



Potential Health Benefits of Thai Seasonal Fruits; Sapodilla and Star Fruit for Elderly People

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Abstract

Nowadays, the proportion of geriatric population has been increased around the world, and likewise has been increased in Thailand. The aged population have high risks of low-immunity and high oxidative stress, which is related to chronic diseases such as; hypertension, stroke, cardiac diseases, diabetics, and cancer. In Thailand, there are many valuable fruits such as; durian, banana, oranges, papaya, and guava, etc. In addition, there are still some seasonal fruits which have interesting useful effects but with less scientific evidences. Sapodilla and Star fruit are rare seasonal fruits that have been claimed to improve the health status with its antioxidant and anti-inflammatory effects in human body. Presently, evidences have revealed that the ripped sapodilla extract possesses the antioxidant capacity with total phenolic, retinoic acid (Vit A), and L-ascorbic acid (Vit C) and scavenging activity on superoxide radical, hydroxyl radical, hydrogen peroxide and nitric oxide (NO). It could inhibit the tumor necrotic factor-alpha (TNF- α). Whereas, the ripped star fruit (sour-type) extract contains the retinoic acid and L-ascorbic acid which was reported in vitro designed study. Interesting evidences in elderly persons showed that supplementation of 100g of either ripped sapodilla or ripped star fruit twice a day for 4 weeks after meal could improve; total antioxidant capacity, Vit.A, and Vit.C status, the 6-minute walking distance, and reduce the nitric oxide (NO). Moreover, supplementation of ripped star fruit could reduce the TNF- α , Low-density lipoprotein (LDL), while the ripped Sapodilla supplement reduced the cholesterol.as. Therefore, this mini review presents the health benefits of seasonal fruits, sapodilla or star fruit for health status among elderly individuals.

Keywords: Carcinogen; Nicotine; Tumor growth; Cytotoxic; Apoptosis

Introduction

Now a days, the proportion of population in aging stage has been increased around the world, and likewise, it will be increasing in Thailand from 9.0 million in 2015 to 15.9 million in 2035 [1]. The aged persons have high risks of chronic diseases such as cardiac disease, type II diabetes, hypertension or musculoskeletal disorder [2], because of low-immunity and high inflammatory status [3,4]. Previous evidences have proposed that the aged-related changes are associated with immune system by releasing the many cytokines such as; C-reactive protein (CRP), interleukin-6 (IL-6), interleukin-1 (IL-1), as tumor necrosis factor-alpha (TNF- α) [4] in result of some complex network of cells activation from oxidants [5]. In addition, the low antioxidant status has been reported among elderly people. Prior evidences showed that the aged individuals had low glutathione (GSH) antioxidant and high oxidative stage by malondialdehyde (MDA) formation from lipid peroxidation and

protein hydroperoxide (PrOOH) releasing from protein oxidation [6,7].

Oxidative stress also has been proposed in the hypertension pathology from lipid metabolism abnormality for example, low level of high-density lipoprotein-cholesterol (HDL-C) and high level of low-density lipoprotein-cholesterol (LDL-C) [8], which was successfully confirmed in a previous elderly people study [9]. In addition, the function of HDL-C is still to promote the cholesterol effusion and inhibit the oxidation of LDL from free radicals [9]. In addition, previous information claimed that low status of LDL oxidation could reduce the releasing of pro-inflammatory mediators from macrophages and reduce adhesion molecule expression on the endothelial cells as nitric oxide synthase (NOS) in order to release the NO [10]. The especially interesting reviews have been documented that high chronic oxidative stress or

prolonged free radical releasing may result in decreased muscle strength, endurance and function capacity [11,12]. Unfortunately, there is not any evidence completely indicating or explaining that why the free radicals reduced the muscle strength and endurance in human. But, a basic theory of muscle fatigue is “an exercise-induced reduction in muscle force generation” has been proposed [13,14]. There are various potential mechanisms by which NO and ROS might influence skeletal muscle force production, affecting calcium regulation, and/or myofilament function. Possibly, high NO can reduce adenosine triphosphate (ATP) production, by inhibition the activity of glyceraldehyde-3-phosphate dehydrogenase [15,16] and creatinine kinase [17] that could limit ATP production. Moreover, high levels of free radicals also inhibited the sarcoplasmic reticulum (SR) calcium APTase (SERCA) activity [18,19], especially high amount of NO inhibits ryanodine activity and retards calcium release [20,21]. Overall evidences indicate the relationship of oxidative stress and inflammation on physical function in elderly population, therefore extra-supplements such as; nutrients, foods, or natural fruits, can be enhanced in among elderly persons.

Functional Food for Health

Now a days, the functional foods containing various nutrient components has been promoted for example; grape peel, green peppers, garlic, onions, vegetables, and fruit juice containing various antioxidant vitamins, and natural phenolics [22]. Especially L-ascorbic acid (Vit C) has potential to enhance the immune system [23,24], in elderly subjects [25]. Moreover, the flavonoids in the aqueous or lipophilic phases in many fruits, vegetables and red wine also have antioxidant property [26] by scavenging free radicals [27]. Moreover, previous review has been concluded that prenylated phenolics have various effects on inhibition of the cyclooxygenases and lipoxygenases activity, and releasing of mediators from neutrophils, mast cells and macrophages [28]. These cells play a vital role in the initiation of inflammatory response by the production of pro-inflammatory mediators as prostaglandin E2 (PGE2) and cytokines as interleukin 6 (IL-6) and tumor necrosis factor-alpha (TNF- α) [29]. Previous report has been confirmed that polyphenols curcumin and epigallocatechin gallate have essential role in immunity by interfering with pro-inflammatory cytokine

synthesis, immune cell regulation, and gene expression [30]. Thus, natural fruits containing various polyphenols and antioxidant vitamins have antioxidant, anti-inflammatory activities and modulate immune function that possibly have potential effects on health in elderly people.

Sapodilla (*Manilkara zapota L*)

Sapodilla is one of many fruits in Thailand, which has sweet taste after ripe. It has classified as *Achras Zapota*, or the scientific name of *Manilkara zapota* Less. It is native to Mexico and Central American [31], and as a fruit tree across tropical and subtropical America, the West Indies, India and Thailand [32,33]. Sapodilla fruit has a sweet taste when ripe and small size of 4-8 cm in diameter with ellipsoid or round shape (Figure 1). The nutritional composition and scientific evidence have not been reported. But, the information of nutrients for standard reference of ripe sapodilla in the United States Database from Department of Agriculture in 2015, represented that 100 g of sapodilla comprises carbohydrates (19.96 g), vitamin C (14.7 mg), and vitamin A (3 μ g) with 83 Kcal of total energy [34]. The benefits on human health has been reported in some reports or studies; for example, the leaves can be used to treat cough, cold, anti-diarrheal, antibiotic, anti-hyperglycemic, and hypo-cholesterol [35]. Previous evidences indicated the Sapodilla has antioxidant activity with polyphenols, especially gallic acid or catechin, methyl-4-O-galloylchlorogenate and 4-O-galloylchlorogenic acid after methanolic extracted [36]. Unfortunately, there are not any scientific evidences on supplementation of fresh Sapodilla fruit in human. Whereas, ripped sapodilla also is popular and consumed in elderly people because of its flavor and sweet taste in Thailand. Presently study of Leelarungrayub and co-worker (2019) showed that sapodilla extract that was prepared after fine homogenized with a motor blender had 1.89 ± 1.09 μ g equivalent to standard gallic acid of total phenolic in one gram, as well as 4.87 ± 0.98 μ g of Vit A and 13.05 ± 2.65 μ g of Vit C in 100 grams of sapodilla extract. Moreover, sapodilla extract also had scavenging activity on superoxide radicals, hydroxyl radicals, hydrogen peroxide and nitric oxide. In addition, it still inhibited the TNF- α releasing from peripheral blood mononuclear cells (PBMC) in vitro model [37].



Figure 1: Sapodilla (*Manilkara zapota L*) (A) and Star Fruit (*Averrhoa carambola L*) (B).

The fresh sapodilla fruit supplement health benefits on elderly population has been confirmed at 100 grams after meal twice a day for 4 weeks, the results showed the improvement on total antioxidant capacity (TAC), as well as reduced the malondialdehyde (MDA) and NO levels significantly. Finally, the anti-oxidative results from supplement of fresh sapodilla fruit, has been confirmed by significant increases of Vit. A and Vit. A in plasma. But no difference was noted in plasma level of TNF- α . However, supplementation of sweet sapodilla should be concerned among diabetic or hyperglycemic elderly persons, because of high level of glucose in sapodilla fruit. There was interesting data of physical performance among elderly subjects, which showed significant increases of 6-minute walking [37]. Possibly, health benefits of supplementation the fresh sapodilla were mainly antioxidant activity, but no anti-inflammatory activity among healthy elderly people. Whereas, the mechanism of walking endurance improvement is still unclear, whether it involved the NO pathway or glucose utilization that should be confirmed in the future. Moreover, to recheck the immune modulatory function of Sapodilla fruit, that is very challenging and more studies in the future are required.

Star Fruit (*Averrhoa carambola L*)

Now a days, there are two types of star fruit, sweet or sour. It is one of the many native fruits grown in all over Thailand, as well as in Taiwan, Indonesia, India, Sri Lanka, etc. Typical characteristics of the star fruit are five -pointed cross section forming a star, green to yellowish skin, when ripped [38]. The previous data has reported various beneficial effects on human health such as anti-pyretic, laxatives, appetite stimulants, diuretics and digestive agent, also including treatment of; throat inflammation, mouth ulcers, toothache, cough, asthma and eye related problems [39,40]. Previous study has revealed the benefits of star fruit on suppression of the glycation and reduced glycohemoglobin in all proteins in aging population [41] Unfortunately, the mechanisms on that results were not confirmed and evaluated. Its bioactive compounds have been proposed with natural compounds such as saponins, alkaloids, flavonoid C-glycosides and tannin [42,43], especially L-ascorbic acid (Vit C) [44]. How different are bioactive compounds of sour and sweet types of star fruit in Thailand? It is still unconfirmed. But a previous study reported the high Vit. C (1.71 ± 0.5 mg) in sour-type star fruit extract at 100 grams and low Vit. A concentration (0.2 ± 0.00 μ g) [45]. The updated evidence showed the beneficial effects on elderly people from supplement of fresh star fruit juice at 100 grams for twice a day after meal for 4 weeks, by increasing TAC, Vit C, Vit A, as well as reduction of MDA and PrOOH in plasma [45,46]. Moreover, supplementation of fresh star fruit also helped to increase the HDL-C and reduced the LDL-C in elderly serums [45]. Interesting results documented on reduced NO, TNF- α , interleukin-23 levels when supplemented for 4 weeks, as well as the 6-minute walking distance among elderly subjects [46]. Therefore, possibly it is claimed that star fruit has

antioxidant and anti-inflammatory activities with its mainly bioactive compound of Vit.C. Previous data has been confirmed that TNF- α and IL-23 are the pro-inflammatory cytokines that released from macrophage cells [47], it may involve the many auto-immune diseases as psoriatic skin disease and ankylosing spondylitis [48]. The mechanisms of the star fruit on improvement on the walking endurance is still unclear because of no evidences of nutrients in star fruit, either glucose or fat contents in fresh star fruit, but the activity on antioxidant related with anti-inflammatory is possibly can be proposed. That is consistency with some previous data that claimed the low muscle strength, endurance and functional capacity when high oxidants and low antioxidant status were presented [49,50]. However, all mechanism hypothesis should be confirmed and evaluated in the future. Moreover, consumption of the fresh star fruit also should be concerned because of high oxalic acid content that will effect on the kidney functions in elderly persons who has renal dysfunction, uremic conditions [51], or chronic kidney disease [52].

Conclusions and Suggestion

Seasonal fruits as Sapodilla and Star fruit either grown in Thailand or any other countries have potential benefits for people, especially elderly people. Consumption of fresh fruits or drinking fresh juices after meal should include in routine. Although, literature have few evidences to refer its efficiency in human life, but they are classified in the natural fruits that can be consumed in many countries. Important recommendation that recently published by WHO/FAD claimed that a minimum of 400 grams of fruits and vegetables per day can prevent the chronic disease such as heart disease, cancer, diabetes and obesity [53], whereas a previous recommendation on dietary pattern following the American Heart Association/American College of Cardiology (AHA)/ACC Guidelines for the healthy US-style eating pattern, unsweetened fruit was 1 cup of fruit or $\frac{1}{2}$ cup of fruit juice or $\frac{1}{3}$ cup of a fruit juice blend can be used [54]. Although, the sapodilla or star fruits that applied in Thai elderly subjects were approximately 3-5 servings or equivalent to 100 grams per meal, that was higher than the previous recommendation only 3-5 serving in Thai Dietary Guidelines for Thai People (2001) [55]. But a previous data indicated that people over the age of 50 years should intake higher number of servings (more than 5 servings per day) than younger adults [56]. Therefore, this review suggested that consumption of the seasonal fruits as sapodilla or star fruit which have antioxidant and anti-inflammatory activities in elderly people, at 5-10 servings per day or 5 servings per meal in morning or in evening will enhance the health status for elderly people.

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