[Reprinted from Industrial and Engineering Chemistry,
Vol. 18, No. 1, page 85. January, 1926.]

Vitamins in Canned Foods

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Reprinted from TEACHERS COLLEGE RECORD, Vol. XXVIII, No. 8, April, 1927

A COMPARATIVE STUDY OF JELLIES AND JAMS MADE WITH AND WITHOUT AN EXTRACTED PECTIN*

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FOR a number of years the use of commercial extracted pectins has been increasing in the classroom and in the home. This has made possible the extension of jelly making to fruits which do not contain a sufficient quantity of pectin to insure a jelly-like consistency. The following report is based on experimental work to compare the methods ordinarily used by the teachers and housewives with the methods advocated by the manufacturers of commercial products. The procedure commonly used by instructors and housewives is called "without an extracted pectin," and the procedure advocated by manufacturers is called "with an extracted pectin."

In this experiment the following fruits were made into jams and jellies:

	"With an Extracted Pectin"	"Without an Extracted Pectin"
Strawberry	jelly jam	 jam
Raspberry	jelly jam	jelly jam
Cherry (sour)	jelly jam	jelly jam
Cherry (sweet)	jelly jam	jelly jam
Currant	jelly	jelly
Blackberry	jelly jam	jelly jam

* This problem was outlined by Miss Dorothy E. Shank and the writer, who took over this piece of work when Miss Shank resigned from Teachers College. The writer wishes to acknowledge the assistance of Mrs. Sarah Alling, as well as the coöperation of Miss Ina Padgett and her class in investigation cookery.

	"With an Extracted Pectin"	"Without an Extracted Pectin"
Peach	jelly jam	jam
Grape	jelly	jelly
Crab Apple	jelly	jelly
Orange	marmalade	marmalade

All of these fruits were bought in their seasonal order and in large quantities so that several trials of jellies and jams could be made from the same lot at the same time. The extracted pectin used in these experiments was a liquid pectin.

As the "with an extracted pectin" recipes call for fully ripe fruit which gives the maximum flavor and color, such fruits were used for all the experiments, and in the case of the peaches a few experiments on fruits which were not fully mature were also carried out. With the ripe raspberries and cherries "without an extracted pectin" a sirupy consistency was obtained instead of a jelly, and with several other fruits the results would have been far better had some less mature fruit been mixed with the very ripe fruit. Since strawberries lack pectin and peaches lack the proper proportion of pectin and acid, no attempt was made to prepare jellies from these fruits without an extracted pectin.

Six to eight weeks after they were made the jellies and jams were judged for texture, flavor, appearance, and keeping qualities as follows:

Texture (25 per cent if perfect)
  Tenderness, consistency, power to quiver, holding angles when cut.
Flavor (25 per cent if perfect)
  Naturalness, sweetness, strength.
Appearance (25 per cent if perfect)
  Transparency, color, shape, glistening surface.
Keeping qualities (25 per cent if perfect).

Judging was done by some of the instructors in Foods and Cookery, Teachers College, and by students in advanced cookery courses. The score for each trial was the average of scores given by ten judges, but in this report the score used is an average of average scores on a minimum of three to six trials.

[Reprinted From the Teachers College Record, Volume XXVII, No. 7, March, 1926]

FOOD CHANGES IN AN ICE REFRIGERATOR AND AN ELECTRICALLY CONTROLLED REFRIGERATOR

A Comparative Study*

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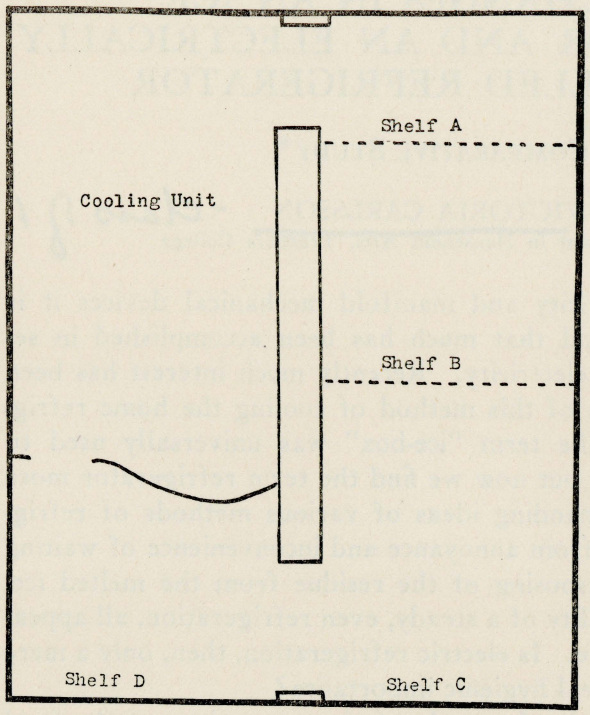
IN this age of electricity and manifold mechanical devices it is not surprising to find that much has been accomplished in securing refrigeration by electricity. Recently much interest has been attached to applications of this method of cooling the home refrigerator. In the past, the term "ice-box" was universally used to signify a cooling device, but now we find the term refrigerator more in keeping with our expanding ideas of various methods of refrigeration. The freedom from annoyance and inconvenience of waiting for the ice man and disposing of the residue from the melted ice, as well as the dependability of a steady, even refrigeration, all appeal strongly to the housewife. Is electric refrigeration, then, only a mere convenience or is it of real hygienic importance?

This paper is the result of a study of the comparison of the food changes in two methods of refrigeration, one by electricity and the other by ice. In the experimental work special consideration was given to range and constancy of temperature and humidity, to the general keeping qualities of certain foods, and to the bacterial increase in foods. The methods in general were those used earlier in an investigation of different types of ice refrigeration, the results of which were published under the title, "Food in the House Refrigerator" in *The Nation's Health,* September, 1924, and in *Teachers College Record,* November, 1924.[1] The present experiment differed in that the cooling units (one ice and one electrically controlled) were placed in two refrigerator boxes of the same make and practically identical in size and construction.

* The large amount of routine laboratory work involved in the bacteriological determinations was made possible through the cooperation of Miss Alice Dede. Throughout this series of experiments the author has been helped greatly by the advice of Professors Jean Broadhurst (Biology) and May B. Van Arsdale (Household Arts) of Teachers College.

[1] By Jean Broadhurst and May B. Van Arsdale, assisted by Victoria Carlsson, Zitella Wertz and others.

The following diagram shows the plan of the two refrigerator boxes.



The following letters will be used in this report in referring to the different shelves in the two refrigerators:

A—The upper or top shelf.

B—The middle shelf.

C—The bottom shelf.

D—The part of the bottom shelf (C) directly under the cooling unit.

Both refrigerator boxes were side icers with open spaces at the top and bottom which allowed complete and rapid movement of air down over the ice or cooling unit. The two refrigerators were placed side by side in one of the research laboratories in Teachers College. The box which was refrigerated by ice was filled every morning. It was therefore probably better iced than is usual in most homes. We felt, however, that it was fairer in this study of comparative refrigeration to use an iced refrigerator at its best, as a full ice chamber gives not only a lower but a more even temperature for each shelf. The electrical refrigerator, which depended upon the vaporization of a liquid refrigerant, had a large cooling unit of evaporating coils which filled the space usually occupied by ice. (The motor, etc., were accommodated outside the box.) The temperatures, as in all electrical refrigerators, were controlled by a thermostat.

In this experiment with electric refrigeration we found that in order

to get the greatest efficiency it became necessary to defrost or "de-ice" the refrigerating tank if it became sheeted with ice or too heavily frosted. The ice sheet acted as an insulator, causing the temperature of every shelf to become higher and that of the tank itself to become lower. The defrosting was accomplished by turning off the electricity for a short period. (It may be hastened by removing the ice sheet by mechanical means (scraping) from the refrigerating unit.)

TEMPERATURE VARIATIONS: RANGE AND CONSTANCY

The temperature determinations were made by readings of two types of thermometers: ordinary laboratory thermometers which were read three times daily and maximum and minimum thermometers read once in twenty-four hours. All the thermometers were checked with a U.S. Bureau of Standards mercury thermometer.

Throughout the four months which this investigation covered the electric refrigerator showed a lower range of temperature than the ice refrigerator, as shown by the following table.

TABLE I

AVERAGE TEMPERATURE RANGE IN ICE AND ELECTRIC REFRIGERATORS FOR A PERIOD OF FOUR MONTHS

Shelves	Ice Refrigerator	Electric Refrigerator
A	47–53	45–49
B	44–47	42–45
D	39–42	36–39

RELATIVE HUMIDITY

The relative humidity of the air was tested, as in our previous experiments, by using known concentrations of sulphuric acid and determining from their subsequent variation in weight the amount of water a given dilution absorbed from the air, or the amount of its own water such a dilution gave up to the surrounding air. The method used was fully described in the earlier published report. The following references were used for the method of testing humidity:

Henderson, N., and Swan, C. C.: Method of Determining Relative Humidity

in Cold Storage Rooms. Used in Bulletin No. 775, U. S. Department of Agriculture.

Stevens: Humidity Relations. *Journal of Phytopathology,* VI, 1916, p. 430. See table by the Biochemic Division of the Bureau of Animal Industry, reprinted in Circular No. 149 (Hastings, A Cold Storage Evaporimeter), September, 1909. This circular includes a discussion of temperature and vapor tension relations.

The humidity was lower throughout the electric refrigerator, as shown by Tables IIA and IIB. This lower humidity was characteristic of the electric refrigerator both when empty and when filled with food.

TABLE IIA

CORRELATED TEMPERATURES AND HUMIDITIES IN REFRIGERATORS WHILE EMPTY

ICE REFRIGERATOR

Average Temperature °F.	Original Acid Strength	Corrected Acid Strength	Relative Humidity	Mean Relative Humidity
Warmest Shelf A 48–54	High 43.18	42.92	51.07	54.83
	Low 38.61	39.04	58.60	
Coldest Shelf D 39–44	High 33.30	32.65	71.80	74.07
	Low 29.84	30.06	76.34	

ELECTRIC REFRIGERATOR

Warmest Shelf A 46–50	High 49.57	49.53	39.00	41.35
	Low 46.62	47.12	43.70	
Coldest Shelf D 36–39	High 43.18	42.91	51.02	54.36
	Low 38.61	39.70	57.70	

In this experiment we had much less difficulty in securing constant humidity readings by the sulphuric acid method than in the work previously reported. One reason, no doubt, was that the temperatures of the different shelves were much less variable in these refrigerators. The differences between empty and filled refrigerators were much less than expected. In fact the results were so strikingly similar that we can draw but one conclusion: we were dealing with refrig-

TABLE IIB

CORRELATED TEMPERATURES AND HUMIDITIES IN REFRIGERATORS TESTED WHILE FILLED WITH FOOD (WITH 100 SQUARE INCHES OF MOIST SURFACE)

ICE REFRIGERATOR

Average Temperature °F.	Original Acid Strength	Corrected Acid Strength	Relative Humidity	Mean Relative Humidity
Warmest Shelf A 48–53	High 43.18	42.73	53.36	56.13
	Low 38.61	38.78	58.9	
Coldest Shelf D 40–44	High 33.30	32.94	72.38	74.54
	Low 29.84	29.86	76.70	

ELECTRIC REFRIGERATOR

Warmest Shelf A 46–50	High 49.57	49.26	39.50	41.65
	Low 46.62	46.76	43.80	
Coldest Shelf D 35–39	High 43.18	42.70	51.30	54.80
	Low 38.61	39.14	58.30	

erators which had a very good circulation of air. This continuous, frequent contact of the circulating air with the ice or cooling unit gave a lower and more constant relative humidity.

A less scientific but more practical moisture test of these refrigerators was based on the keeping qualities and appearance of food. The first to be tested was lettuce; later, tomatoes were tested.

In unwrapped loose leaf lettuce the outside leaves wilted more rapidly in the electric than in the ice refrigerator, but in the ice refrigerator the lettuce leaves showed more discoloration. The advantage, however, seemed to lie with the electrical refrigerator, as the inner leaves of the lettuce in the electrical refrigerator were always crisper and less discolored than those in the ice refrigerator.

In the later experiments with lettuce, sections of fairly compact heads were used. The heads of lettuce were soaked in cold water for one half hour and allowed to drain; then they were cut into radial sections of definite size and weight. These sections were wrapped in pieces of cheesecloth which were of like size and weight and which

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