Effect of processing condition on the formation of resistant starch from two Nigeria Cassava (*Manihot esculenta*) varieties

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Presentation Outline

- Introduction
- Materials and methods
- Results and discussion
- Conclusion

Introduction

Resistant starch

- Total amount of starch undigested in the small intestine

- Passes into the colon where it can be fermented by natural microflora to short-chain fatty acids

- These metabolites appear to have important biological effects for improved physical and mental health (Birt *et al*., 2013).


The Best Sources of Healthy
RESISTANT STARCH
raw potato starch
Bob's Red Mill
POTATO STARCH
green bananas & plantains
potatoes
yams & sweet potatoes
rice
lentils
legumes

Types of RS

- Physically inaccessible starch (RS_1)

- Starch granules (RS_2)

- Retrograded starch (RS_3)
- Chemically modified starches (RS_4)

Benefits of RS

- Pre-biotic effect on colon micro flora
- Reduce the risk of colon cancer and cardiovascular diseases.
- useful in controlling glycaemic plasma responses.
- Increase in mineral absorption, faecal bulk and excretion of butyrate and acetate
- ingredient in high-quality foods to give crispness, expansion, better mouth feel, colour and flavour

Production of RS_3

- RS_3 is produced by gelatinization and retrogradation
- The type of starch, processing condition, and duration and storage conditions.
- Processing techniques includes baking, pasta production, extrusion cooking, steam cooking, autoclaving (Sajilata *et al*., 2006).

- Commercially, RS_3 have been prepared from high amylose corn starch (>40% amylose).
- Native cassava starch contains amylose (19.6% to 24.1%).
- Recent trend in research is to source for the use of native crops in production of RS.
- Cassava is suitable for RS_3 production (Worawikunya, 2007)

- Nigeria is the world's largest producer of cassava (about 45 million metric tons per annum).

- Autoclaving in production of RS has been reported in rice, high amylose corn starch,normal maize starch and in cassava

- There are scanty work on formation of RS from Nigeria cassava varieties

Objective

- To enhance the use of cassava starch as a functional food and thus increase the industrial utilization of cassava in Nigeria.

- study the effects of different processing condition (autoclaving) on formation of Resistant starch using two improved varieties of Cassava

Materials and Methods

- Materials
  - TMS 30572 and 98/0581 (IITA) Ibadan
  - commercial isoamylase obtained from *Pseudomonas sp.* Amyloglucosidase (EC. 3.2.1.3 from *Aspergillus niger*, 11,500 U/mL) pancreatic-α-amylase (Sigma-Aldrich, Steinheim, Germany)

Method

- starch extraction from cassava (IITA, 2005).
- enzymatic debranching of cassava starch (Mutungi *et al*., 2009)
- debranched and undebranched starch were autoclaved (Milasinovic *et al*., 2009).
- starch-to-water ratio of 1:1, 1:3, and 1:5, autoclaving temperatures (110 °C and 121 ºC), Time (15 min) at four cycles (Sangick *et al*., 2004).
- Storage at refrigeration and Freezing

Analyses

- Amylose (Williams *et al.,* 1970).

- The total starch contents (Dubois *et al*., 1956; Mcready 1970).

- Resistant starch content (McCleary *et al.,* 2002).

Results and discussion

Table 1: Effect of autoclaving at 110 ºC on formation of resistant starch content (g/100 g)

Variety	Cooling cycle	Undebranched			Debranched		
		1:1	1:3	1:5	1:1	1:3	1:5
30572	1	6.21d	6.07f	6.24d	22.63e	22.47c	22.51e
	2	7.52c	7.39d	7.54b	24.31c	23.79b	23.95c
	4	9.07a	9.01b	9.14a	25.93a	25.31a	23.43a
98/058	1	6.18d	6.19e	6.11d	22.41f	22.52c	22.30e
	2	7.51c	7.52c	7.45c	23.74d	23.84b	23.63d
	4	8.98b	9.17a	8.96a	25.27b	25.30a	25.12b

Means with the same alphabet in the same column are not significantly different ($p<0.05$)

Table 2: Effect of autoclaving at 121 ºC on formation of resistant starch content (g/100 g)

Variety	Cooling cycle	Control			Debranched		
		1:1	1:3	1:5	1:1	1:3	1:5
30572	1	6.70d	6.52c	6.15e	22.90c	22.70d	22.41c
	2	7.90c	7.87b	7.35d	24.34b	23.92c	23.63b
	4	9.21b	9.19a	8.82b	25.72a	25.40a	25.12a
98/0581	1	6.79c	6.50c	6.21e	23.01c	22.71d	22.43c
	2	8.07b	7.75b	7.90c	24.33b	23.92c	23.86b
	4	9.64a	9.21a	9.13a	25.97a	24.80a	25.40a

Means with the same alphabet in the same column are not significantly different ($p<0.05$)

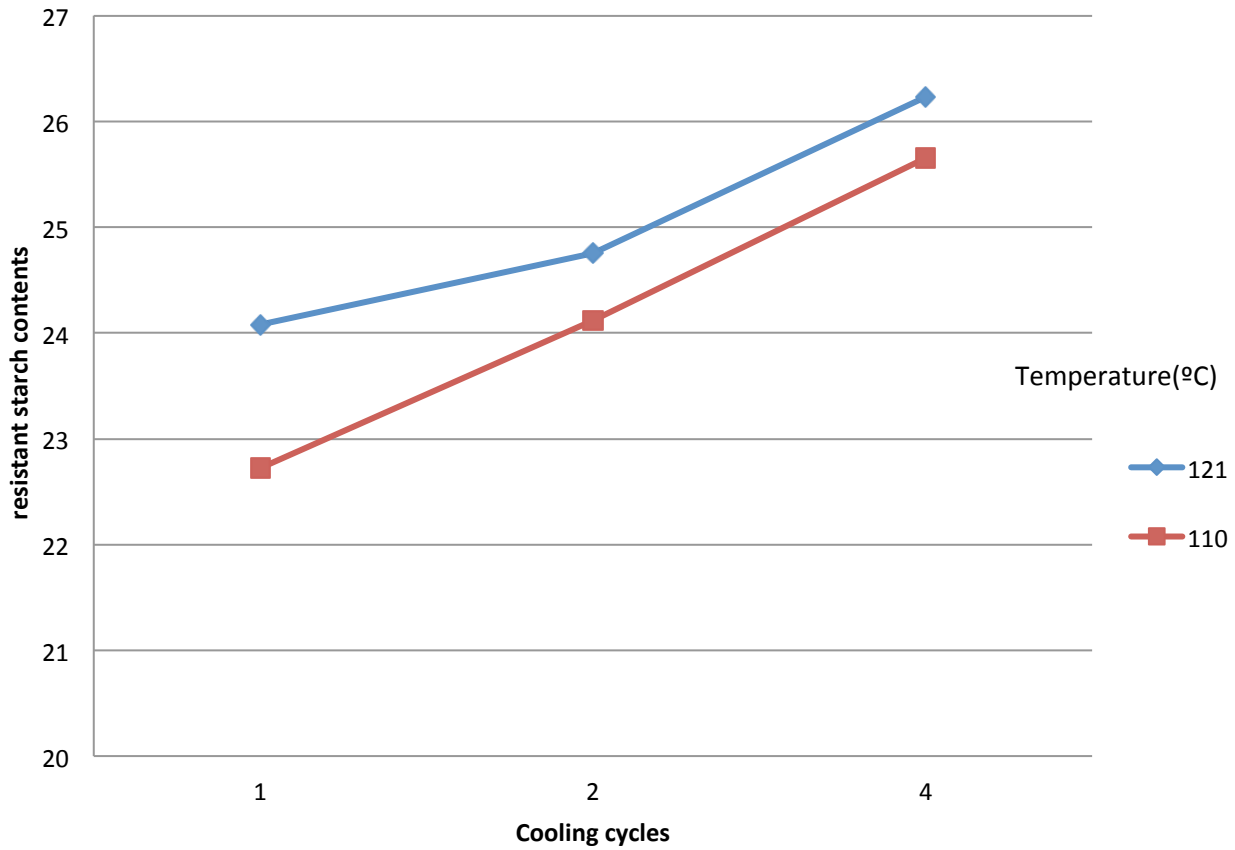

Fig. 1: The effect of cooling cycle and autoclaving temperature on resistant starch contents of debranched sample of TMS 30572

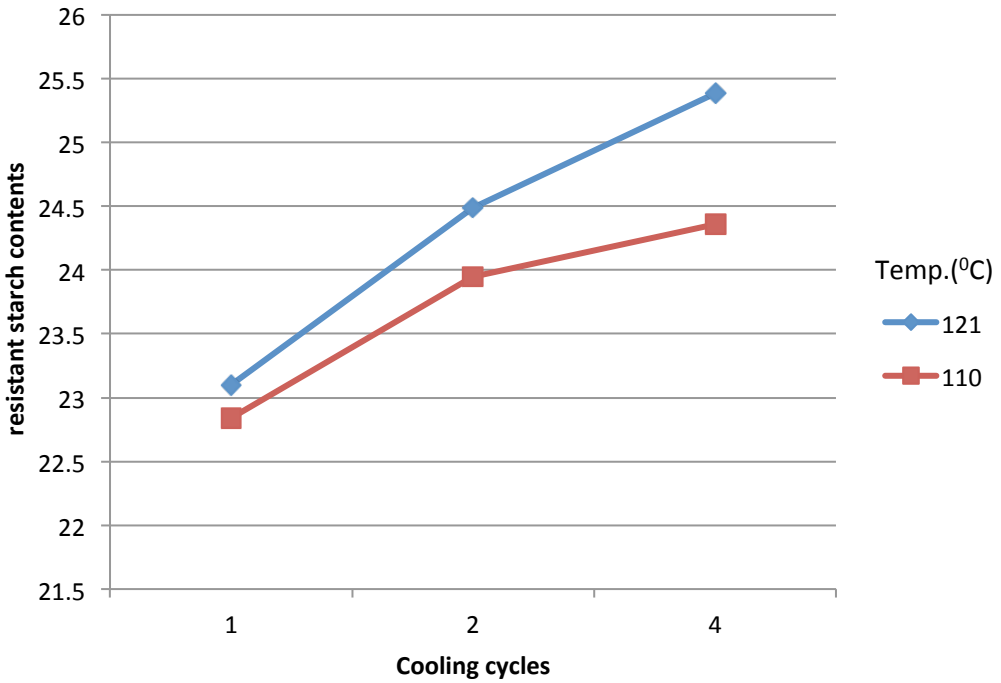

Fig. 2: The effect of cooling cycle and autoclaving temperature on resistant starch contents of debranched sample of TMS 98/0581

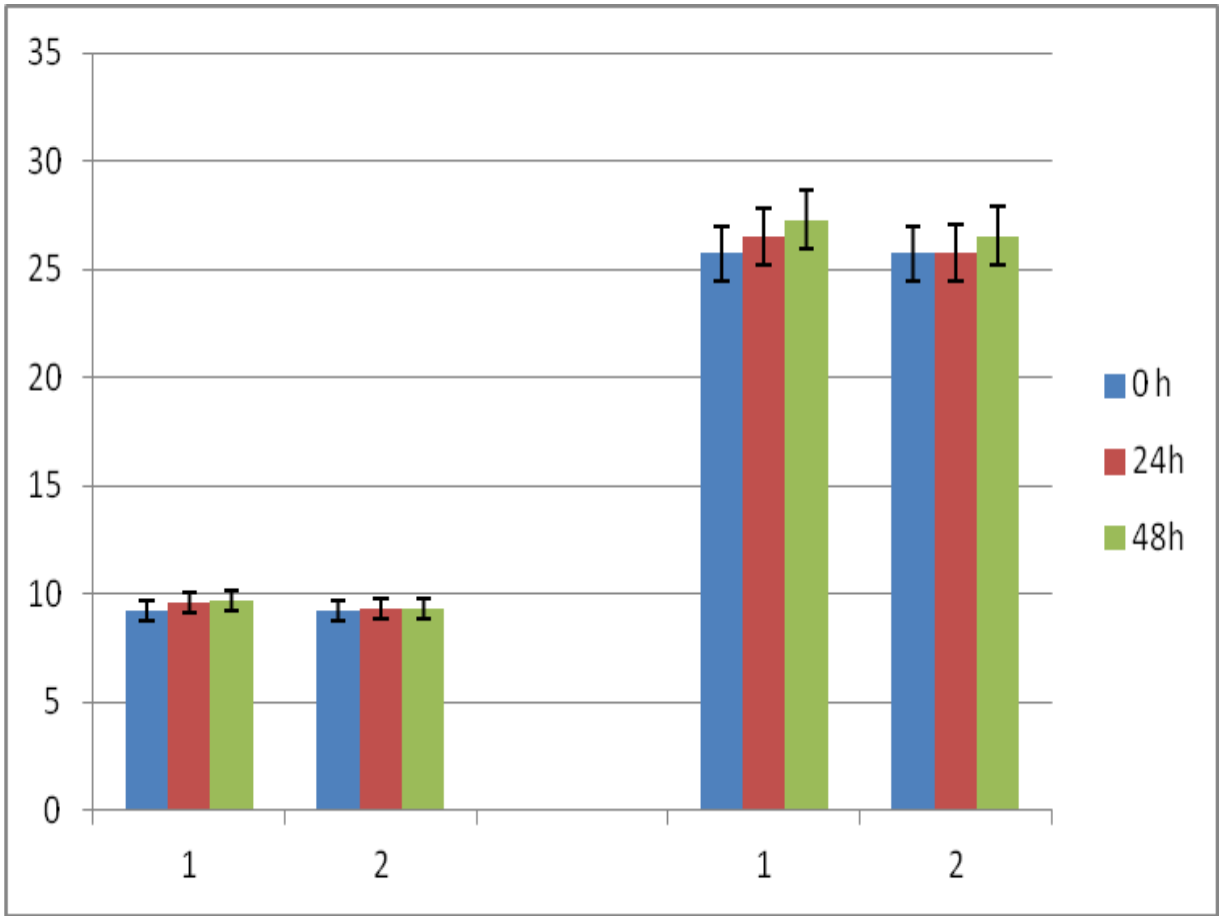

Fig 1: Effect of storage condition on formation of RS in undebranched and debranched starch samples for TMS30572
1- Refrigerated samples
2. frozen samples

conclusion

❖debranching process, autoclaving temperature and storage condition and time had effects on formation of resistant starch.

Higher temperature gave higher yield of resistant starch contents

Heat and cool cycles and storage condition had effects on the formation of RS.


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