | 9 | 250 ml |
| Orange Juice, freshly squeezed | 46 | 12 | 250 ml |
| Apple juice, clear (Liquifruit) | 48 | 14 | 250 ml |
| Grapefruit juice, freshly squeezed | 48 | 11 | 250 ml |
| Peach and Orange Juice (Liquifruit) | 50 | 13 | 250 ml |
| Peach fruit and other pure fruit juices blend (Rhodes) | 51 | 11 | 250 ml |
| Apple Juice (Ceres) | 52 | 12 | 200 ml |
| Ruby grapefruit and other pure juices blend (Rhodes) | 52 | 11 | 250 ml |
| Mango and other pure fruit juices blend (Rhodes) | 53 | 11 | 200 ml |
| Mango and Orange Juice (Liquifruit) | 54 | 14 | 250 ml |
| Raspberry and rooibos juice (Sir Fruit) | 54 | 8 | 259 ml |
| Secrets of the Valley (Ceres) | 54 | 11 | 200 ml |
| Strawberry and banana and other pure fruit juices blend (Rhodes) | 55 | 8 | 200 ml |

For products to be endorsed with the GIFSA Often Foods and/or Diabetes SA (DSA) endorsement logos, the GI has to be low and the GL per serving is not allowed to be more than 15. There are fruit juices that are higher GI (mostly intermediate), but these will never be endorsed with the GIFSA Often Foods and/or DSA endorsement logos, although they can qualify for the GIFSA Sometimes Foods (Orange) endorsement logo or GIFSA Best with Exercise (Red) endorsement logo, if the product is high GI or high GL per serving.

**Table 3:** Typical GI values for other sugar sweetened beverages, all with Intermediate GI scores 56 – 69 (The South African Glycemic Index and Load Guide by Gabi Steenkamp and Liesbet Delport, GIFSA, 2016: 2017 – 2019 edition)

| **Description** | **GI** | **GL** | **Serving size** |
|---|---|---|---|
| Coca Cola, or Coke | 58 | 20 | 330 ml |
| Coca Cola, or Coke | 58 | 30 | 500 ml |
| Carbonated Soft Drinks, average | 61 | 21 | 330 ml |
| Carbonated Soft Drinks, average | 61 | 31 | 500 ml |
| Cordial (fruit squash) | 66 | 18 | 330 ml |
| Orange squash (similar to Oros) | 66 | 21 | 330 ml |
| Fanta / Sprite | 68 | 23 | 330 ml |
| Fanta / Sprite | 68 | 35 | 500 ml |

Most sugar sweetened beverages are intermediate to high GI and they are also generally served in larger quantities, i.e. 330ml tins or 500ml bottles. As can be seen in the table above, they have a GL of over 20 per typical serving of 330 ml tin or glass and a GL of over 30 per 500 ml bottle serving, which has a huge impact on blood glucose and insulin levels. GL measures the impact a specific carbohydrate food portion/serving has on blood sugar levels. It incorporates both the quantity (serving size) and quality (GI) of the dietary carbohydrate consumed.

For illustration purposes, a serving of 330 ml of higher GI Carbohydrate Soft Drink or CSD (e.g. Fanta / Sprite) has a GL of 34g carbohydrate x 68 (GI) / 100 = 23 compared with a serving of 200 ml of low GI fruit juice (e.g. Ceres Secrets of the Valley juice, which has a GL of 20.2g carbohydrate x 54 (GI) / 100 = 11. This requires less than half the amount of insulin from the body to cope with (for both healthy and diabetic persons) given the fact that a smaller serving of 200 – 250 ml low GI pure fruit juice contains less carbohydrate and is also digested slower than the higher GI CSD's which are generally also served in larger quantities.

Careful consideration of both the GI and GL per serving means that it is restrictive to describe certain carbohydrates as good or bad food based on sugar content or origin alone (intrinsic / inherent or added). All carbohydrate foods can fit into a healthy diet as it depends on when it is eaten, how much is consumed (portion size) and what it is combined with.

## D. Closing Comments

- Abstracting from the conclusion of a comprehensive and contemporary (2015) review *"A Review and Critical Analysis of the Scientific Literature Related to 100% Fruit Juice and Human Health by Dianne A Hyson, College of Social Sciences and Interdisciplinary Studies, California State University, Sacramento, CA."*

  *The association between the consumption of pure (100%) fruit juice (PFJ) and human health is uncertain. The current review summarizes data published between 1995 and 2012 related to PFJ with a focus on juices that are widely available and studied in forms representing native juice without supplemental nutrients or enhanced phytochemical content. The collective data are provocative although challenges and unanswered questions remain. There are many plausible mechanisms by which PFJ might be protective, and investigation of its effects on human health and disease prevention must remain an active area of research. It is notable that a number of studies did not find an association between fruit juice and adverse outcomes related to bodyweight, plasma lipids, or blood glucose in adults or children.*

  In the context of regulatory environment it is important to take note of the second last paragraph of this comprehensive and contemporary review: *"Although weight gain has been cited as a potential concern associated with fruit juice intake, many studies in the current review imply that dietary compensation or other mechanisms associated with components in juice might account for the lack of predicted weight gain, even when juice provided additional calories."* The final paragraph recommends more powerful research.

- Sievenpiper et al, Mayo Clin Proc. July 2015;90(7):984-991 2015, Mayo Foundation for Medical Education and Research, makes a case that *the data that implicates Fructose as the main culprit in the drive of type 2 diabetes*, and then probably also for other NCDs, *is misinterpreted*. GIFSA would agree that there is good evidence to be cautious of products with added fructose, but also that the science regarding fructose metabolism, is still developing and not conclusive. To regard inherent fruit juice fructose in the same light as the added sugar or fructose in SSB's and therefore also taxable, may well be misplaced at this time.

- The World Health Organisation (Guideline: Sugars intake for adults and children, 2015) divides it into 3 groups, namely:

  a. **"Free sugars"** including monosaccharides and disaccharides added to foods and beverages by the manufacturer, chef or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates;
  b. **"Intrinsic sugars"** are those incorporated within the structure of intact fruits and vegetables (usually a combination of inherent fructose, sucrose and glucose) and
  c. **sugars from milk** (lactose and galactose);

  However, the South African regulations (Regulations Relating to the Labelling and Advertising of Foodstuffs, R146 of 2010) do not classify sugars the same way, where "free sugars" are called "added sugar". GIFSA maintains that 100% fruit juice should be placed in the category of intrinsic sugars, like fruit, vegetables and dairy products.

- The UK government's view is that fruit juice and milk based drinks (that do not contain added sugar) will be excluded from the proposed sugar tax and that one small serving of 100% fruit juice can be taken as one serving contribution to one's fruit and vegetable intake per day. http://www.foodnavigator.com/Trends/Sugar-salt-and-fat-reduction/UK-sugar-tax-consultation-launched. This agrees with the view that GIFSA maintains that 100% fruit juice should be placed in the category of intrinsic sugars, like fruit, vegetables and dairy products.

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