Phytate and Fiber Content in Thai Fruits Commonly Consumed by Diabetic Patients

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The amount of phytate and total dietary fiber of 6 popular tropical fruits eaten by diabetic patient residing in Bangkok were studied. They were dragon fruit, durian, guava, longan, mango, and pineapple. Fruit containing the highest content of total dietary fiber was guava which had about 2.7%. Longan contained the lowest fiber content equal to 0.19%. The highest content of phytate was found in pineapple about 0.09% and the lowest content was in longan about 0.037%. It was noticed that longan contained the lowest total dietary fiber and the lowest phytate content.

Keywords : *Phytate, Fiber, Fruit*

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Dietary fiber is part in the plant that cannot be digested in the human body but it is partially digestable in the colon e.g. pectic substance. In the general fiber of the plant there is some part carbohydrate e.g. cellulose, hemicellulose and pectic substance, and no carbohydrate e.g. lignin, and gum[1]. Epidermological data have revealed negative correlations between fiber intake and colon cancer, ischemic heart disease and diabetes mellitus[2]. Water soluble dietary fibers can delay sugar digestion and absorption[3] which reduce the insulin level and hormones[4,5], from the digestive tract which bring about improvement of insulin sensitivity and glucose utilization[5]. Various bile acid chelation effect of these fibers has also been demonstrated[6].

Diabetes mellitus is a major cause of morbidity and mortality and is increasing in prevalence in many populations around the world including Thailand. The most common form of diabetes is non-insulin dependent diabetes mellitus (NIDDM) or Type II diabetes, comprising over 90% of cases. The American Diabetes Association estimated the prevalence of diabetes among adults to be 7.4% in 1995; this is expected to rise to ~9% in 2025[7] and in 2000 the average prevalence of diabetes in Thailand[8] was 4.8% which was 6.9% for urban areas and was 3.8% for rural areas. In diabetic patients the control of complex carbohydrate and dietary fiber intake would lead to lower serum triglyceride and cholesterol levels as well[9].

Fruits contain a considerable amount of dietary fibers as well as phytate[10], which modulate glycemia and produce different glycemic index (GI) of foods[11]. Phytic acid or phytate is inositol phosphate which occur naturally in plants as phosphate linkage. Phytate affects the digestability of starch by combining with protein or combined with digestive enzymes which are protein associated with starch[3]. At present, evidence on fiber and phytate content in Thai fruits is scanty and stimulated the authors to carry out the present study.

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Material and Method

Collection of samples

Six samples of fruits were purchased from markets in the Bangkok metropolitan area according to the preference of the diabetic patients. They were guava, dragon fruit, pineapple, durian, mango and longan. The samples were blended, dried in the oven 525°C and grounded to powder.

Sample preparation

The samples were weighed at 0.5 gram and put into four tubes, two tubes for analyzing protein

and two tubes for analyzing ash.

Phytate determination

Phytate was extracted from duplicate samples of dried food using diluted HCL.Extract was mixed with EDTA/NaOH solution and placed on an ion-exchange column. Phytate was eluted with 0.7M NaCl solution and wet-digested with a mixture of concentrated HNO_3/ $H2SO_4$ to release phosphorus, which was measured colorimetrically. The amount of phytate in the original sample was calculated as hexaphosphate equivalent[12].

Fiber determination

Duplicate samples of dried fruits, sugar extraction if containing >10% sugar were gelatinized with Trammel (heat stable α-amylase), and then enzymatically digested with protease and amyloglucosidase to remove protein and starch. Four volumes of ethanol were added to precipitate the solubilized dietary fibers. The solutions were allowed to stay at room temperate overnight. Total residue was filtered by washing with 78% ethanol 95% and acetone. After drying, the residue was weighed. One duplicate was analyzed for protein, and the other was incinerated at 525°C and was determined by weighting. Total dietary fiber was calculated as weighed residue-weighed protein ash[13].

Results

The results are shown in Table 1, Fig. 1 and Fig. 2. There seems to be no correlation between the dietary fiber and phytate contents in these 6 fruits. Guava contained the highest dietary fiber concentration (2.70%), whereas phytate was equal to 0.080%. Longan had the lowest total dietary fiber (0.190%) as well as the lowest phytate content (0.0370%) Pineapple had the highest phytate (0.090%), whereas the total dietary fiber content was equal to 0.920% which ranked in the middle. Durian, mango and dragon fruit contained a moderate amount of total dietary fiber and phytate content.

Table 1. Phytate, fiber content and glycemic index in Thai fruits commonly consumed by diabetic patients

	Total dietary fiber (g/100g)	Phytate (g/100g)
Dragon fruit	2.140	0.039
Durian	1.870	0.051
Guava	2.700	0.080
Longan	0.190	0.037
Mango	0.860	0.086
Pineapple	0.920	0.090

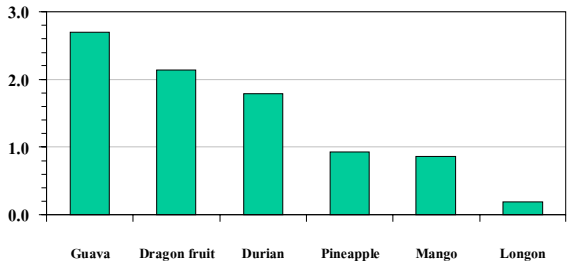

Fig. 1 Total dietary fiber content (g/100g)

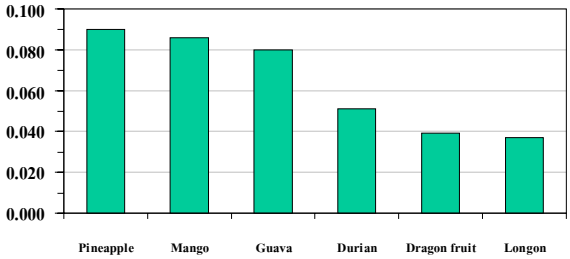

Fig. 2 Phytate content (g/100g)

Discussion

Guava is one of the most popular fruits eaten in Thailand. It has been postulated as a very healthy fruit since it contains concentrated vitamin C[13]. The present data revealed that guava also contained the highest total dietary fiber (2.40%) and a rather high phytate content (0.08%). These were due to the higher cellulose and uronic acid content[14] in this fruit more than the other 5 fruits. It is advisable that for colon cancer, ischemic heart disease and diabetes, patients should eat more guava. On the other hand, longan had the lowest total dietary fiber (0.19%) and the lowest phytate (0.037%) content and it is anticipated to cause higher glycemic response and may be unhealthy. It is surprising to see that ripe mango had a rather high phytate (0.086%) and a low dietary content. It is anticipated that ripe mango should have a high glycemic index. Dragon fruit also contained rather high dietary fiber (ranked 2nd) but it had a very low phytate content with durian and pineapple being in the middle. The relationship between the total dietary fiber, phytate content and glycemic effect of these fruits is needed in order to improve dietary counseling efficiency.

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ปริมาณไฟเตทและเส้นใยอาหารในผลไม้ไทยที่ผู้ป่วยเบาหวานชอบรับประทาน

สุรีย์ นิติธรรม, สุรัตน์ โคมินทร์, เอกชัย ณิชาโชติสฤษฎ์

ได้ทำการศึกษาหาปริมาณไฟเตท และเส้นใยอาหารของผลไม้เมืองไทย 6 ชนิด ในผู้ป่วยโรคเบาหวานที่อาศัยในเขตกรุงเทพมหานครชอบรับประทาน ผลไม้ที่ศึกษาได้แก่ แก้วมังกร ทุเรียน ฝรั่ง ลำไย มะม่วง และสับปะรด ผลการศึกษาพบว่าผลไม้ที่มีปริมาณเส้นใยอาหารสูงสุด ได้แก่ ฝรั่ง ซึ่งมี 2.7% แต่ลำไยมีปริมาณเส้นใยอาหารน้อยสุดคือ 0.19% สำหรับผลไม้ที่มีปริมาณไฟเตทสูงสุดได้แก่ สับปะรด ซึ่งมี 0.09% แต่ลำไยมีปริมาณไฟเตทต่ำสุดคือ 0.03% จึงขอยืนยันว่าในผลไม้ทั้ง 6 ชนิดนี้ ลำไยมีปริมาณเส้นใยอาหารและปริมาณไฟเตทต่ำที่สุด