TECHNICAL REPORT
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THE EFFECT of VARIOUS SWEETENING AGENTS on the QUALITY of CANNED JELLIED CRANBERRY SAUCE

by
Abdul R. Rahman
Edward E. Anderson
Margaret Driver
Karl R. Johnson
and
David S. Criz

Project reference: 1G762713A034

March 1974

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

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13. ABSTRACT

A study was initiated to determine the effect of various sweetening agents on the flavor, color, texture and shelf life of canned jellied cranberry sauce.

The canned product was stored at 4.4°, 21° and 37.7°C. for 12 months and the following results obtained: (1) Sweetening agents consisting of more than 75 percent low or high conversion corn sirup adversely affected the flavor and texture of the sauce, this on the basis of both subjective and objective tests; (2) Storage time and temperature did not appreciably affect the pH, soluble solids and acidity; (3) Anthocyanin pigments underwent degradation during storage. Higher temperature and longer storage period resulted in greater pigment degradation.

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Corn sirup	6					
Sucrose	6					
Dextrose	6					
Storage	6					
Temperature	6					
Flavor	7					
Color	7					
Texture	7					
Shelf life	7					
Acidity	7					
Soluble solids	7					
Anthocyanin pigments	7					
Pigments	7					

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FOREWORD

This study was initiated in order to provide factual data concerning the effect of several combinations of corn sirup product, sucrose, and dextrose on the overall quality of canned jellied cranberry sauce. The compilation and evaluation of the data obtained from this study will enable the U.S. Army Natick Laboratories to determine whether or not the current specification on canned cranberry sauce (Z-C-656) is realistic in limiting the amount of corn sirup solids to 25 percent of the sugar solids.

This work was performed under Project No. 1G762713A034, Military Food Service and Subsistence Technology.

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ABSTRACT

A study was initiated to determine the effect of various sweetening agents on the flavor, color, texture and shelf life of canned jellied cranberry sauce.

The canned product was stored at 4.4°, 21° and 37.7°C. for 12 months and the following results obtained: (1) Sweetening agents consisting of more than 75 percent low or high conversion corn sirup adversely affected the flavor and texture of the sauce, this on the basis of both subjective and objective tests; (2) Storage time and temperature did not appreciably affect the pH, soluble solids and acidity; (3) Anthocyanin pigments underwent degradation during storage. Higher temperature and longer storage period resulted in greater pigment degradation.

INTRODUCTION

This study was initiated to provide factual data concerning the effect of various sweetening agents such as sucrose and dextrose with several combinations of corn sirup products on the flavor, color and texture of canned jellied cranberry sauce after storage for different times at different temperatures. Baker and Goodwin[1] indicated that sugar at higher concentrations (65 percent) does not appear to protect the jellying values of the cranberry pectin at boiling temperatures and that the inversion of sugar does not influence jelly strength. Kohman[6] stated that anthocyanins are hydrolyzed in such acid fruits as cranberry and loganberry and the anthocyanidin is precipitated as a brown sediment. This may account for the so-called darkening of commercially canned cranberry sauce. Servadio and Francis[4] found that the pigment content and color of cranberry juice were relatively stable at 1.6°C. and degraded very quickly at 37.7°C. Francis[5] indicated that the ratio of absorption at 535 and 415 nm in the acid ethanol extraction media was calculated as an index of pigment content. Sastry and Tischer[7] indicated that the period of storage exerted the maximum influence on the deterioration of the anthocyanin pigment in Concord grape juice as compared to the presence of air or nitrogen in the headspace of the container or storage of the sample in dark or exposed light. Both the mono- and the diglucosides of the anthocyanidin were found to decrease as a result of storage.

EXPERIMENTAL PROCEDURES

Pulp extracted from the Howe variety of cranberry was mixed with 14 different sweetening agents as shown below. The sweetened pulp was then processed into regular jellied cranberry sauce according to the usual commercial practice at a pilot plant installation of a major cranberry sauce producer. The sweetening agents were added as follows:

No. of treatment	Sweetening agent
1	75% MISS[1] + 25% HCCS[2]
2	75% MISS + 25% LCCS[3]
3	60% MISS + 40% HCCS
4	60% MISS + 40% LCCS
5	50% MISS + 50% HCCS
6	50% MISS + 50% LCCS
7	25% MISS + 75% HCCS
8	25% MISS + 75% LCCS
9	100% HCCS
10	100% LCCS
11	100% Dextrose
12	50% Dextrose + 50% MISS
13	75% Dextrose + 25% MISS
14 (Control)	100% MISS

MISS = Medium invert sugar sirup - 74.6 solids (50 percent invert sugar + 50 percent sucrose)
HCCS = High conversion corn sirup - 82.8 solids
LCCS = Low conversion corn sirup - 82.0 solids

The jellied cranberry sauce was packed in No. 2 enamel cans with 120 cans of each treatment being packed. The cans were rearranged in groups, each group consisting of 6 cans of each of the 14 treatments. 5 groups were placed in each of the 4.4°, 21°, and 37.7°C. storage rooms. The aforementioned groups were examined at 0, 4, 8 and 12 month intervals as follows:

A. Objective tests:
   1. Texture using the Bloom Gelometer. Jellied cranberry disks 3/8" thick and 2-3/4" in diameter were used in these tests.
   2. Color: using the Acid Ethanol extraction method (5).
   3. Acidity: Using AOAC method (2)
   4. Brix: Using the Abbe Refractometer
   5. pH: Using the Beckman pH meter

B. Subjective tests:
   1. Overall acceptability using consumer panels at the U.S. Army Natick Laboratories (NLABS).
   2. Flavor, color and texture using a technological panel consisting of ten experienced technologists at NLABS.

RESULTS AND DISCUSSION

Food acceptance results as shown in figure 2 indicate that cranberry sauce packed with 100 percent low conversion corn sirup and stored at 4.4°, 21° and 37.7°C. consistently received the lowest scores regardless of the length of storage time (0 to 12 months). Statistical analyses indicated that this pack was significantly different from the rest. However, figure 2 shows a general trend of high scores for packs containing a greater percentage of medium invert sugar sirup and lower scores for packs containing higher percentages of low or high conversion corn sirup. Similar trends are indicated in the acceptability scores of the technological panel as shown in figure 1. This indicates that higher contents of low or high conversion corn sirups (75 percent and up) tends to adversely affect the flavor of jellied cranberry sauce.

Results of the optical density of acid ethanol extracts as shown in figure 4 indicate higher pigment contents in packs 8, 9 and 10 in the early stages of the study when stored at 4.4° and 21°C. However, at higher temperature (37.7°C.) these differences tend to narrow down due to rapid pigment degradation. This indicates that pigment degradation is correlated to time and storage temperatures. Higher temperature and longer storage period results in greater pigment degradation. However, these results did not correlate closely with the color scores of the technological panel as shown in figure 3 since no significant difference was observed in the sensory evaluation of the different products.

The results of the Bloom Gelometer texture measurements as shown in figure 6 indicate that samples 10, 9 and 8 containing 100 percent LCCS, 100 percent HCCS, and 25 percent MISS + 75 percent LCCS respectively possess softer texture than the rest. A similar trend is reflected by the technological panel scores as shown in figure 5. Higher contents of LCCS and HCCS seem to weaken the texture of the canned jellied cranberry. In addition, free liquid was observed in cans containing these samples as compared with the rest of the samples which were free of such liquid.

Results shown in figures 7, 8 and 9 indicate that storage time and temperature did not appreciably affect the pH, soluble solids and acidity of the canned jellied cranberry sauce.

LITERATURE CITED

1. Baker, G. L. and W. M. Goodwin, 1941. Pectin decomposition vs. sugar inversion in jelly. Food Industries, Aug., 45-6.

2. Association of Official Analytical Chemists, 1965. Official Methods of Analysis, 10th Ed. The Association, Wash., D. C.

3. Snedecor, G. W., 1956. Statistical Methods. Iowa State College Press, Ames, Iowa.

4. Servadio, G. T. and F. J. Francis, Relation between color of cranberry and color stability of sauce. Food Technol. 17, (5) 124-8.

5. Francis, F. J. 1957. Color and pigment measurement in fresh cranberries. Proc. Am. Soc. Hort. Sci. 69, 296.

6. Kohman, E. F. 1952. The color in cranberries, Food Technol. 6, 160.

7. Sastry, L. V. L. and R. C. Tischer, 1952. Behavior of the anthocyanin pigments in Concord grapes during heat processing and storage. Food Technol. 82-6.

FIG. 1- AVERAGE FLAVOR RATINGS OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

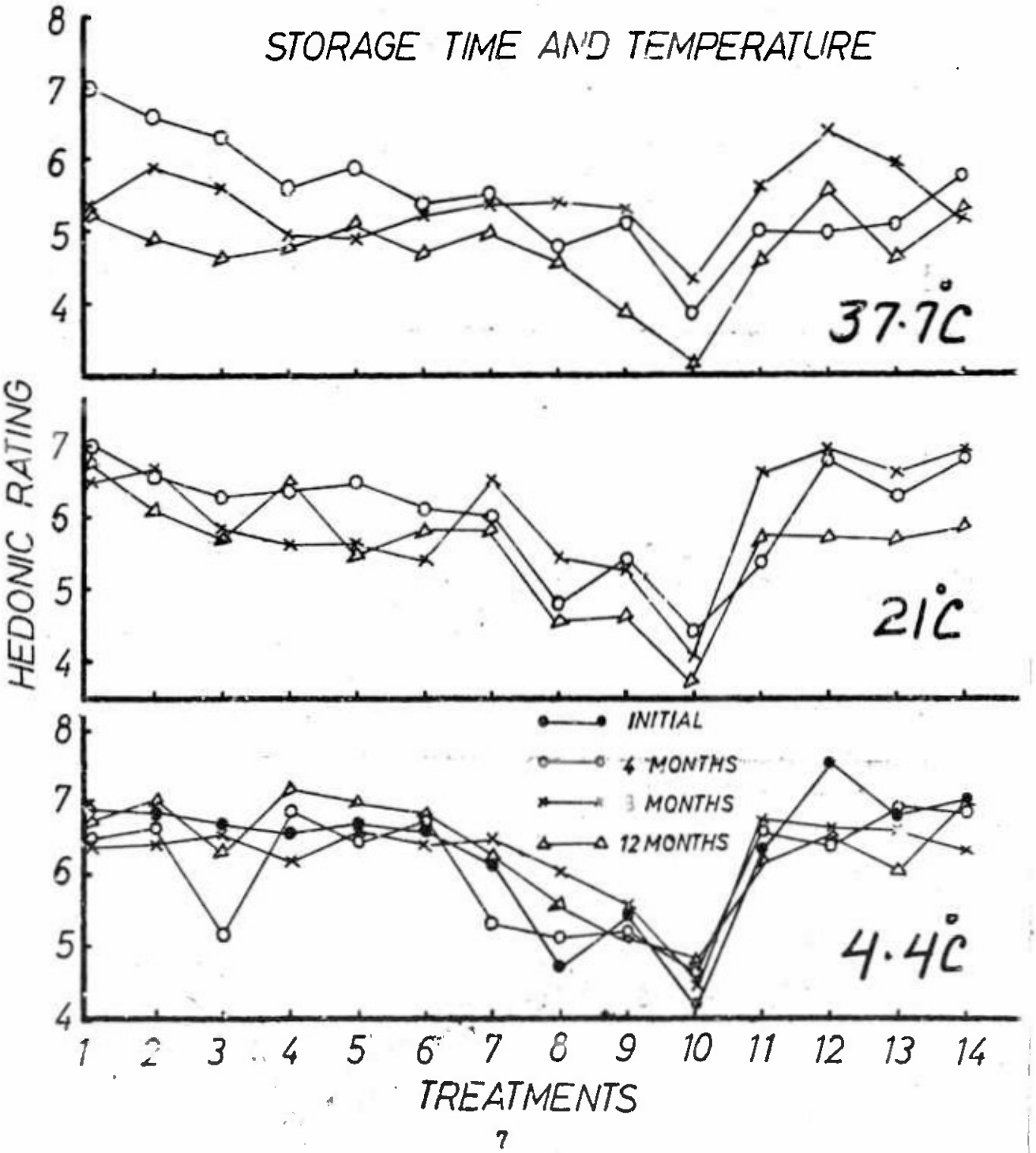

FIG. 2-ACCEPTANCE SCORES OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

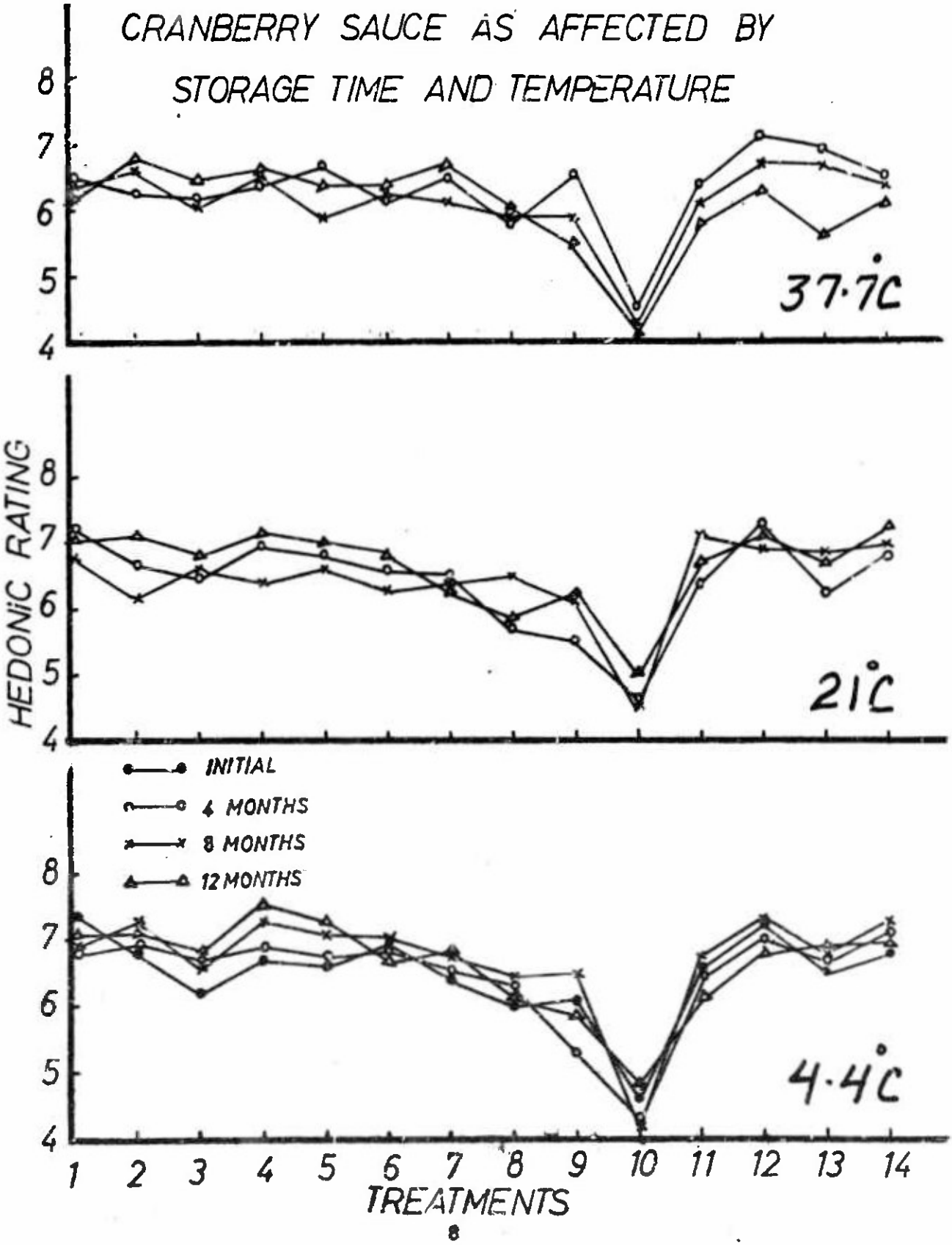

FIG. 3 - AVERAGE COLOR RATINGS OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

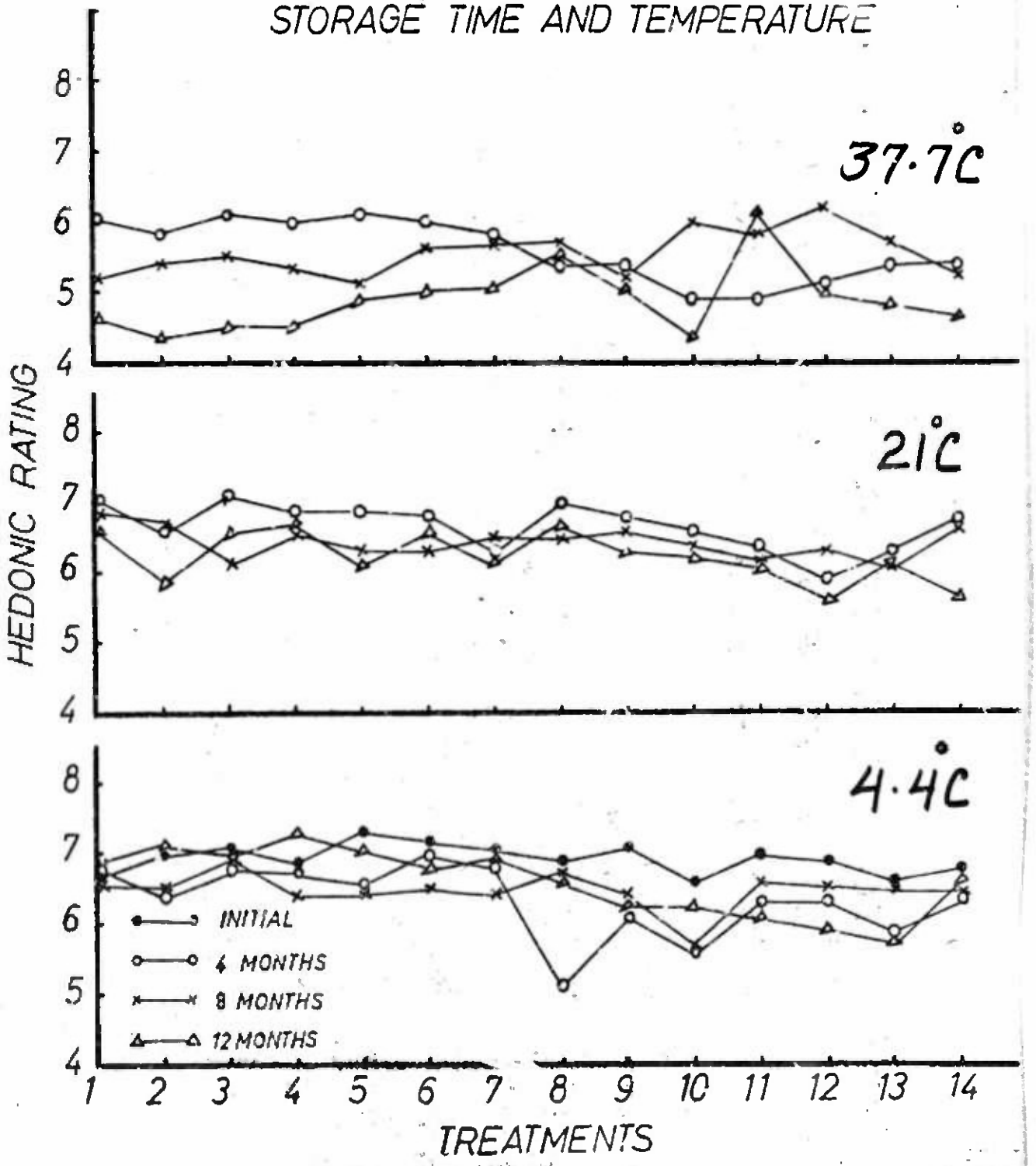

FIG. 4 – OPTICAL DENSITY OF ACID-ETHANOL EXTRACTS OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

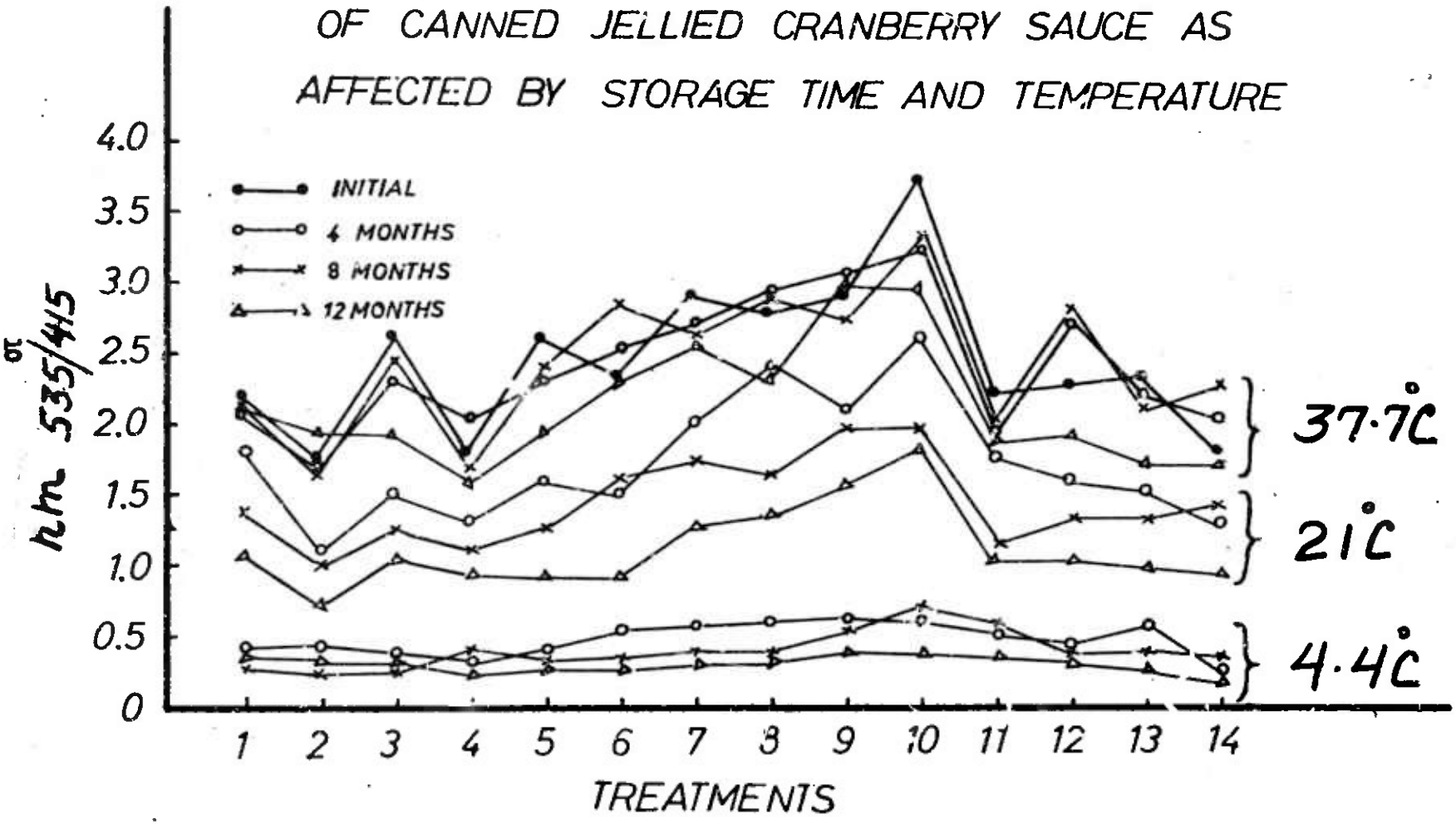

FIG. 5-AVERAGE TEXTURE RATINGS OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

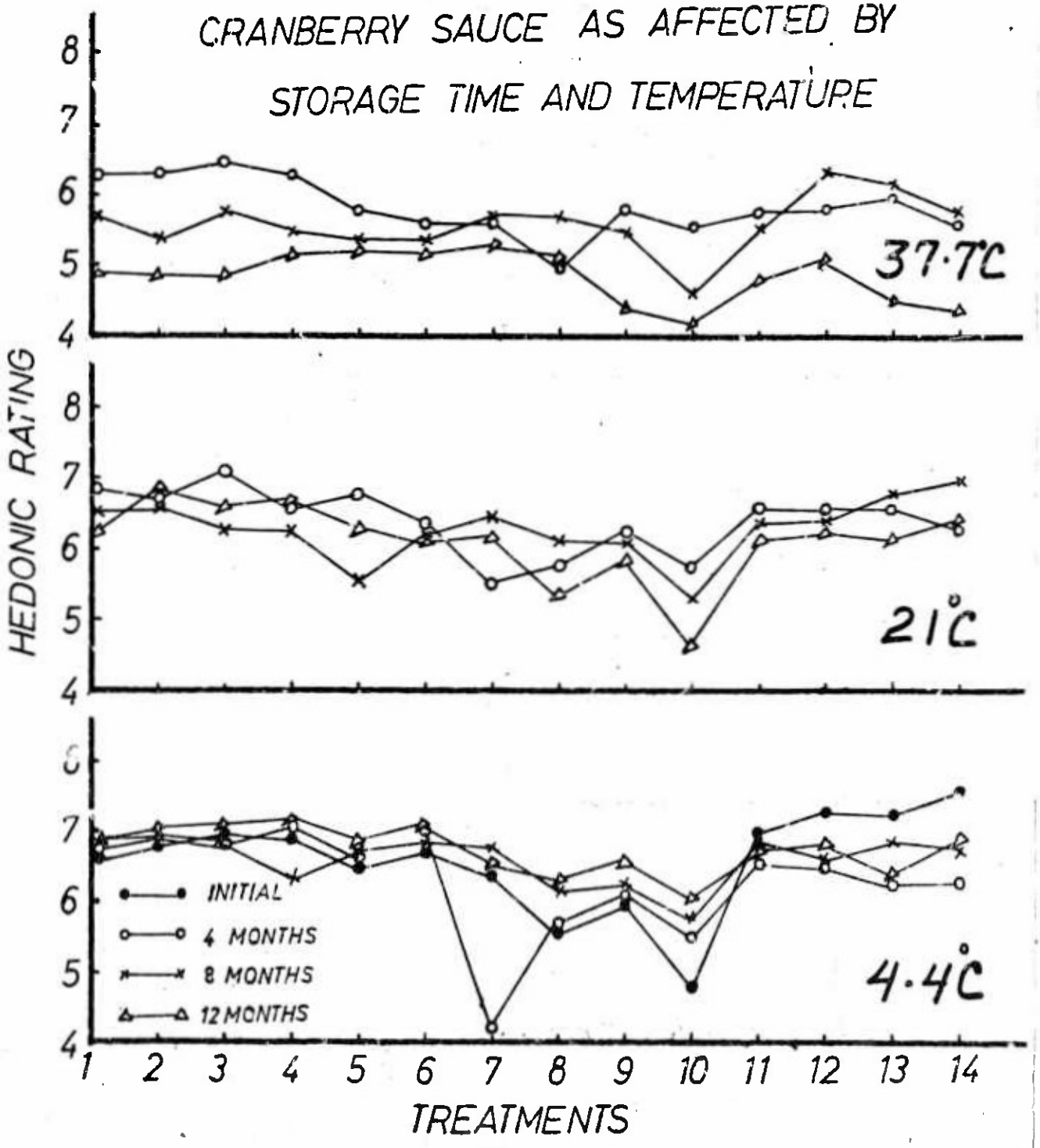

FIG.6-TEXTURE OF CANNED JELLIED CRANBERRY SAUCE AS DETERMINED BY THE BLOOM GELOMETER

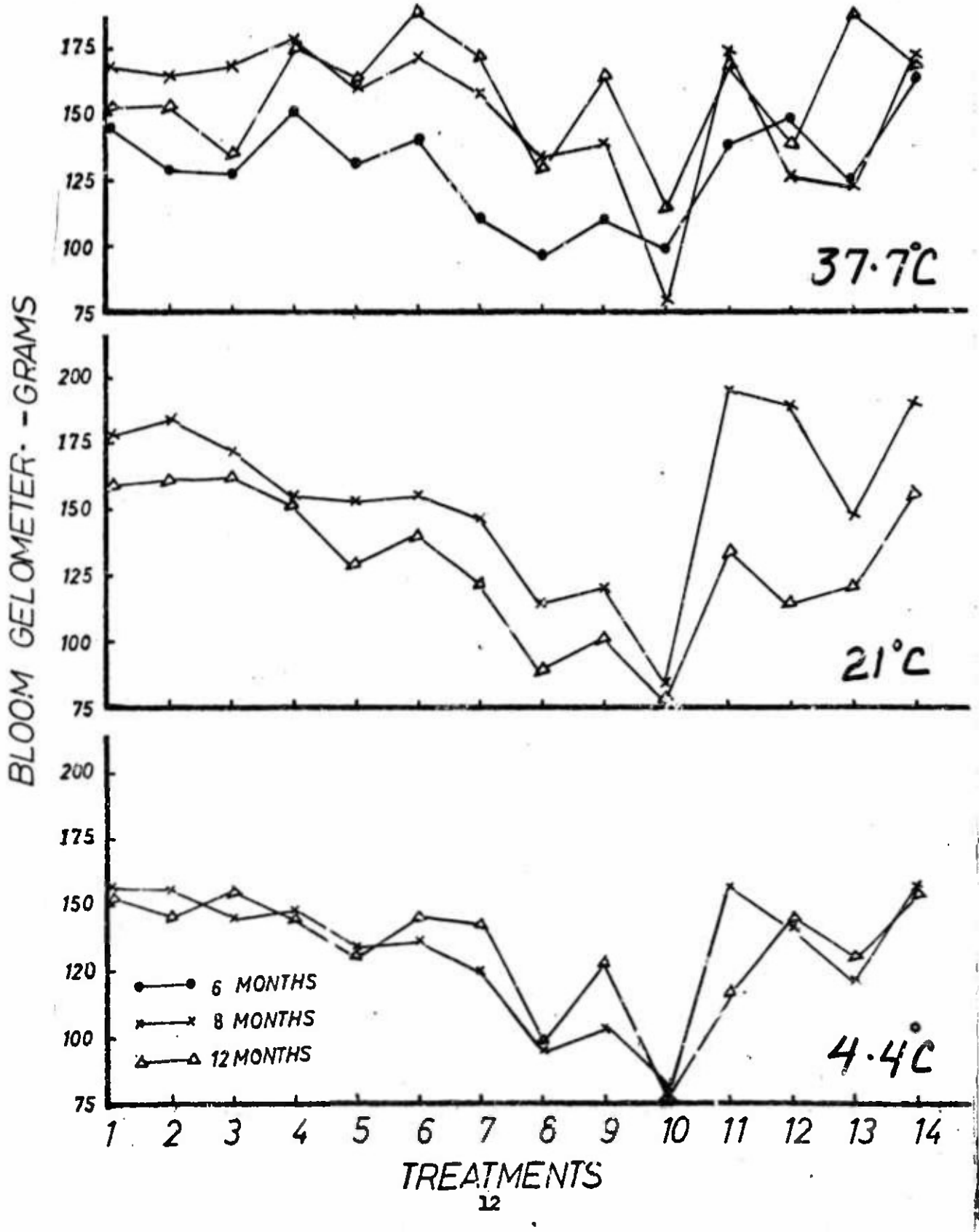

FIG. 7 - TOTAL SOLUBLE SOLIDS (DEGREES BRIX) OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

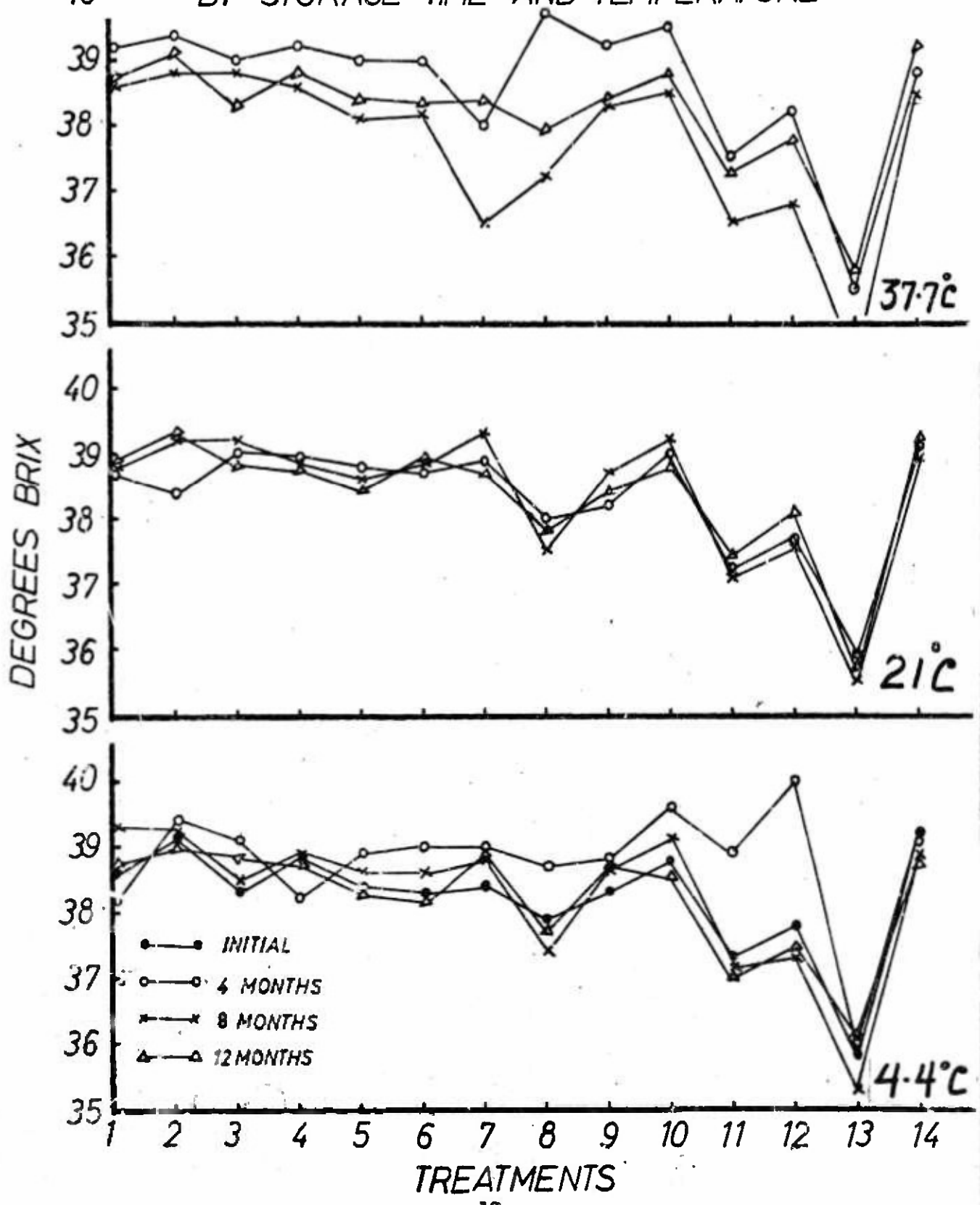

FIG. 8-pH OF CANNED JELLIED CRANBERRY SAUCE AS AFFECTED BY STORAGE TIME AND TEMPERATURE

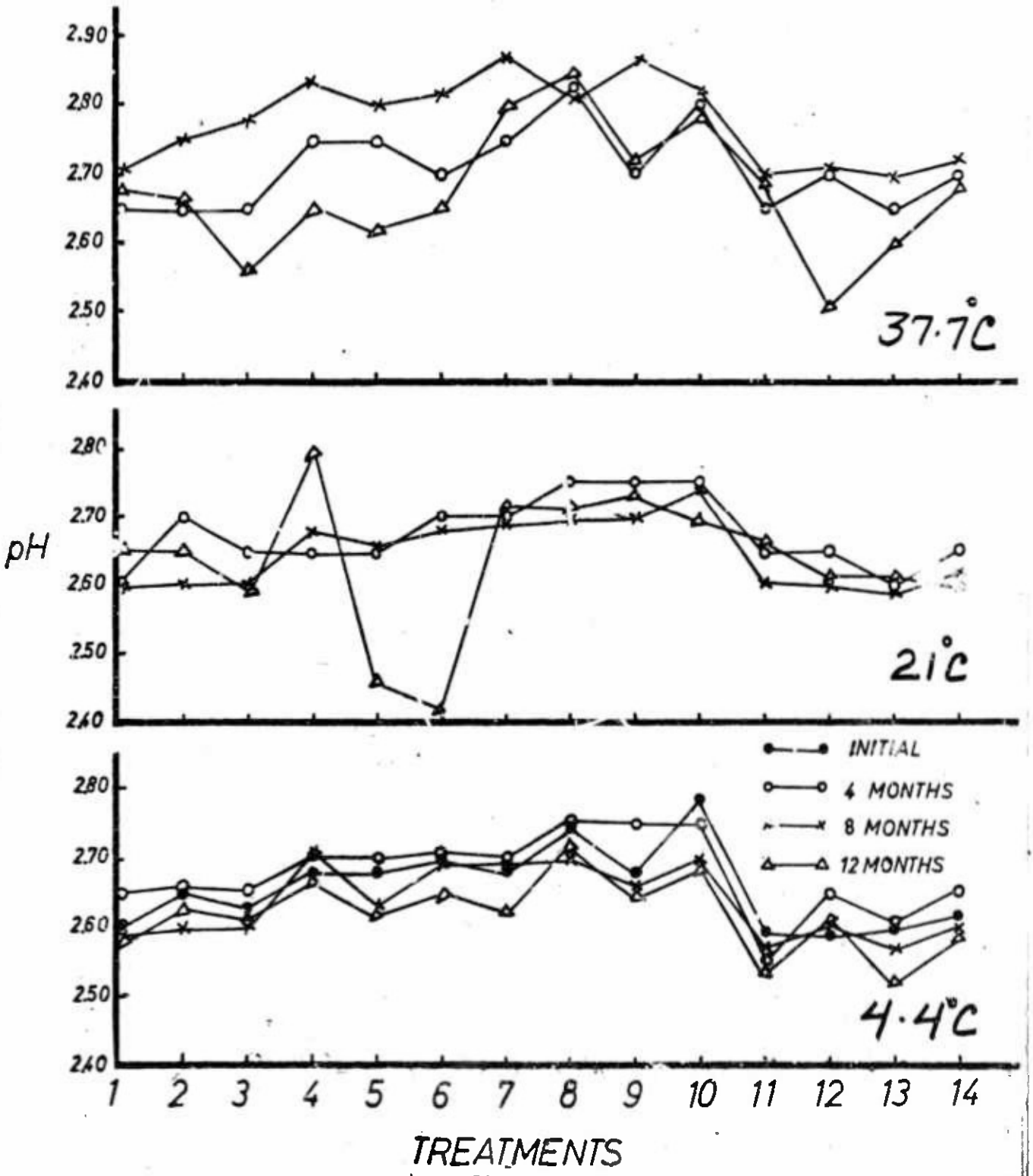

FIG. 9- ACIDITY