Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

European Journal of Experimental Biology, 2012, 2 (2):385-388

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Effect of cooking on amylose content of rice

Ashish Jain, Sughosh M Rao, Sarika Sethi, Abhinav Ramesh, Swapnil Tiwari, Sanjeeb Kumar Mandal, Nishant kumar Singh, Ashish Singhal, Naisarg Modi, Vibhav Bansal and Chitra Kalaichelvani

School of Bioscience and Technology, VIT University, Vellore, Tamil Nadu, India

---

ABSTRACT

In diabetes type 2, there is a deficiency of insulin which results in improper/ slow breakdown of food. This results in sugar level spikes immediately after a meal, which can be harmful. Hence, diabetics must have food stuffs which have a slow release rate so as to not cause any spikes. In order to find out the most suitable method of cooking rice for diabetic patients, we found out the amylose content of rice cooked by different methods and co-related it with Glycemic Index (GI). Glycemic Index is release of glucose in the blood by the breakdown of carbohydrates. Higher the glycemic index, faster breakdown of food and thereby more release of glucose in the blood, so immediate requirement of insulin, which can be toxic for diabetic patients. Glycemic index and amylose content are inversely proportional to each other. There is a wide variation in the amylose content of rice depending on the way it is cooked. In this paper, the effect of cooking on amylose content of rice is described using various experimental approaches. Various method of cooking involves traditional method, microwave and steam cooked method. The amylose content of the rice is then co-related with its glycemic index.

Keywords: Rice; Glycemic Index; Amylose Content; Diabetes; Cooking.

INTRODUCTION

Rice is the most important staple food for a large part of the world's human population, especially in East Asia, Southeast Asia, South Asia, the Middle East, and the West Indies [6]. The awareness of the general public related to health foods has been on the rise recently and people are looking for the right variety of rice and more efficient methods of cooking it for diabetics. Due to the low insulin concentration in the body, the release of sugar into blood is less controllable than normal, leading to spikes in blood sugar after meals for them. High blood sugar, if left untreated, can cause dehydration, electrolyte imbalance etc. over short term and retinopathy, nephropathy over long term. Hence, this is an acute problem faced by all diabetics.

Brown rice is obtained directly from the plant and is rich in nutrients like vitamin B1, B3 and minerals like iron which can be used in preventing deficiency diseases like beriberi etc. [8]. The nutrient content of consumable rice varies with the processing techniques. For example, brown rice undergoes minimal processing and thus retains most

of the original nutrients within the grain, whereas white rice or polished rice is devoid of most of the nutrients as they are pushed into the husk of the grain during processing which is then removed during polishing [9].

Similarly, the starch content also varies with the cooking methods viz., traditional methods or home-made or microwaved method etc. [6].

Rice contains two types of starch in rice: amylose and amylopectin. Amylose is a long straight starch molecule that does not gelatinize during microwave cooking [4] and hence rice with more amylose content tends to cook fluffy, with separate grains. Besides, amylose also hardens and forms during crystals during cooking and melts when the rice is re-heated. Rice that is high in amylose has a lower Glycemic Index number [1, 7]. This is because amylose is harder to break down than simple sugars like glucose etc. and ensures a sustained release of sugar into blood without spiking immediately after a meal.

MATERIALS AND METHODS

The following reagents are used for estimation of amylose content and for preparation of standard:
95% Ethanol: Prepared from 100% Ethanol
1N NaOH, Iodine - Potassium iodide solution
Standard amylose: Obtained from HIMEDIA
1N Acetic acid: From NICE Chemicals
Glassware: Borosil
Water bath: High Precision water bath from Acmas was used
Spectrophotometer: From Amersham Biosciences to measure OD
Cuvette: Quartz Cuvette to measure OD
Software: HandyGraph Software to draw graph
1N NaOH solution: Dissolve 40g of NaOH in 1000ml distilled water
1N Acetic acid solution: Dilute 57.5 ml glacial acetic acid to 1000ml using distilled water
Iodine - Potassium iodide solution: Dissolve 0.26 g of Iodine in 10 ml of Potassium iodide solution containing 2.6 g of KI

Standard Amylose Solution: Take 40mg of pure potato starch (amylose) in a 100 ml volumetric flask and add 1 ml of 95% ethanol and 9.0 ml of 1N NaOH. Shake well and boil over water bath for 10 minutes and make up the solution to 100 ml using distilled water.

Method: We weighed 100 mg well powdered milled rice into 100 ml volumetric flask and to it 1 ml 95% ethanol and 9 ml 1 N NaOH was added. The sample was heated for 10 minutes in boiling water bath, cooled and the volume was made up to 100 ml. 5 ml was pipetted from the 100 ml into another 100 ml volumetric flask. To it 1 ml I N acetic acid and then 2 ml iodide solution were added and the volume was made up to 100 ml. The mixture was stirred and allowed to stand for 20 minutes and the per cent Transmittance at 620 nm was determined using a colorimeter. A series of standard starch solution containing 0, 20, 40, 60, 80 and 100% amylose was prepared as in the steps 1 to 5. The transmittance of the standards was read at 620nm and a standard graph was plotted. Amylose content of the sample was determined in reference to the standard curve and expressed on percent basis.

RESULTS

In Table 1, five different amylose solutions were prepared at different concentrations and the absorbance values at 620nm were noted down. The absorbance readings were triplicated for standard amylose and standard graph was obtained as follows:

Table 1: Preparation of Standard Graph from Amylose

Amylose Concentration (mg/mL)	Abs @ 620 nm			Avg. Abs	Std. Deviation		
	T1	T2	T3		T1	T2	T3
Blank	0	0	0	0	0	0	0
8	0.079	0.072	0.077	0.076	+0.003	-0.004	+0.001
16	0.156	0.156	0.149	0.153	+0.003	+0.003	-0.004
24	0.239	0.24	0.239	0.239	0.000	+0.001	0.000
32	0.321	0.32	0.33	0.323	-0.002	-0.003	+0.007
40	0.40	0.40	0.40	0.40	0.000	0.000	0.000

This table is used in making the graph shown below. The procedure followed to obtain these readings is described in the Materials and Methods section. T1, T2, and T3 are the triplicated values.

Scale
X Axis: 1cm - 8mg/ml
Y Axis: 1cm - 0.08OD

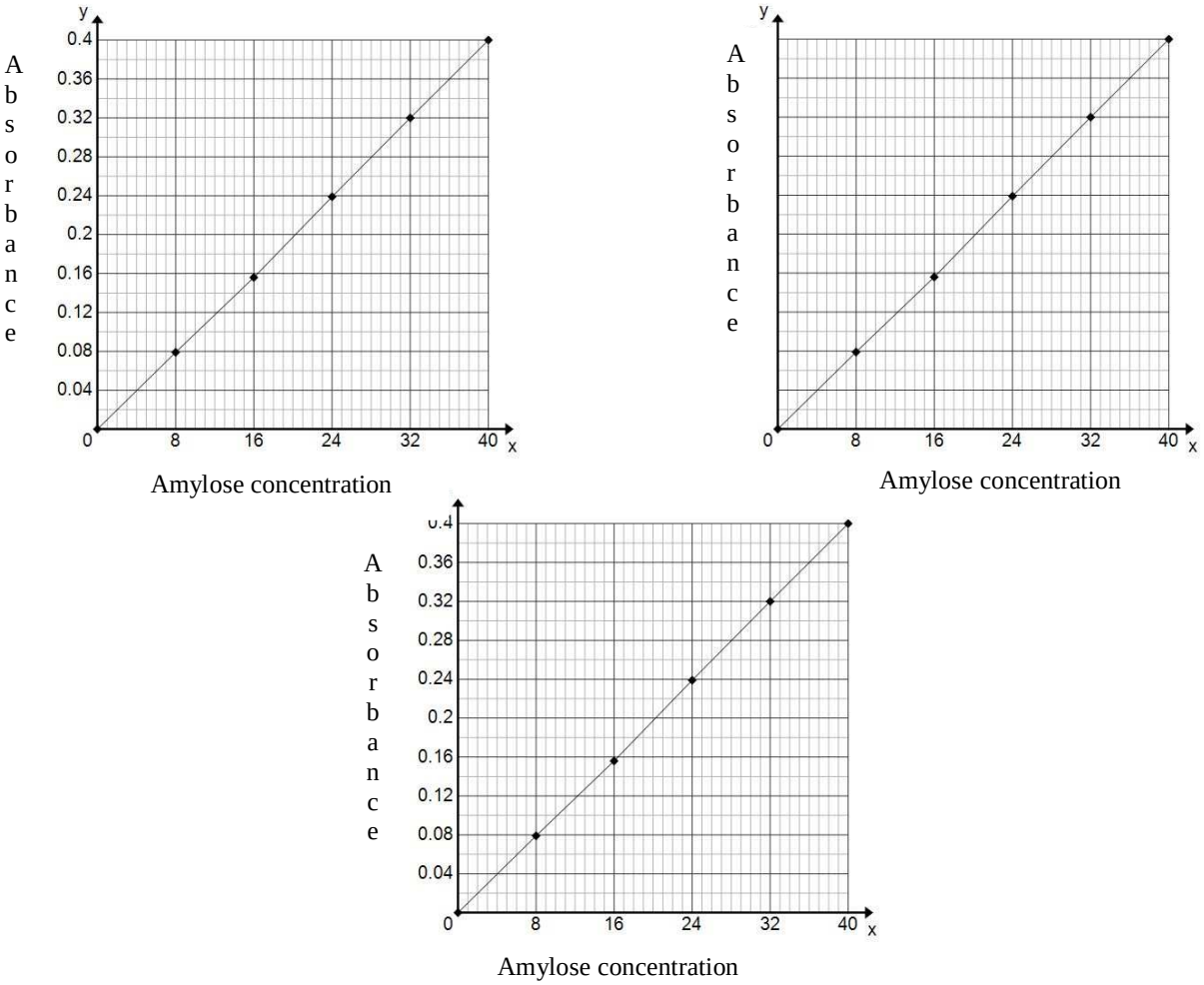

Figure 1: The above graphs are obtained by taking Concentration on the X-axis and Absorbance at 620nm on the Y-axis for each of the set of values.

Table 2: **Extrapolated values of rice cooked by different methods**

Cooking Method	Abs @ 620 nm			Avg. Abs	Amylose Concentration (mg/mL)
	T1	T2	T3		
Steam Cooked	0.169	0.172	0.171	0.171	17.35
Traditional Method	0.195	0.194	0.196	0.195	19.67
Microwaved	0.227	0.227	0.230	0.228	22.98
Raw	0.258	0.259	0.259	0.259	25.99

This table lists the amylose content of rice which is cooked by different methods. The values are obtained from extrapolating from the standard amylose curve.

DISCUSSION

Table 3: Co-relation between amylose content and Glycemic index of rice [8]

If	Then
Amylose content is high	Low Glycemic Index and the rice grains will show high volume expansion (not necessarily elongation) and a high degree of flakiness. The rice grains cook dry, are less tender, and become hard upon cooling.
Amylose content is low	High glycemic Index and the rice grains will cook moist and sticky

It is seen that amylose content is inversely related to the Glycemic index.

From table 2, it is observable that the amylose content of microwaved rice is highest after raw, uncooked rice. Hence, this method of cooking rice is the most suitable for diabetic patients as the Glycemic Index will be lowest. Since the Glycemic Index is low, the breakdown rate is slower, which prevents the sugar levels in blood from spiking just after a meal.

REFERENCES

[1] DJ Jenkins *et al*. (**1981**). *Am J Clin Nutr* 34; 362–366.
[2] Knowler WC, Barrett-Connor E, Fowler SE, et al., *N Engl J Med*. **2002**;346(6):393–403.
[3] Brouns et al. (**2005**). *Nutrition Research Reviews* 18; 145–171.
[4] Chiu CJ, Liu S, Willett WC, Wolever TM, Brand-Miller JC, Barclay AW, Taylor A., *Nutr Rev*., **2011** ;69(4): 231-42.
[5] Temelkova-Kurktschiev TS, Koehler C, Henkel E, Leonhardt W, Fuecker K, Hanefeld M., *Diabetes Care*. **2000** Dec;23(12):1830-4.
[6] White Rice, Brown Rice, and Risk of Type 2 Diabetes in US Men and Women."*Arch Intern Med* **2010** 170: 961-969.
[7] International table of glycemic index and glycemic load values: **2002**."*Am J Clin Nutr* **2002** 76: 5-56
[8] Brand-Miller JC, Pang E, Bramal L. *Am J Clin Nutr* **1992**;56:1034–6.
[9] Srisawas, W. and Jindal, V. K. (**2007**), *Journal of texture studies*, 38: 21–41. doi: 10.1111/j.1745-4603.2007.00084.x