Effects of green tea on diabetic rats

Recently several research reports have come on the beneficial effects of green tea on human health. The scientists at Uludag University Science and Literature Faculty, Bursa, Turkey have studied the effects of green tea on serum paraoxonase/arylesterase activities and lipoprotein oxidizability in streptozotocin-induced diabetic rats (65 mg/kg [intraperitoneal]). Green tea was given in tap water (2%) for 3 and 6 weeks to control (CGT-3w and CGT-6w) and diabetic (DGT-3w and DGT-6w) rats, and they were compared with the control and diabetic groups (D-3w and D-6w), respectively. Serum insulin level was significantly increased in the DGT-6w group; serum lipid and plasma and tissue malondialdehyde levels were reduced in the DGT-3w and DGT-6w groups. Oxidizability of apolipoprotein B-containing lipoprotein fraction was found to be significantly reduced in the DGT-6w group. Serum total antioxidant capacity showed a significant increase in the CGT-6w and DGT-6w groups. Paraoxonase activity was significantly reduced in the D-3w and D-6w groups and increased in the DGT-6w group. Thus, it is concluded that green tea might have antihyperlipidemic and antioxidative effects and may slow the progression of atherogenesis by reducing oxidation of lipoproteins and preserving paraoxonase activity. Tas Sibel, Sarandol Emre, Ziyanoks Sedef, Aslan Kemal and Dirican Melahat, Effects of green tea on serum paraoxonase/arylesterase activities in streptozotocin-induced diabetic rats, Nutr Res, 2005, 25(12), 1061-1074.

Effect of storage on the stability of annatto dye in a simulated orange-RTS beverage

Annatto (Bixa orellana Linn.) seeds are the source of an orange-yellow pigment. The water-soluble annatto dye formulations can be used in beverages, bakery and other food products. The scientists at Central Food Technological Research Institute, Resource Centre, Habshiguda, Uppal Road, Hyderabad, India worked on an annatto water-soluble dye formulation containing norbixin fraction 22.4 g/litre in making an orange-ready-to-serve (RTS) beverage model with citric acid and sugar. The orange-RTS beverage was stored at ambient and refrigerated conditions in transparent as well as amber-coloured glass bottles for a period of 5 months. A dilute solution of the annatto dye formulation (working stock) without addition of citric acid and sugar was also stored under similar conditions. It was observed that the annatto water-soluble dye formulation and the orange-RTS beverage stored at refrigerated conditions stored well, whereas the losses were very high for the working stock of the formulation irrespective of the storage period/method.

Effect of processing strawberries to different products

The scientists at Institute of Nutrition, Friedrich Schiller University Jena and Institute of Beverage Technology, University of Applied Sciences Lippe and Hoxter, Lemgo, Germany investigated the effect of processing on various products like juice, nectar, wine and puree. For investigation of the antioxidant capacity as well as the contents of ascorbic acid, total phenolics and total anthocyanins, samples were taken after different stages of production to determine the effects of processing. The content of vitamin C was measured spectrophotometrically. The total phenolic content was analyzed by using the Folin-Ciocalteu method and the amount of total anthocyanins was determined by using the pH-differential method. Two different methods—the trolox equivalent antioxidant capacity assay and the ferric reducing antioxidant power test — were used to determine the hydrophilic antioxidant capacity. This study showed the decrease of all investigated parameters within processing strawberries to different products. The content of ascorbic acid decreased with production time and processing steps, especially during heat treatment. The investigations on total phenolics in strawberry products proved fining to be a mild method to clarify berry juices and wines without removing high amounts of total phenolics. Fermentation did not lead to heavy losses of total phenolics, probably due to polymerization and condensation of monomer phenolics such as anthocyanins. Total anthocyanins and the hydrophilic antioxidant capacity decreased while using high temperatures. Anthocyanins also decreased considerably during the processing of wines, mainly caused by fermentation and pasteurization [Klopotek Y, Otto K and Boehm V. Processing strawberries to different products alters contents of vitamin C, total phenolics, total anthocyanins, and antioxidant capacity, J Agric Food Chem, 2005, 53(14), 5640-5646].

Development of pomegranate juice processing technology

The researchers at University of Harran, Urfa, Turkey investigated the effects of clarification agents and methods on pomegranate juice quality. During experiment fruits were pressed as whole, and extracted juice was clarified with gelatin, polyvinylpolypyrrolidone (PVPP) and natural sedimentation. In order to determine the effects of these clarifying techniques on product quality, pH, total phenolic substances (TPS), anthocyanin, turbidity and total colour density tests were applied to each sample. In clarification, the main purpose was to reduce the amount of phenolic substances. Phenolic substances were controlled in each clarification method. The most effective method observed during this study was the application of 1g/litre gelatin for clarification. Sensory evaluation also applied for clarified juices and gelatin application was selected by panelists to be superior [Vardin H and Ferencioğlu H, Study on the development of pomegranate juice processing technology: clarification of pomegranate juice, Nahrung, 2003, 47(5), 300-303].
Development of low erosive carbonated fruit drinks

Dental erosion and retail sales of soft drinks is increasing and this is more prevalent in lower socio-economic groups. Erosion of tooth tissue by dietary acids and acidic beverages has been investigated in detail on enamel in vitro studies. Carbonated soft drinks are potentially more erosive than non-carbonated beverages due to the additional carbonic acid present.

The scientists at Dental School, N West, UK and Glaxo Smithkline Consumer Healthcare, Coleford, Gloucestershire, UK tested an experimental formulation of carbonated blackcurrant drink to determine the erosive potential compared to a conventional carbonated orange drink and water over a 20 day period using a similar design as in previous studies. The study was a single centre, single blind, randomised placebo controlled three cell crossover design involving 15 volunteers. The test drinks were an experimental carbonated ready-to-drink (RTD) blackcurrant drink, a conventional carbonated RTD orange drink and water. Two enamel samples were retained in situ, in the midline of the hard palate on an upper removable acrylic appliance. Drinks (250 ml volumes) were consumed four times per day during 20 working days. Measurements of enamel loss were made on enamel samples after 2, 5, 10, 15 and 20 days by profilometry.

The researchers concluded that the experimental carbonated blackcurrant drink caused significantly less enamel loss than the conventional carbonated orange drink at all time points measured, but was not significantly different from water at 2, 5 and 20 days. However, it is possible to modify carbonated soft drinks in a manner similarly shown with non-carbonated soft drinks, to minimise dental erosion [West NX, Hughes JA, Parker DM, Moohan M and Addy M, Development of low erosive carbonated fruit drinks; 2. Evaluation of an experimental carbonated blackcurrant drink compared to a conventional carbonated drink, J Dent, 2003, 31(5), 361-365].

Antioxidant capacity of Indian herbal teas during storage

Herbal tea, which is generally a polyherbal formulation made up of different medicinal plants, is also considered as a source of antioxidants. The antioxidant activity of food products or beverages may get affected due to conditions of cultivation, collection, industrial processing, packaging and storage procedures. Storage conditions become a very important factor as far as antioxidant activity of any herbal tea is concerned.

The changes in the stability of antioxidant capacity with time and its relation to the phenolic content were evaluated by researchers at the Herbal Research, Industrial Toxicology Research Centre, Lucknow, India in eight Indian herbal teas. Antioxidant capacity was determined over a period of 15 months from the date of their procurement using assays for SOD mimetic activity, LPO inhibitory capacity and total thiol content, which decreased positively with time. Total phenolic content was determined spectrometrically according to the Folin-Ciocalteu method and calculated as gallic acid equivalents (GAE). Herbal teas with higher phenolic content showed a comparatively less decline in antioxidant capacity. The SOD mimetic activity values in control samples (at the time of procurement) were seen to be in the range of 54.63-93.64 units/min/mg of extract which after 15 months of storage decreased up to 7.4-folds in some samples. LPO inhibitory capacity was observed up to 96.75% in herbal tea E at the time of procurement which dropped to 63.85% inhibition of MDA formation/5µl of extract after 15 months. In case of total thiol, the values were seen in the range of 0.55-1.71 mg/g and after 15 months it was from 0.12 to 0.21 mg/g. In all these cases high antioxidant activity was seen in the samples with higher phenolic content which also showed comparatively less decline in antioxidant capacity after considerable storage time. The results have significance, as most of the herbal teas available in the local markets in India do not carry any information regarding the period of use without decline in its beneficial effects [Naithani Vijay, Nair Smitha and Kakkar Poonam, Decline in antioxidant capacity of Indian herbal teas during storage and its relation to phenolic content, Food Res Int, 2006, 39 (2), 176-181].
Effect of grapefruit, orange and pineapple juice intake on blood lipid profile in normolipidemic rats

The scientists at Lebanese American University, Byblos, Lebanon worked on effect of acute and chronic grapefruit, orange and pineapple juice intake on blood lipid and lipoprotein metabolism in normolipidemic rats. During experiment the effects of acute juice intake were studied after three hours of a single juice-lipid load instilled intragastrically. In the chronic study, blood samples from fasted animals were subjected to analyses after six months of either water [control] or water-juice [1:1] intake. In the acute study, plasma triacylglycerol [TAG], and chylomicron [CM] TAG and cholesterol concentrations concomitantly with delayed gastric emptying. Plasma cholesterol levels and very-low-density lipoprotein [VLDL] secretion and metabolism were not affected. In the chronic study, only grapefruit juice significantly decreased plasma and VLDL, TAG concentrations and relative VLDL particle size with respect to other groups. All juices significantly increased VLDL apolipoprotein B [apoB] secretion, but plasma total apoB concentrations were highest in the grapefruit group and lowest in the orange and pineapple groups. No effect on blood cholesterol levels was observed.

The cardioprotective benefit of chronic juice intake in normolipidemic rats may be chiefly through mechanisms independent of a direct effect on blood lipid profile, although orange and pineapple, but not grapefruit, relatively improved the metabolism and clearance of blood lipoprotein particles. As a result of delayed gastric emptying, grapefruit and pineapple juices may exhibit moderate sharp increases in postprandial plasma TAG concentrations accompanying peak digestion and absorption [Daher CF, Abou-Khalil J and Baroody GM, Effect of acute and chronic grapefruit, orange and pineapple juice intake on blood lipid profile in normolipidemic rats, Med Sci Monit, 2005, 11(12), BR465-BR472].

Assessment of the volatile composition of juices of apricot, peach and pear

The behaviour of volatile compounds according to two enzymatic treatments applied during the manufacture of fruit juices of apricot, peach and pear was investigated by the team of scientists at Barcelona, Spain. More than 80 compounds were detected of a wide range of chemical families (alcohols, aldehydes, ketones, terpenoids, esters, norisoprenoids, ...). Theaspirane and alpha-isophoron were tentatively identified for the first time in apricot and peach fruits. The enzymes used, for extraction or clarification of fruit juices, modified the polysaccharides separated by molecular weight and the content of soluble polysaccharides. This could indicate differences in the fruit juice matrix, which could be related to observed changes in the volatile profile. In apricot, the enzymes enhanced the juice in terpenes and norisoprenoids as varietal compounds. In peach and pear, the enzymes used did not favour the amount of lactones and decadienoate esters, the character impact compounds, respectively [Riu-Aumatell M, Lopez-Tamames E and Buxaderas S, Assessment of the volatile composition of juices of apricot, peach, and pear according to two pectolytic treatments, J Agric Food Chem, 2005, 53(20), 7837-7843].
Tea is, next to water, the most widely used beverage worldwide. The beverage is an infusion of dried leaves of *Camellia sinensis* (Linn.) O. Kuntze and can be classified into the three types green, black and Oolong tea depending on the process of treatment of the leaves after harvesting. Green tea is derived from leaves, which were exposed, to steam or dry heat in order to inactivate oxidative enzymes. Besides its prominent role as a common beverage, green tea has gained much interest because of the increasing number of reports on beneficial health effects.

Recent reports on sporadic cases of liver disorders (acute hepatitis, icterus, hepatocellular necrosis) after ingestion of dietary supplements based on hydro-alcoholic extracts from green tea leaves led to restrictions of the marketing of such products in certain countries of the EU. Since, green tea is considered to exert a number of beneficial health effects and therefore, green tea products are widely used as dietary supplements, scientists investigated the possible mechanism of hepatotoxicity of green tea extracts and in the components involved in such effects. Thus, a study was designed by researchers from Germany, France, and Switzerland to investigate the cytotoxicity of hydro-alcoholic green tea extracts in rat hepatocytes in primary cultures. Furthermore, important constituents of hydro-alcoholic green tea extracts were tested individually for their cytotoxicity in hepatocytes.

Seven hours after seeding on collagen, rat hepatocytes in primary culture were treated with various hydro-alcoholic green tea extracts (two different native 80% ethanolic dry extracts and an 80% ethanolic dry extract cleared from lipophilic compounds). Cells were washed, and reduction of resazurin, used as a viability parameter monitoring intact mitochondrial function, was determined. It was found that all seven green tea extracts examined enhanced resazurin reduction significantly at a concentration range of 100-500 µg/ml medium, while a significant decrease was observed at 1-3 mg/ml medium. Decreased levels were concomitant with abundant necrosis as observed by microscopic inspection of the cultures and with increased leakage of lactate dehydrogenase activity from the cells. In a separate series of experiments, the green tea constituents (−)-epicatechin, (−)-epigallocatechin-3-gallate, caffeine and theanine were tested at concentrations reflecting their levels in a typical green tea extract. Synthetic (+)-epigallocatechin (200 µM) was used for comparison. Cytotoxicity was found with (−)-epigallocatechin-3-gallate only. The concomitant addition of 0.25 mM ascorbate/0.05 mM α-tocopherol had no influence on cytotoxicity. In conclusion, the results suggest that high concentrations of green tea extract can exert acute toxicity in rat liver cells. (−)-Epigallocatechin-3-gallate seems to be a key constituent responsible for this effect. The relatively low bioavailability of catechins reported after oral exposure to green tea argues, however, against a causal role of these constituents in the reported liver disorders [Schmidt M, Schmitz HJ, Baumgart A, Guédon D, Netsch MI, Kreuter MH, Schmidlin CB and Schrenk D, Toxicity of green tea extracts and their constituents in rat hepatocytes in primary culture, *Food Chem Toxicol*, 2005, 43(2), 307-314].

Optimization of hot water extraction for Sapodilla juice

The scientists at Faculty of Food Science and Technology, University of Putra, Malaysia employed a central composite design to optimize the extraction conditions of sapodilla (*Achras zapota* Linn.) juice using hot water extraction. The independent variables were juice extraction time (30-120 min) and temperature (30-90°C). The combined effect of these variables on juice yield, odour, taste and astringency were investigated. The results showed that extraction temperature was the most important factor affecting the juice characteristics as it exerted a significant influence on all the dependent variables. Higher temperature increased the juice yield, taste and odour but also showed an increase in astringency which affected the acceptability of the juice [Sin HN, Yusof S, Abdul Hamid N Sheikh and Rahman R Abd, Optimization of hot water extraction for sapodilla juice using response surface methodology, *J Food Eng*, 2006, 74(3), 352-358].
Concentrations and health risk of polycyclic aromatic hydrocarbons (PAH) in tea

There is a lot of scientific evidence indicating that tea consumption might have health promoting properties, including the effects of reduction of cholesterol, depression of hypertension, anti-oxidation and anti-microbial effects, protection against cardiovascular disease and cancer. But it has also been suggested that certain pollutants in tea leaves may pose a health threat to tea drinkers. The main pollutants that have been investigated widely and intensively are heavy metals, fluoride and pesticides. Relevant sanitary standards of these pollutants for tea leaves have been formulated.

PAHs, a class of compounds that consist of two or more fused aromatic rings, are a well-known class of carcinogens found in some foods and they have been intensively studied over the last few years. Gaseous and particle-bound PAHs can be transported over long distances before deposition and may accumulate in vegetation. This could indirectly cause human exposure to PAHs through food consumption and, thus, might pose a human health threat.

Tea leaves possess high surface area, so they may accumulate PAHs, especially from air. The production process of tea leaves may also lead PAHs into product, because many of them are dried using combustion gases from burning wood, oil or coal. PAHs are invariably present in the combustion gases and can be absorbed by tea product when they contact. So it is important to investigate concentrations and health risk of PAHs in tea, and to formulate sanitary standards of PAHs for tea. However, little information is available on the release of PAHs into tea liquor and their health risk; and these are the bases to formulate sanitary standards of PAHs for tea.

The main objectives of the study conducted by scientists of China were: to determine PAHs content in 8 brands of Chinese tea; to study the release of PAHs from tea by examining their concentrations in the tea liquor; and to analyze the health risk to the tea drinkers by calculating the sanitary standards of PAHs for tea and the daily PAHs intake.

Sixteen PAHs were simultaneously measured in 8 brands of tea and in infusions of one brand of black tea. It was observed that the total contents of the 16 PAHs ($\Sigma$PAHs) in the tea samples ranged from 323 to 8800 $\mu$g/kg with the highest $\Sigma$PAHs found in a black tea. PAHs (3-4 rings) were dominant in all tea samples, with a contribution of 77.7-98.7% of the $\Sigma$PAHs. Infusion times from 10 to 120 min were studied during which 3.03-7.69% of the total PAHs contained in the black tea was released into the liquor. The percentages of PAHs released (RR) from the tea into the liquor were inversely proportional to the $\lg K_{ow}$ of the PAHs with a mean formula of $RR = 261.7/\lg K_{ow} - 41.32$ and $R = 0.899$. To analyze the potential health risk, sanitary standards of the 16 PAHs for tea leaves were calculated to be 0.1-110 mg/kg and the daily PAHs intake from the black tea was calculated to be 6.36 $\mu$g per person [Lin Daohui, Tu Youying and Zhu Lizhong, Concentrations and health risk of polycyclic aromatic hydrocarbons in tea, Food Chem Toxicol, 2005, 43 (1), 41-48].

Effect of calcium fortification on mixed milk

Calcium in milk is easily absorbed by the intestine than the calcium from the vegetables and cereals. Hence, high intake of calcium is possible through formulating calcium fortified dairy products. The scientists at National Dairy Research Institute, Karnal, Haryana, India fortified milk with calcium at the rate of 50 mg/100 ml using three salts of calcium, viz. calcium chloride, calcium lactate and calcium gluconate. Fortification of milk with these salts destabilized the milk drastically due to decrease in its $pH$. However, the calcium fortified milk was stabilized by adjusting its $pH$ with disodium phosphate which restored its heat stability. Fortification of milk with calcium and adjustment of $pH$ with base caused a significant increase in viscosity but a significant decrease in the curd tension. Higher calcium in the aqueous phase might lead to higher absorption of the added salts. The fortified milk can be used by individuals who may not ingest enough calcium to meet minimum daily requirements [Arora S, Ranjan P, Sharma GS, Sindhu JS, Singh G, Singh AK and Kansal VK, Effect of calcium fortification on heat stability and physico-chemical properties of mixed (Cow and Buffalo 1:1) milk, Indian J Dairy Sci, 2005, 58(4), 242-246].
Antiviral effect of catechins in green tea on influenza virus

Green tea is produced from the leaves of the evergreen plant *Camellia sinensis* (Linn.) O. Kuntze. It contains various useful chemical compounds such as catechins, caffeine and vitamins, most notable components being catechins including EGC, ECG, EGC and EC.

These compounds from green tea were evaluated by researchers at the Department of Biotechnology, College of Engineering, Yonsei University, Seoul, South Korea for their ability to inhibit influenza virus replication in cell culture and for potentially direct virucidal effect. Among the test compounds, the EGC and ECG were found to be potent inhibitors of influenza virus replication in MDCK cell culture and this effect was observed in all influenza virus subtypes tested, including A/H1N1, A/H3N2 and B virus. The 50% effective inhibition concentration (EC50) of EGC, ECG and EGC for influenza A virus were 22-28, 22-40 and 309-318 µM, respectively. EGC and EGG exhibited hemagglutination (HA) inhibition activity, EGC being more effective. However, the sensitivity in hemagglutination inhibition was widely different among three different subtypes of influenza viruses tested. Quantitative RT-PCR analysis revealed that, at high concentration, EGC and EGG also suppressed viral RNA synthesis in MDCK cells whereas EGC failed to show similar effect. Similarly, EGG and EGG inhibited the neuraminidase activity more effectively than the EGC. The results show that the 3-galloyl group of catechin skeleton plays an important role on the observed antiviral activity, whereas the 5′-OH at the trihydroxy benzyl moiety at 2-position plays a minor role. The results, along with the HA type-specific effect, suggest that the antiviral effect of catechins on influenza virus is mediated not only by specific interaction with HA, but altering the physical properties of viral membrane [Song-Jae Min, Lee Kwang-Hee and Seong Baik-Lin, Antiviral effect of catechins in green tea on influenza virus, *Antiviral Res*, 2005, 68(2), 66-74].

Effects of fermented soy milk on the liver lipids under oxidative stress

The team of scientists at Graduate Institute of Nutrition and Health Sciences, Taipei Medical University, Taipei, Taiwan, China investigated the effects of fermented soy milk powder on the antioxidative status and lipid metabolism in the livers of CCl4-injected rats. During experiment forty-five healthy male Sprague-Dawley rats were randomly assigned to five groups according to five different diets: control (AIN-76), AIN-76+high-dose fermented soy milk powder, AIN-76+low-dose fermented soy milk powder, AIN-76+high-dose milk yogurt powder and AIN-76+low-dose milk yogurt powder. The experiment lasted for 8 weeks. After 4 weeks, all the rats received intraperitoneal administration of CCl4 (0.2 ml/100g body wt) every week. Total cholesterol (TC), triglyceride (TG), thiobarbituric acid reacting substances (TBARS), alkaline phosphatase (ALP) and antioxidative enzymes in the liver were evaluated. Results showed that there was also no significant difference in TBARS and antioxidative enzymes in the liver. TC and TG in the groups fed with fermented soy milk powder were generally lower than those fed with casein powder. It is concluded that consumption of fermented soy milk helps in lowering total cholesterol and TG accumulation in the liver under CCl4-induced oxidative stress [Lin CY, Tsai ZY, Cheng IC and Lin SH, Effects of fermented soy milk on the liver lipids under oxidative stress, *World J Gastro*, 2005, 11(46), 7355-7358].
Stability of carotenoids in tomato juice during storage

Carotenoids represent important biological compounds that are widely distributed in fruits and vegetables. Of the various carotenoids, lycopene has received considerable attention in recent years because of its possible role in the prevention of chronic diseases such as prostate cancer. Epidemiological studies have also shown that the increased consumption of lycopene-rich foods, such as tomatoes and tomato-based products, is associated with a low risk of cancer. In addition to lycopene, both lutein and 

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\text{cis} - \text{carotene}
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are also present in tomatoes in much smaller amounts.

Scientists at Department of Nutrition and Food Science, Fu Jen University, Taipei, Taiwan studied the stability of carotenoids in tomato (Lycopersicon esculentum Mill.) juice during storage. Tomato juice was processed by hot-breaking of tomatoes at 82°C, screening, heating at 121°C for 40 seconds and then storing in the dark or under light at 4, 25 and 35°C for 12 weeks. Results showed that the amounts of all-trans-lutein and its cis isomers decreased with increasing storage time for all the treatments. Light enhanced the degradation and isomerization of all-trans-lutein, and 13-cis-lutein was more susceptible to formation than 9-cis-lutein. Similar trends were observed for β-carotene and lycopene. However, light exposure promoted the formation of di-cis, 9-cis- and 13-cis-[β]-carotene. For lycopene, 15-cis-lycopene was the major isomer formed during dark storage at 4°C, while 9-cis- and 13-cis-lycopene were favoured at 25°C and 5-cis- as well as 13-cis-lycopene dominated at 35°C. Under light storage, both 9-cis- and di-cis-lycopene (II) were the main isomers generated at 35°C, whereas 13-cis- and 15-cis-lycopene were the most abundant at 4 and 25°C.

In conclusion, the higher the storage temperature, the greater are the losses of all-trans plus cis forms of lutein, β-carotene and lycopene during illumination. All-trans-lycopene showed the highest degradation loss, followed by all-trans-β-carotene and all-trans-lutein. More cis-isomers of lycopene than lutein or β-carotene were generated during storage. However, the type of major isomers formed may be inconsistent, depending on storage conditions [Lin CH and Chen BH, Stability of carotenoids in tomato juice during storage, Food Chem, 2005, 90 (4), 837-846].

Clarification and concentration of melon juice using membrane processes

The increasing quality demand for fresh fruits results in an increase in rejected melons (Cucumis melo Linn.). Juice processing could overcome the product losses occurring but thermal sensitivity of melon juice flavour prohibits conventional thermal processing. Scientists of France and Costa Rica use membrane processes for microbial stabilization and concentration and developed a novel way of using permeate (clear juice) as well as retentate (pulpy juice). Enzyme activities in the products during and after processing may need some attention prior to industrial application of the process.

Melon juice obtained from fruits discarded by exporters was first clarified by crossflow microfiltration and then concentrated by osmotic evaporation (OE). The resulting clarified melon juice was highly similar to the initial juice, except for insoluble solids and carotenoids, which were concentrated in the retentate. Average permeation flux was relatively high (about 80 litre/hr/m²), with continuous extraction of retentate at a volumetric reduction ratio of 3. After concentration of the clarified melon juice to as much as 550g/kg of total soluble solids using a continuous feed-and-bleed procedure of OE, it is found that almost the entire composition of the product was preserved. This integrated membrane process is a genuinely innovative way of treating melon juice, as it allows high-value products to be obtained from fruits discarded by the fresh market. On one hand, the clarified melon juice and its concentrate can be marketed as part of fruit beverages to which they can contribute fruit sugars and specific aroma; on the other hand, a pulpy juice (retentate), which is enriched in provitamin A and can be used as raw material to extract β-carotene or directly in functional drinks, is obtained [Vaillant Fabrice, Gisse Mady, Chaverri Marco, Perez Ana, Dornier Manuel, Viquez Floribeth and Dhuique-Mayer Claudie, Clarification and concentration of melon juice using membrane processes, Innov Food Sci Emerg Technol, 2005, 6(2), 213-220].
Nutritional beverages are formulated to provide specific nutrient combinations to individuals with special dietary needs. Many nutritional beverages are consumed as oil-in-water emulsions that consist of small lipid droplets dispersed in an aqueous liquid. The advantage of using oil-in-water emulsions is that a combination of oil-soluble, water-soluble and amphiphilic nutrients can be combined into a single product that is convenient to manufacture, store and consume. A recent survey of commercial emulsion-based nutritional beverages has found that they have fat contents between 1 and 7 wt%, protein contents between 1 and 5 wt%, and pH values between 6.5 and 7.0. In addition, these products usually contain relatively high concentrations (>1 mM) of certain types of mineral ions, e.g., Na, K, Ca, P, Cl and Mg.

The influence of calcium ions and chelating agents on the thermal stability of model nutritional beverages was examined by Scientists of Thailand and USA. Oil-in-water emulsions [6.94% (w/v) soybean oil, 0.35% (w/v) WPI, 0.02% (w/v) sodium azide, 20 mM Tris buffer, 0–10 mM CaCl₂, and 0–40 mM EDTA or citrate, pH 7.0] were stored at temperatures between 30 and 120°C for 15 minutes. The particle size, particle charge, creaming stability, rheology and free-calcium concentration of the emulsions were then measured. In the absence of chelating agents, appreciable droplet aggregation occurred in emulsions held at temperatures from 80 to 120°C, which led to increased emulsion particle diameter, shear-thinning behaviour, apparent viscosity and creaming instability. Addition of chelating agents to the emulsions prior to heating decreased, but did not prevent, droplet aggregation in the emulsions. EDTA was more effective than citrate in decreasing droplet aggregation.

Heat treatment increased the amount of chelating agents required to prevent droplet aggregation in the emulsions. Free-calcium concentration and droplet surface potential was independent of heat-treatment temperature, indicating that the performance of the chelating agents in binding calcium ions was not affected by the heat treatment. It was suggested that increased hydrophobic attractive interactions between the droplets occurred during heating, which induced droplet aggregation [Keowmaneechai E and McClements DJ, Influence of EDTA and citrate on thermal stability of whey protein stabilized oil-in-water emulsions containing calcium chloride, Food Res Int, 2006, 39 (2), 230-239].

Native protein recovery from potato fruit juice by ultrafiltration

Potato fruit, i.e. the stream resulting after the extraction of the starch from the potato, contains up to 2.5% [w/w] of proteins that are potentially valuable for the food market. However, today the recovery of protein from the potato fruit juice with reverse osmosis membranes results in a protein concentrate that is not suitable for human consumption. The investigations conducted by scientists of The Netherlands, Germany and Denmark showed that the use of ultrafiltration with additional diafiltration is able to produce a higher quality protein. Tests with the produced protein show that the quality depends on the rate of diafiltration used and that the product has functional properties that are equal or better than the compared commercial food product that are currently used [Zwijnenberg Harmen J, Kemperman Antoine JB, Boerrigter Marcel E, Lotz Martin, Dijkstra Jan E, Poulsen Poul Emil and Koops Geert-Henk, Native protein recovery from potato fruit juice by ultrafiltration, Desalination, 2002, 144 (1-3), 331-334].
Beverage

High pulsed electric field technology is better than pasteurization for ascorbic acid stability of refrigerated orange-carrot juice

It has been reported that incorporation of a proportion of carrot juice provides a considerable contribution to the nutritive characteristics of orange juice because oranges have high vitamin C content, and the carrot have highest level of carotene.

Thermal processing is one of the methods by which appropriate foods are preserved and made available to the consumer. During thermal treatment, in addition to the inactivation of microorganisms, varying percentages of desirable constituents such as nutrients, colour, flavour and texture are destroyed. Retention studies of vitamins to assess the effects of food processing on the nutritive value of foods are of great importance to food technologists and consumers. Vitamin C is thermodlabile its concentration decreases during storage, depending on storage conditions, such as temperature, oxygen content and light. Pulsed electric field electro-technology (PEF) has the potential to pasteurize several foods nonthermally via exposure to high-voltage short pulses while the material is between the electrodes of a treatment chamber.

The scientists at Spain worked on the shelf life of orange-carrot juice treated by PEF. They studied the degradation kinetics of ascorbic acid in the juice (stored at 2 and 10°C) according to the PEF conditions applied. In parallel they applied a conventional thermal treatment to orange-carrot juice and compared the results. For experiment the mixed orange and carrot juice was obtained after appropriate washing and hygienization of the oranges, the juice was extracted and placed in a tank. Carrot juice was obtained after washing the vegetables first with a diluted solution of sodium hydroxide and afterwards with drinking water. The washed vegetables were ground, and the juice was sifted and mixed with the orange juice (80% orange and 20% carrot). The mixed juice was packaged in Elopack packages and frozen (−40°C).

The results revealed that PEF processing is an alternative to conventional thermal pasteurization of orange-carrot juice. Ascorbic acid is a good parameter for this. PEF treatment at 25 kV/cm for 280-330 µs allows the half-life of the juice to reach 50 days when stored at 2°C, whereas when the preservation temperature is 10°C the half-life is 19 days. The ascorbic acid content in juice treated by PEF is greater than in juice pasteurized conventionally, and it is maintained for a longer period when stored in refrigeration, so that its nutritive value is also greater (Torregrosa F, Esteve MJ, Frígola A and Cortés C, Ascorbic acid stability during refrigerated storage of orange-carrot juice treated by high pulsed electric field and comparison with pasteurized juice, J Food Eng, 2006, 73(4), 339-345).

New method to assess the quality degradation of food products and beverages during storage

The scientists at Higher School of Food Industries of Tunis, Tunisia investigated a new method that may be used to globally quantify the quality degradation of a food product during storage or commercialization. The new concept is based on defining and formulating a single index called the Global Stability Index (GSI), varying between zero and one and taking simultaneously into account the time variations of all pertinent quality indices proper to the food product under study. This index enables one to judge the degradation of the microbiological, the physicochemical and the sensory quality of the food product during storage in a global fashion. The new method, referred to as the GSI method, has been successfully tested in studying the stability of an orange based carbonated beverage by simultaneously considering the time variations of the brix and the CO₂ partial pressure of the drink. It is particularly recommended that the proposed index is to be used in comparing the quality degradation rates of a given food product stored under different conditions or those of different products stored under a common set of conditions (Achour Mohsen, A new method to assess the quality degradation of food products during storage, J Food Eng, 2006, 75(4), 560-564).