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Original research

Commercial herbal detoxification tea products in Singapore: compositions and claims

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Abstract

Herbal detoxification products are generally well-received by consumers due to their belief that these products remove toxins from the body and benefit health. However, data on herbal detoxification products commercially available in Singapore are limited. This study examined the product marketing information (delivery format, selling platform, pricing), health claims and non-health related claims, composition (herbs and other ingredients) and reported efficacies of herbal ingredients found in commercial herbal detox products in Singapore. *Glycyrrhiza uralensis* (42.5%), *Flos chrysanthemum morifolium* (27.5%), and *Zingiber officinale* root (22.5%) were the top three most prevalent herbs found in the surveyed products. None of the surveyed products contained colourings. Flavouring was found in 47.5% of the products and almost all the products (92.5%) were sweetened. *Glycyrrhiza uralensis* was the most popular added sweetener (42.5%), followed by sugar (17.5%), and stevia (12.5%). Preservatives were seldom added and were found in 2.5% of surveyed products. Most of the products stated health claims (72.5%). Digestion (35%), liver health (20%) and immunity (15%) comprised the top three detoxification health claims. Non-health claims, such as the absence of preservatives (30%), colourings (27.5%) and caffeine (27.5%), were stated on 55% of the products.

The active herbal ingredients used in commercial detoxification herbal tea products seem credible based on the limited clinical and scientific evidence available. More studies are required to evaluate the efficacies and pharmacological properties of these herbs. The health claims stated on these products are applicable to the concept of detoxification that relates to the domains of digestive, liver, and immune health. However, the scientific and clinical concepts of detoxification should be better communicated to consumers to avoid misinterpretation.

Keywords: Detoxification, detoxification herbal tea, detoxification herbs, health claims, non-health claims

Introduction

Toxins can build-up in the body as by-products of metabolism or introduced from external sources. The accumulation of toxins within the body is believed to interfere with healthy bodily functions and disrupt good health. Their removal is essential to maintain healthy bodily functions and good health.

Detoxification is the physiological removal of toxins the human body and is mainly carried out by the liver [1]. Detoxification can also refer to the use of medical interventions such as antidote administration, dialysis or chelation therapy [1] to free the body from poisons and addictive substances. Recently, detoxification can also refer to the cleansing of the human digestive tract, usually by stimulating stronger intestinal motility, enhancing bowel movement, and relieving constipation [2]. Alternative medicine practitioners advocate other methods of detoxification, including detoxification diets and physical activities [2]. In herbal medicine, detoxification involves the use of herbs to remove toxins that have accumulated in the body. Detoxification herbs may be used to neutralize poisons from other herbs before the herbal preparation is consumed [3].

Commercial detoxification products are generally welcomed by consumers due to their belief that these products benefit their health by removing toxins from the body. While herbal detoxification products are mainly well-received by consumers, data on the types of detoxification herbal products commercially available in Singapore are limited. This study examined the product marketing information (delivery format, selling platform pricing), health and non-health claims, composition (herbs and other ingredients) and efficacies of commercial herbal detoxification products in Singapore. The concluding information may address the scientific credibility of this category of commercial products.

Materials and Methods

Data collection

All products labelled with the words 'detox', 'detoxification' or similar on the shelves of two major pharmaceutical retail outlets (Guardians and Watson), two major supermarkets (Cold Storage and Fairprice) and two major e-commerce platforms (Lazada and Shopee) in Singapore were included in this study. The product marketing information, such as country of manufacture, delivery and retail form, price, composition, health and non-health claims of the selected products were recorded by trained research personnel. This information is required on the item's packaging as regulated by the Health Science Authority, Singapore. The presence of specific ingredients (added colourings, flavourings, preservatives, and sweeteners) in each product was also noted from its product label. The daily cost was computed by dividing the product's price by the number of daily doses, which was calculated as the ratio of the delivery units in the product to the number of delivery units recommended to be taken daily.

Results

Forty products were included in the study. The products were sourced from physical stores (27.5%) and e-commerce platforms (72.5%). They were manufactured in three distinct geographical regions: Asia (62.5%), America (30%), and Europe (7.5%). Slightly more than half of the products were retailed in teabag form (52.5%). Other retail forms included pre-packaged mixed herbs (17.5%), sachets (15.5%), and ready-to-drink liquids (10%). Loose herbs made up the remainder (0.5%). The products were consumed either as liquid (85%) or powder (15%).

The cost of daily consumption, based on the recommended servings, was calculated to be S$2.37±3.50 (mean±SD), ranging from S$0.28 to S$16.00. Most of the products (87.5%) cost less than S$5.00 per day, with three-quarters costing less than S$2.00 daily.

Data analyses

Data were statistically described and analyzed using Microsoft Excel (version 2103, April 2021). Significance is reached when $p < 0.05$.

Composition

Twenty-nine different herbs were used in the 40 surveyed herbal detoxification tea products (**Table 1**). The common and/or scientific names of each herb is given as named on the product labels. *Glycyrrhiza uralensis* (*G. uralensis*, 42.5%), *Flos chrysanthemum morifolium* (*C. morifolium*, 27.5%), *Zingiber officinale* root (*Z. officinale*, 22.5%), *Citrus reticulata* peel (*C. reticulata* peel, 20%), *Taraxacum mongolicum* (20%), *Flos lonicera japonica* (17.5%), *Mentha piperita* (12.5%), *Ziziphus jujuba* fruit (10%), *Prunella vulgaris* (10%), and *Cinnamomum cassia* (10%) were the top ten most prevalent herbs found in the surveyed products (**Fig. 1**).

Table 1 Types of herbs (in alphabetical order) used in herbal detoxification tea products commercially available in Singapore (*n*=40)

Astragalus	Flos *chrysanthemum morifolium*	*Prunella vulgaris*
Black fungus	Flos *lonicera japonica*	*Mentha piperita* (peppermint)
Black pepper	*Glycyrrhiza uralensis* (liquorice)	Pueraria
Cassia seed	Hawthorn	Reed rhizome
Cinnamon bark	Herba abri	*Siraitia grosvenorii* (monk fruit)
Citrus reticulata peel	Herba Scutellariae barbatae	Star anise fruit
Clove Bud	Herba hedyotis diffusae	Wolfberry (goji berry)
Dandelion root	Longan	*Zingiber officinale* (ginger)
Fennel fruit	Mulberry leaf	*Ziziphus jujuba* fruit (red dates)
Figs	Panax ginseng root	

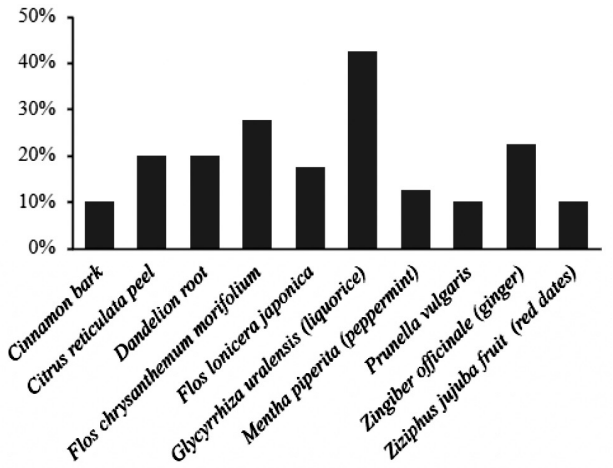

Figure 1 Top ten common herbs used in herbal detoxification tea products commercially available in Singapore (*n*=40)

Colourings, flavours, sweeteners and preservatives

Colourings were absent in all the surveyed products. Nearly half of the products (47.5%) were flavoured. Pomegranate (7.5%) and acai berry (5.0%) were the two more prevalent flavours (**Fig. 2**). Most of the surveyed products (92.5%) were sweetened. *G. uralensis* was the most added sweetener (42.5%), followed by sugar (17.5%) and stevia (12.5%). (**Fig. 3**). Added preservatives were found in only a small number (2.5%) of the herbal detox tea products. The identity of the added preservatives was not disclosed.

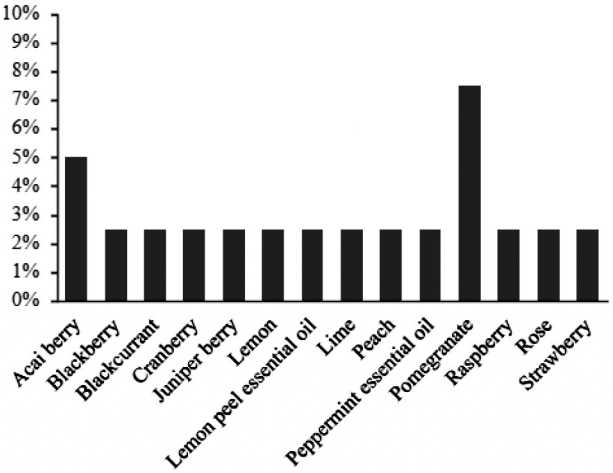

Figure 2 Prevalence of added flavours in herbal detoxification tea products commercially available in Singapore (*n*=40)

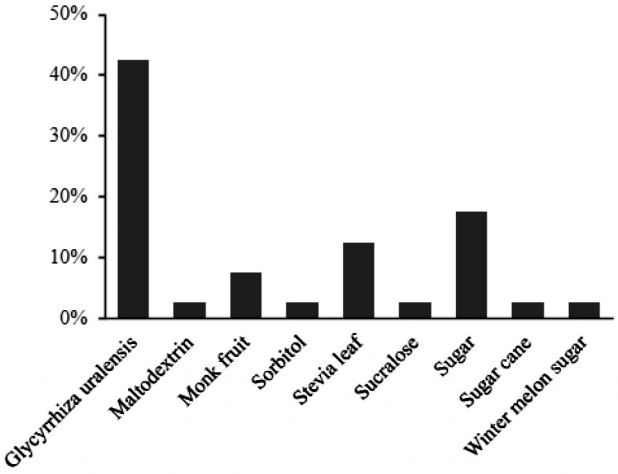

Figure 3 Prevalence of added sweeteners found in herbal detoxification tea products commercially available in Singapore (*n*=40)

Health and non-health claims

Health claims were stated by 29 products (72.5%). These claims were categorized into 25 health domains. Digestion (35%), liver health (20%), immunity (15%), respiratory health (12.5%) and weight management (12.5%) comprised the top five health claims.

Non-health claims were stated by 22 products (55%). Non-health related claims are statements made on specific product features that are not related to health benefits. Of the 17 non-health related claims, the absence of preservatives (30%), colourings (27.5%), caffeine (27.5%) and genetically modified organisms (GMO) (25%) were the most stated.

Discussion

Digestion, liver, and immune health were the top three most common health claims stated in the herbal detoxification products studied.

The intestinal epithelium lining the human intestine presents the first barrier to ingested external toxins. It also consists of a detoxification system to eliminate harmful foreign chemical substances. The maintenance of a healthy, functional intestinal epithelium is essential in the detoxification process and explains the predominant digestive health claim of commercial detoxification products in Singapore.

The liver plays a critical role in the body's detoxification process, so keeping the liver healthy and functional becomes a priority. Hepatocytes metabolize and bio-transform harmful, lipophilic toxins into harmless, hydrophilic metabolites via a two-phases process [1]. It is understandable, therefore, why liver health is the second most common health claim made by detoxification products commercially available in Singapore.

The main reason for body detoxification is improved health and immune function. This explains why immunity is the third most common health claim made by commercial detoxification products.

The question remains whether the commercial products, and their active ingredients, can scientifically or clinically support these stated health claims. The top three prevalent herbs used in the commercial detoxification products surveyed were *G. uralensis*, *C. morifolium*, and *Z. officinale*. *G. uralensis* (or liquorice) is a medicinal herb, commonly used in Traditional Chinese Medicine (TCM) and western herbal remedies [4]. It is also often used as an alternative sweetener in TCM and western herbal remedies [5]. The use of *G. uralensis* as a detoxifying herb was reported in 'Shen Nong Ben Cao Jing', a classic Chinese herbology book written more than 2,500 years ago [3]. Numerous prescriptions containing *G. uralensis* were recorded in other TCM masterpieces. Its main bioactive constituents are triterpene saponins and different polyphenols such as licochalcone A, glycyrrhizic acid, isoliquiritigenin, liquiritigenin, and liquiritin [4]. *G. uralensis* has been reported to exhibit different pharmacological activities, in-

cluding anti-inflammatory [6–8] and antioxidant [4, 9]. Evidence suggests that the biological activity of this popular herb is attributed to its flavonoid contents [7]. Other evidence indicates unique phytochemicals from *G. uralensis* contributes to its bioactivity [4]. *G. uralensis* has been shown to protect against tetrachlorocarbon-induced liver damage in mice [4]. Excess *G. uralensis* complexes free toxic aconitine in traditional herbal preparations [3]. Glycyrrhizic acid from *G. uralensis* has been proven to be effective in inhibiting the production of high-mobility group box-1 and preventing ischemia/reperfusion-induced liver injury [10]. 18β-Glycyrrhetinic acid, an *in vivo* metabolic component of glycyrrhizic acid, protects against drug-induced liver injury [11–16]. Studies show that pre-treatment minimizes cyclophosphamide-induced hepatotoxicity [11] and reduces methotrexate-induced liver injury [12], both of which are closely related to the activation of the PPARγ and Nrf2 pathways [13].

Similar pre-treatment has been shown to significantly reduce liver alanine transaminase, aspartate transaminase levels, and serum fatty acid, and carnitine level in acetaminophen-induced hepatotoxicity [14]. 18β-GA may protect against fatty liver diseases. Studies show that it inhibits liver fat production and deposition in high fat diet-induced animals [15]. Intraperitoneal injection of 18β-GA restored bile acid homeostasis and inhibited inflammatory injury in a rat model of non-alcoholic steatohepatitis [16]. *G. uralensis* demonstrated significant antimicrobial actions against Streptococcus mutans and Staphylococcus albicans [17]. It showed an antiviral effect on H1N1 [4]. The anti-inflammatory property of *G. uralensis* may contribute to its immuno-regulatory property [6, 8]. Gancaonin N from *G. uralensis* downregulated NF-κB/MAPK pathway and attenuated inflammatory response *in vitro* [6]. Glycyrrhetinic acid inhibits the enzyme 11-ß-hydroxysteroid dehydrogenase enzyme type 2 with a resultant cortisol-induced mineralocorticoid effect and the tendency towards the elevation of sodium and reduction of potassium levels [5]. Because of this aldosterone-like action, the daily consumption of *G. uralensis* is never justified as its benefits are minor compared to the adverse outcomes of long-term consumption [5]. There is limited data on the efficacy and associated mechanism of detoxification by *G. uralensis*.

More scientific studies are required to evaluate the detoxification efficacy and the associated mechanisms of this popular herb. With the current scientific data, it is easy to understand why *G. uralensis* is the predominant herb used in commercial herbal detoxification products in Singapore.

Various studies have demonstrated the digestive and immune health benefits of *C. morifolium* [18, 19]. *C. morifolium* alleviated functional constipation by significantly increasing the stool water content, small intestine propulsion rate, and gastrointestinal motility in Sprague Dawley (SD) rats [18]. *C. morifolium* polysaccharides improved colitis in rats by reducing intestinal lesions, alleviating intestinal inflammation, enhancing intestinal homeostasis, modulating the balance of intestinal microbiota, improving intestinal motility and relieving constipation [18, 19]. The relative abundance of Lactobacillus and Romboutsia increased, while those of Lachnospiraceae and Roseburia decreased compared with a control group [18]. *C. morifolium* polysaccharides reduced intestinal lesions, enhanced intestinal homeostasis, increased amino acid uptake, promoted intestinal motility and relieved constipation [18]. The mechanisms may be via the regulation of the expression of RAS, FABP1 and SLC1A5 proteins [18]. Infused tea from *C. morifolium* exerted significant antioxidant and anti-inflammatory activities i*n vitro* [20]. The phytochemical composition of *C. morifolium*, comprising of flavonoids

(rutin, luteolin, apigenin), phenolics (chlorogenic acid, caffeoylquinic acid), triterpenoids, and steroids, most likely contributes to the reported biological activities [21, 22].

Z. officinale (ginger) is commonly used in traditional herbal medicine and in food as a spice and condiment [23]. Numerous studies have reported the significant biological activities of *Z. officinale* towards digestive, liver, and immune health [24, 25]. Incubation with ginger extract modulated the faecal microbiota structure and promoted the growth of some beneficial bacterial populations, such as Bifidobacterium and Enterococcus [24]. It also elevated the levels of short-chain fatty acids [24]. The same study identified 6-gingerol as the main ginger polyphenol that significantly increased the Bifidobacterium abundance [24]. A recent meta-analysis of 17 in-vivo experiments and three clinical trials provided comprehensive evidence of the efficacy of ginger to improve the liver function in fatty liver disease by increasing the production of liver enzymes (alanine and aspartate aminotransferases), reducing the hepatic fat content, elevating the expressions of antioxidant enzymes (catalase and superoxide dismutase), and diminishing the generation of reactive oxygen species (malondialdehyde) [25]. Much of the reported beneficial health effects may be attributed to its antioxidant [26] and anti-inflammatory [27] properties.

Recent evidence supporting the harmful effects on health of artificial preservatives and colourings adds fuel to the popular movement to exclude these additives from the human diet [28, 29]. The absence of added preservatives and colourings were popular non-health claims on the digestive health and antioxidant products in this study [30, 31]. It is unsurprising, therefore, that the absence of added preservatives and colourings became the top two non-health claims stated on the commercial detoxification products. Despite being rarely used as the subject of a non-health claim in food and supplements, caffeine shared the position of second most common non-health claim on commercial herbal detox products. Caffeine can have both positive and negative health effects [32]. It is a central nervous system stimulant and has been used as a cognitive enhancer, increasing alertness and attentional performance. It is classified by the US Food and Drug Administration and European Food Safety Authority as generally recognized as safe [33]. Added caffeine must be listed on the ingredients of food product labels. Caffeine that is naturally present in herbal products does not need to be listed as an ingredient. Because caffeine is not considered a nutrient, its level and presence are not required to be listed on nutrition facts panels. Herbal products can be considered as hidden sources of caffeine [33]. The Health Science Authority has included caffeine in its list of ingredients with specific concerns, which include stimulatory effects, and excessive use leading to nervousness, irritability, sleep disturbance, diuresis, elevated blood pressures, heart rate, and gastrointestinal disturbance [34]. While the Health Science Authority does not require mandatory declaration of caffeine levels in commercial herbal products, it suggests the manufacturers or dealers to include cautionary statements to guide the safe use of their products, such as to limit the concurrent use of caffeine-containing products, and to indicate the amount of caffeine in their products [34]. None of the surveyed detoxification herbal tea products declared their caffeine levels. With the increase in consumers' use of over-the-counter herbal products for health maintenance and self-care, it is imperative for consumers to be knowledgeable about the caffeine content of these herbal products. The 'caffeine-free' claim may reassure consumers who are conscious of the 'hidden' caffeine in their herbal tea products [33].

Conclusion

The active herbal ingredients used in commercial detoxification herbal tea products seem credible based on the limited clinical and scientific evidence available. More studies are required to evaluate the efficacies and pharmacological properties of these herbs. The health claims stated on these products are applicable to the concept of detoxification that relates to the domains of digestive, liver, and immune health.

Conflict of Interests

None.

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