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Evaluation of starch hydrolysis for glycemic index prediction of rice varieties

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iBET Instituto de Biologia Experimental e Tecnológica
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INTRODUCTION

MATERIAL

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Introduction

Rice, one of the staple foods of the world's population, is consumed as white cooked polished grain and has been considered a high glycemic index (GI) food.

Objective

Because is a fundamental food in our diet, it will be very important to evaluate its characteristics that can contribute to know the different glycemic responses of several rice types.

Introduction

Factors that influence glycemic index of rice varieties wich can be precditors of starch digestion

- ❖ Starch: amylose and amylopectin content
- ❖Gelatinization characteristics
- ❖Food processing

High-amylose rice varieties

Lower viscosity profile

Lower glycemic values?

Material

Rice Varieties	Type
Ceres	*Japonica* (Carolino)
Maçarico	*Indica* (Agulha)
Basmati	Basmati
Waxy	Glutinous

- Standards: Corn starch (S 4126, Sigma)

  HI-MAIZE resistant starch

Methods

Amylose content
Standard iodine colorimeric method (ISO 6647-2:2015).

Viscosity parameters
Gelatinization and pasting profiles were determined by rapid visco analyzer (RVA) and AACC method 76-21.

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Methods

In vitro kinetics of starch digestion

The starch digestibility and estimated GI was measured by Goni et al., (1997) method.

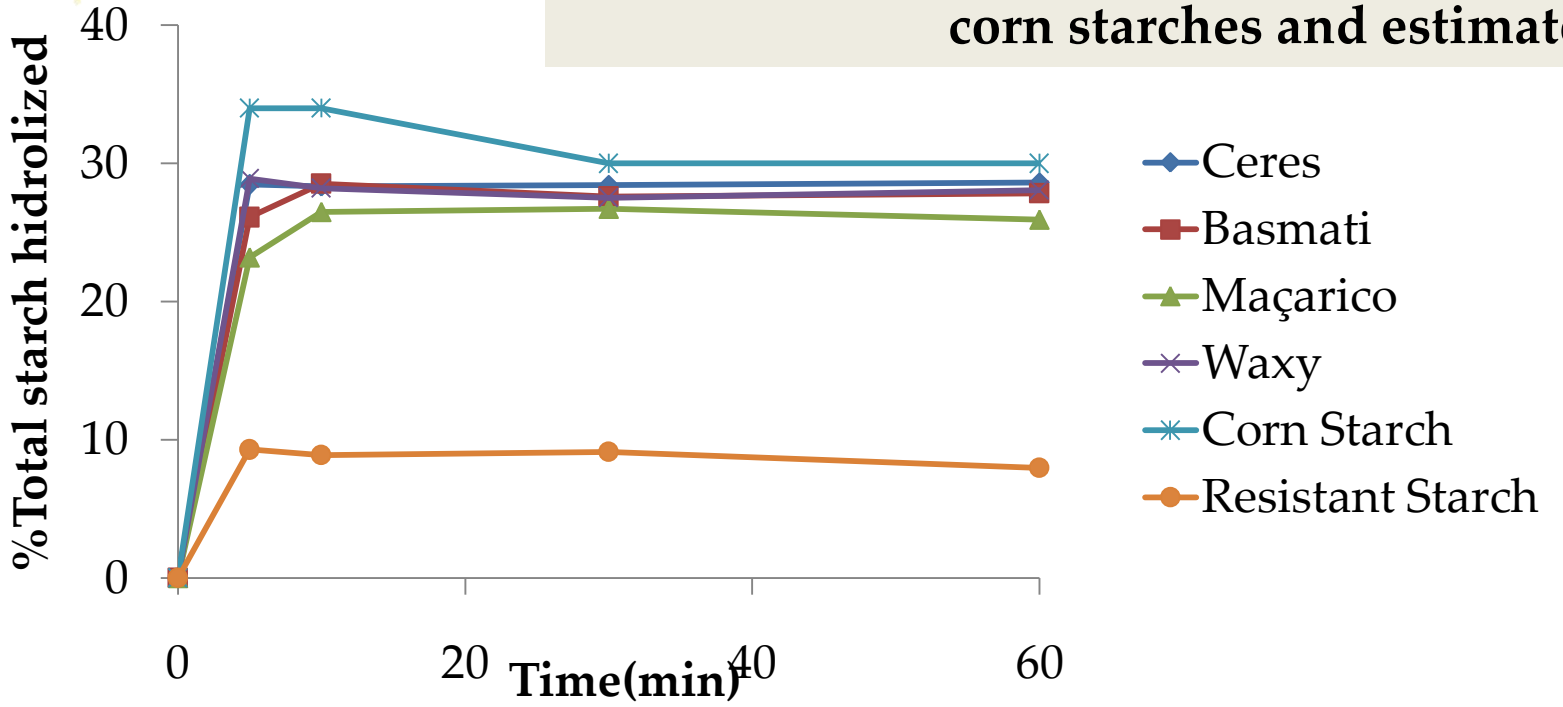
The rate of starch digestion was expressed as a % of the total starch hydrolyzed at different times (0, 5, 10, 30, and 60 min). The kinetics of starch digestion was estimated by follow equations:

(1) $C = C\infty(1 - e^{-kt})$
(2) $AUC = = C\infty\ (t_f - t_0) + \ (e^{-kt}{}_f - e^{-kt}{}_0)]$
(3) HI= AUCsample/AUC reference sample
(4) GI= 39.6207 + (0.5498xHI)

C- starch hydrolyzed at time t (%);
C∞- equilibrium starch hydrolyzed after 60 min (%);
k - kinetic constant;
HI- hydrolysis index ;
GI- glycemic index;
AUC- area under the hydrolysis curve

Results

•***In vitro*** **starch hydrolysis rate compared with corn starches and estimated GI**



• There was a wide variation in the starch hydrolysis curves, with significant differences between the **normal** (higher hydrolysis rate, **GI = 94.6**) and the **resistant starch** corn starches (lower hydrolysis rate, **GI = 54.8**).

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Results

•*In vitro* **starch hydrolysis rate compared with corn starches and estimated GI**

Samples	Estimated GI (%)
Ceres	88.49[b]
Basmati	86.65[c]
Maçarico	83.71[d]
Waxy	88.20[b]
Corn Starch	54.80[e]
Resistant starch	94.60[a]

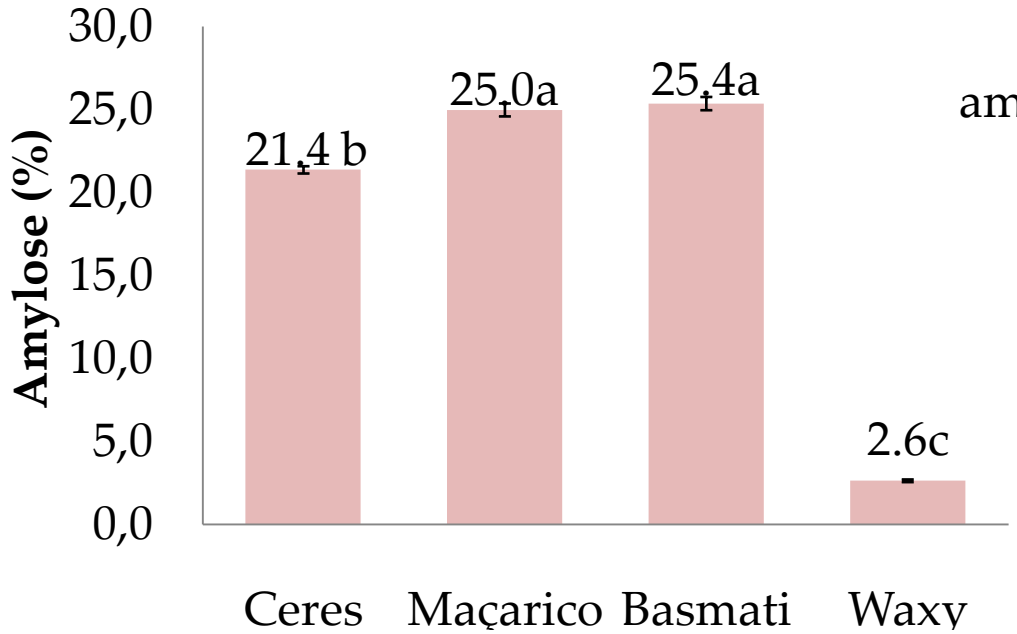
•It was possible to establish significantly differences between the different rice types

•Ceres has the highest rate of and Maçarico has the lowest of starch hydrolysis

The results obtained show the effectiveness of the method for GI estimation

Results

- **Variation in GI of rice samples and its relation with amylose content**

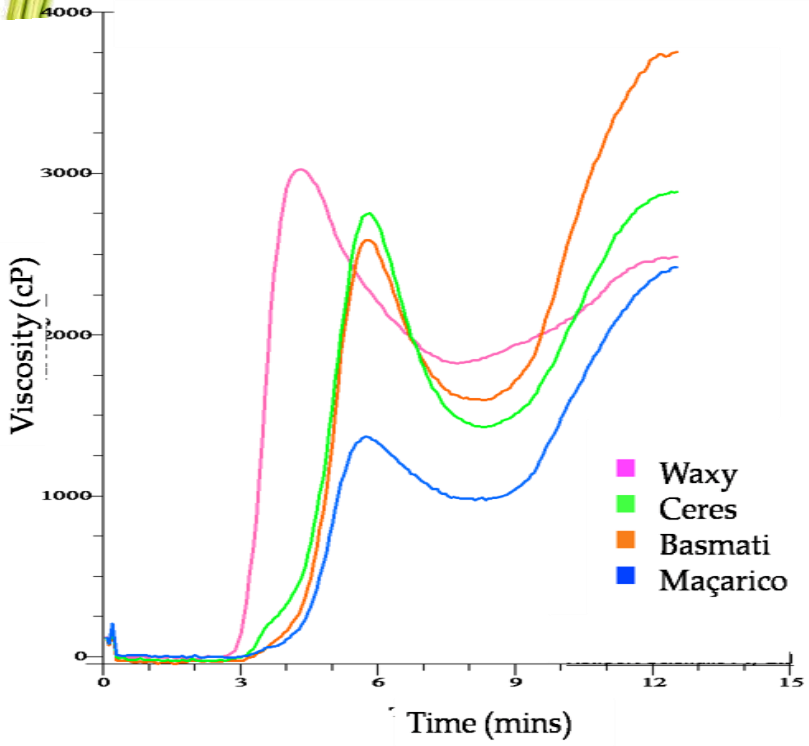


The 4 rice types differ in amylose content (exception for Basmati and Maçarico varieties).

Basmati (25.4%) and Maçarico (25.0%) with the highest amylose content, also have the lowest GI (86.6 and 83.7 respectively).

Results

- **Variation in GI of rice samples and its relation with viscosity profiles**



Waxy rice has the maximum peak viscosity and also had a one of the highest GI=88.20

Maçarico shows the lowest viscosity profile and corresponds to the rice variety with the lowest GI=83.71

Results

- **Variation in GI of rice samples and its relation with viscosity profiles**

Types	RVA parameters			
	Peak	Trough	Breakdown	Final Viscosity
Ceres	2750[b]	1428[c]	1322[a]	2892[b]
Basmati	2589[c]	1592[b]	997[c]	3755[a]
Maçaricó	1368[d]	977[d]	391[d]	2422[d]
Waxy	3025[a]	1819[a]	1206[b]	2488[c]

RVA parameters peak, trough and breakdown have a positive correlation with the GI (0.96, 0.82 and 0.99).

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Conclusions

❖ The rice varieties with higher amylose contents and lower pasting profiles exhibit lower GIs compared with the Waxy and intermediate amylose varieties.

❖The results obtained support the use of the starch hydrolysis method for rice GI estimation.

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