

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

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Batch 37

| | | |
|---------------------------|---------------------------------|----------------|
| 1. SUBJECT CLASSIFICATION | A. PRIMARY Agriculture | AQ10-0000-0000 |
| | B. SECONDARY Food processing | |

2. TITLE AND SUBTITLE
Some nutritional consequences of the Maillard reaction

3. AUTHOR(S)
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|--------------------------|---------------------------|----------------------|
| 4. DOCUMENT DATE 1971 | 5. NUMBER OF PAGES 1p. | 6. ARC NUMBER ARC |
|--------------------------|---------------------------|----------------------|

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Calif.--Davis

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publisher, Availability*)
(Presented at Western Hemisphere Nutrition Cong. III, 1971)

9. ABSTRACT

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|---|--------------------------------------|
| 10. CONTROL NUMBER PN-AAC-308 | 11. PRICE OF DOCUMENT |
| 12. DESCRIPTORS Food chemistry Maillard reaction? | 13. PROJECT NUMBER |
| | 14. CONTRACT NUMBER CSD-1587 Res. |
| | 15. TYPE OF DOCUMENT |

SOME NUTRITIONAL CONSEQUENCES OF THE MAILLARD REACTION. V. C. Sgarbieri, M. Tanaka, C. O. Chichester and J. Amaya, University of Rhode Island and Institute for Food Research, Campinas, Brazil.

The Maillard reaction between free amino acids and reducing sugars yields several types of compounds (Hodge, J. E., *J Agr Food Chem* 1:928, 1953) which may have a detrimental effect on the nutritional value of foods undergoing this reaction.

In a series of experiments we incorporated browned and non-browned freeze-dried banana powder in a rat diet otherwise normal but low in protein (8% casein). The banana powder was the only source of carbohydrate in the experimental diets. The PER for the fresh banana diet was lower than the standard casein (2.5), but that of the diet containing browned banana was significantly lower than that containing fresh banana. As the contribution of banana to the amino acid pattern of the diet was low, the marked decrease in the PER of the diet containing browned banana is thought to be due to a low level of toxicity induced by the browning reaction.

In other experiments a completely synthetic diet was used. A mixture of amino acids in the proportion recommended for rats (Rogers and Harper, *J Nutr* 87:272 and 267, 1965) was incubated with glucose for 30 days at 37°C at a water content of 16%. At the end of the incubation period the amino acids were analyzed to estimate the losses, and feeding experiments with weanling male rats were performed. Complete supplementation of diets with the essential amino acids lost during browning estimated on the basis of chemical analysis, did not restore the nutritive value to the same level as the non-browned diet.

The calculated nitrogen efficiency ratio (NER) was significantly lower than the control in the browned diet and the supplemental amino acid browned diet.

The Amadori rearrangement product of two essential amino acids, i.e., leucine and tryptophan, was synthesized to determine its nutritional value.

Absorption studies were conducted by stomach intubation of the radioactive product in water solution. The availability of the amino acids in this form to the microorganism *Streptococcus zymogenes* and to the rats was also determined by growth studies. Our results indicate very poor absorption of the amino acids which had participated in the initial phases of the Maillard reaction, but an adaptive effect was evident in time.