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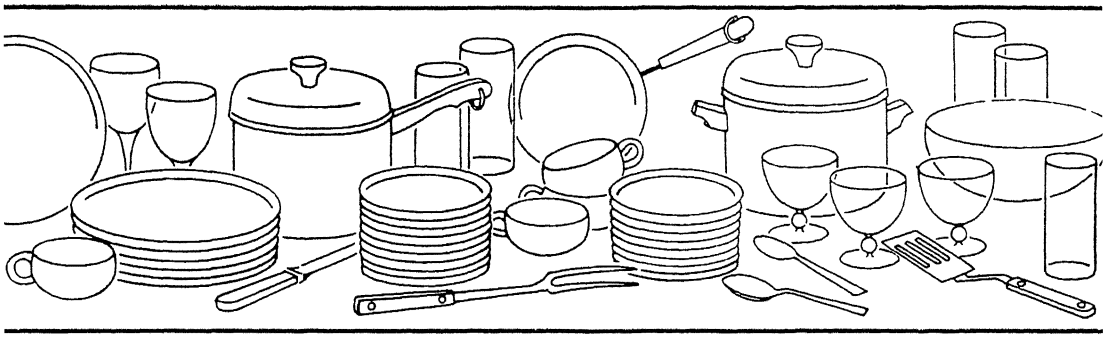

A Study of Hand versus Mechanical

DISHWASHING METHODS

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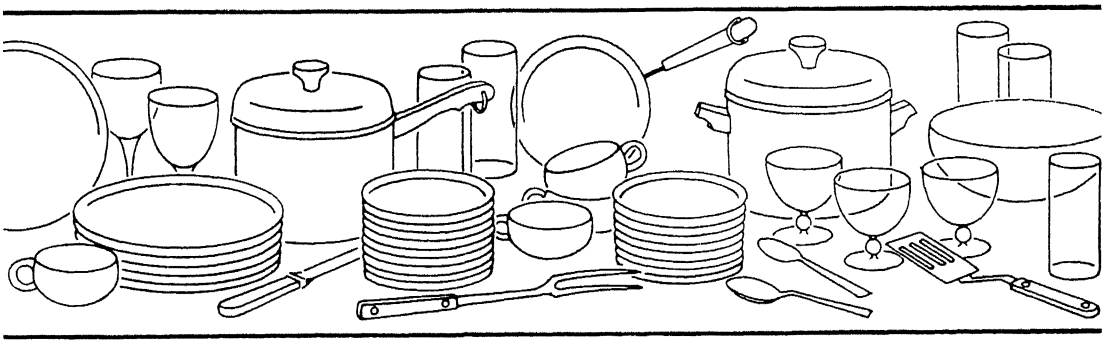

ACKNOWLEDGMENTS

The authors wish to express their gratitude to the ten families who spent many hours participating in this study. The homemakers' cooperation and enthusiasm were sincerely appreciated, and their contributions give further proof that homes can be revealing "laboratories" and homemakers fine technicians whose actual experiences should speak loudly to other homemakers.

We especially appreciate the splendid cooperation and assistance from the Electric Sink Division of the National Electrical Manufacturers' Association and its member companies, namely: Avco Manufacturing Company, General Electric Company, Hobart Manufacturing Company, Hotpoint, Inc., and Westinghouse Electric Corporation, whose interest and financial support made this study possible.

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A STUDY OF HAND VERSUS MECHANICAL DISHWASHING METHODS

ELAINE KNOWLES WEAVER CLARICE E. BLOOM
ILAJEAN FELDMILLER

PURPOSE OF THE INVESTIGATION

For generations, the so-called menial task of dishwashing has been the target of many trite editorials, cartoons, and jokes. That such a task could be of sufficient importance to warrant research has frequently been questioned in academic circles. To millions of homemakers, family helpers, and manufacturers of mechanical dishwashers, dishwashing has serious aspects.

Time study surveys[1, 2, 3] indicate that an average of about 1¼ hours is spent in washing dishes per home per day. Assuming some 48,500,000 homes in the U. S. A., more "man-hours" of work, as expressed by industry, are spent in washing dishes than in coal mining, automobile manufacturing, or other well-unionized industries. If as little as one dollar per hour labor costs could be charged, dishwashing could be classed as a multibillion dollar industry.

Dishwashing, as a household task, cannot be easily dispensed with as long as family meals are prepared and eaten in the home. Time required for dishwashing may be considered more problematic in today's home than with past generations for several reasons: (1) employment outside the home of more women, both with and without children; (2) shortage of and high cost of domestic help; (3) community and social demands on all members of the family. Furthermore, many women and other family members dislike dishwashing because of its tedious, monotonous, and repetitive nature.

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[1]Muse, Marianne. "Time Expenditure on Homemaking Activities in 183 Vermont Farm Homes." Bul. No. 530, Agricultural Experiment Station, Burlington, Vermont, 1946.

[2]Sater, V. Enid. "Time and Cost Evaluation of Dishwashing by Different Methods." Bul. No. 303, Agricultural Experiment Station, State College of Washington, Pullman, Washington, 1934.

[3]Warren, Jean. "Use of Time and Its Relation to Home Management." Bul. No. 734, Agricultural Experiment Station, Cornell University Ithaca, N. Y., 1940.

Appreciating the problems of dishwashing, some 14 manufacturers of household appliances are at the present time producing mechanical dishwashers which they hope will reduce time and effort involved in the task. The dishwashing machine is not the relatively new appliance that many persons tend to believe it is. The first patent was issued in 1850. During developments in dishwashers over the past 30 years many of the problems in design and performance have been mastered so that today's modern appliance is automatic, well designed, and highly efficient. As yet, and in spite of professed dislike for dishwashing, mechanical dishwashers are in only 3.5 percent of electrically wired American homes.

Why have dishwashers not been purchased in greater numbers? Why are they difficult to sell? It might be assumed that cost is a major factor; yet television can be found in 75 percent of the homes in United States. Frequent inquiries coming to the Household Equipment Division of the Ohio Agricultural Experiment Station indicated that considerable interest in dishwashers does exist. During the period 1950-52, specific questions from homemakers included the following: "Is a mechanical dishwasher worth the investment?" "How much time will a dishwasher save?" "Do dishes really get clean in a dishwasher?" "Can all dishes be washed in a dishwasher?" and "Will dishwashers use a great deal of water?"

During the same period letters were received from five of the major manufacturers of dishwashers asking similar questions but wanting answers based on research: "How many dishes do women wash?" "How much time do women spend washing dishes by hand?" "How much time could they save with a dishwasher?" and "How much water do women use when hand washing dishes?"

No specific information could be found to adequately answer either group of questioners; thus, an investigation seemed pertinent and timely. Previous studies on homemakers' uses of time in various household tasks implied mainly "guess-timates" for dishwashing rather than actual time recorded. No information was available concerning time spent in dishwashing by the same women before and after a mechanical dishwasher was employed.

PLAN FOR THE STUDY

OBJECTIVES

The objectives of this study were:

1. To determine whether or not automatic methods of dishwashing in the home saved time on the part of the homemaker over hand washing methods and, if so, to what extent.

2. To determine changes in practices and learning habits experienced by women in the use of the dishwasher which might be used in demonstrations or in providing better instruction books accompanying the appliance.
3. To ascertain cleanliness from standpoint of bacterial count in hand as compared to machine washed dishes.
4. To ascertain major problems involved in the installation and use of the automatic dishwasher.

PART I: PRELIMINARY INVESTIGATION

A review of literature provided information dealing with such factors as time requirements, attitudes, and work simplification techniques in hand dishwashing. No reports could be found that gave similar information in the use of a mechanical dishwasher.

When planning an investigation of any household task the opinions and problems of homemakers always assist in guiding and directing the purposes and procedures.

For the purpose of this study, a preliminary survey was made by sending questionnaires[4] to 390 dishwasher owners in nearby Columbus, Ohio, areas who had owned dishwashers for at least one year. The names of the owners were provided by Columbus distributors, dealers, plumbers, and builders. These owners were asked such questions as why they bought a dishwasher, installation costs and problems, water heating capacity, water conditions, costs of operation, service problems, opinions, and the like. One hundred and sixty-three homemakers responded.[5]

Responses to the questionnaire revealed the following information:

Nearly 90 percent of the homemakers owning dishwashers were over thirty years of age.

Sixty-four percent had four or more members in the family.

Six brand names of dishwashers were represented.

Over 75 percent of the dishwashers were less than two years old.

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[4]Questionnaire, Appendix, page 33.

[5]Feldmiller, Ilajean. "Factors in Choice and Use of Dishwashers as Reported by 163 Ohio Women, 1952." (Unpublished Master's Thesis, The Ohio State University, Columbus, Ohio, 1952).

Reasons for purchasing dishwashers and percent of group giving those reasons were:

To save time	30.7 percent
To make work easier	25.2 percent
To modernize home	9.8 percent
Insistence of another person	4.3 percent
Problems with hired help	4.3 percent
To eliminate hand washing	4.9 percent
To get dishes cleaner	2.4 percent
Dislike of housework	1.8 percent
No particular reason	7.4 percent

When asked if the dishwasher saved time over hand washing methods, the women estimated savings as follows:

Up to one hour per day	57.9 percent of group
Over one hour	39.3 percent of group
No time saved	2.4 percent of group
No response	0.5 percent of group

Reasons expressed for selecting a particular brand and percent of group were as follows:

Wanted a front opening	25.2 percent
Thought it was "best"	17.2 percent
Satisfaction with other appliances of same manufacturer	16.6 percent
Recommendation of builder	12.3 percent
Recommendation of friends	9.8 percent
Price cut	4.8 percent
Top opening	3.7 percent
Larger size	1.8 percent
No reply	8.6 percent

Costs of installation were known by only 44 of the 163 owners or 27 percent. Of these, 31 installations were less than $100 and 13 exceeded that amount.

About 30 percent of the women reported having had one or more service charges on their dishwashers ranging from $10 to $20.

One hundred forty-seven of the 163 respondents used Columbus water. About three-fourths of them were satisfied with the performance of their dishwashers.

Water of 0-3 grains hardness is considered soft. Columbus water, softened to 4 grains or 68 p.p.m., actually verges on soft water conditions.

When the respondents were asked to give their opinion of the water conditions, only about 20 percent of the Columbus water users considered it soft; 54 percent, medium hard, and 13 percent considered it hard. Three percent did not respond.

These answers typified those constantly found by investigators of water conditions and furthered evidence that homemakers or the public in general lack information about water. Service man and home economists for various manufacturers of both dishwashers and washing machines report that this lack of knowledge concerning water is responsible for the major share of poor performance complaints.

The respondents were also asked to record the size of their hot water tanks. Only one-fourth reported tanks of 30 gallons or less; about one-half, 30 to 50 gallons; and one-fourth, 50 gallons and over. It is the opinion of the investigators, again, that estimates are faulty as sales reports indicate that the majority of homes have only 30 gallon water heaters; furthermore, the respondents did not know the temperature of water generally used for washing dishes.

When asked what suggestions they had to give new dishwasher users, the respondents listed the following:

Proper loading
Willingness to change methods
More definite instruction books
A good demonstration by a home economist
Use of different detergents until the most suitable one is found

Suggestions given for consideration of manufacturers for their dishwashers were:[6]

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[6]Manufacturers have long recognized all of these problems. Some have been solved in new models and all manufacturers are constantly doing research work to improve them.

Less noise, better drying
Better racks for silver
Food disposal unit combined with dishwasher (suggested by 4 women)
Elimination of plastic parts
Mesh or wire screen over impeller
Arrangement to allow for 12-inch plates and stem ware
Space to allow for flexible use for odd-shaped items
Better detergents to prevent staining of aluminum
Better washing results

PART II: INTENSIVE INVESTIGATION

To truly comprehend the value of a mechanical dishwasher in the home it seemed necessary to compare practices in homes before and after this appliance was put into use.

For the purpose of this phase of the study a group of ten homemakers who had not previously owned dishwashers were selected as cooperators for intensive study over a period of time. The first experimental period included a 30-day study of hand dishwashing methods, followed by a 4- to 6-week period during which dishwashers provided by cooperating manufacturers were installed in each home and new practices were established. The final or third period included study of dishwashing by machine.

During the two experimental periods a breakdown of the dishwashing process was made and analyzed by researchers in the study. Bacterial count of dishes was ascertained by swab method on four occasions during each of the experimental periods. This study was conducted with the assistance of the Bacteriology Department at The Ohio State University.

The limitations of this study were recognized. Ten homes could hardly be considered representative of all homes in Ohio. Yet it was believed that actual detailed information of "before and after" practices could be more revealing than opinions and guesses of a thousand women.

SELECTION OF COOPERATORS

Families participating in this study were selected from names furnished by the Franklin County, Ohio, Home Demonstration Agent and faculty members of the School of Home Economics. The Ohio Agricultural Experiment Station workers in home economics are located at The Ohio State University in Columbus, Ohio.

Qualifications for selection included the following: the families were (1) to be home owners, (2) to be made up of four to six members, (3) to have a desire to own a dishwasher, (4) to show an interest in participation, (5) to have an adequate supply of hot, soft or softened water, (6) to have a kitchen suitable for the installation of a dishwasher, and (7) to live close enough to The Ohio State University for observers to conveniently make visits.

Five of the cooperating families lived on farms; the other five were urban dwellers.

DISHWASHERS INCLUDED IN THE STUDY

The five member companies of the Electric Sink Division of the National Electrical Manufacturers Association cooperated by granting funds to assist with financing the study. In addition, each company furnished two dishwashers and aided with installation costs in the homes of the cooperators.

Features of the five dishwashers are given on page 43.

DEFINITION OF DISHWASHING PROCESS

The term dishwashing has various implications to different people. To some it is limited to the actual washing and wiping of dishes. For the purpose of this study the process included those activities which were closely associated with the task, namely: clearing the table after the last course; putting away leftovers; scraping and/or rinsing and stacking dishes preparatory to hand washing or loading dishwasher; disposal of garbage; feeding of pets; preparation of dishwater; the actual washing, rinsing and wiping; and washing and/or wiping of counter tops, range and sink.

COOPERATORS' ACTIVITIES

Homemaker participation was divided into three periods of approximately one month each.

First period: Hand washing. For her use, the homemaker was given 30 copies of a form for daily recording the number of individual items washed and time spent for the entire process. (See Appendix).

In order to establish uniform starting and stopping points in the hand washing process that would be comparable to the machine washing when dishes might be left in the machine until the next meal the time for putting away dishes was not included. The cooperators stacked dishes on a work counter after drying so that they might be counted for the record. Time required for counting was not included in the total time.

The amount of water used for pre-rinsing, washing and final rinsing of dishes was measured by the cooperators four times during the 30-day period. Water consumption records were taken on typical days when there were no extra people at meals and no activities that would add to the number of dishes.

The amount of water used was determined by measuring the depth of the water retained in the sink for various processes. The number of quarts per inch had been predetermined.

In order to record the amount of detergent used the cooperator started with a new package on the first day and used from that package only for dishwashing. At the end of the period she weighed the amount remaining in that or a subsequent package if more than one was used.

The number of tea towels used and washed during this period was also recorded.

Second period: Establishment of new dishwashing practices. During the second period, which in most cases was from four to six weeks, dishwashers were installed in the homes, and demonstrations of their use were given by home economics representatives of the distributors for the cooperating manufacturers. This span of time gave the cooperators an opportunity to experiment and become acquainted with their new appliance and to adjust to a changed routine that could be used during the last period of study.

No detailed records were kept during these weeks. The women did, however, carefully study direction books in order to determine how adequately each answered a new user's questions. They also kept account of installation costs and problems.

Third period: Machine washing. When the individual cooperator felt that she was accustomed to using the dishwasher and had established her habits of work, she started on the third period which included a second 30 days of record keeping. For this period record forms were modified to accommodate the information related to the use of the dishwasher. (See Appendix.) Again the cooperator recorded total time spent daily in the performance of the dishwashing process, individual items washed by machine and by hand, condition of the dishes as they came from the machine, number of people served and other practices and activities.

Again she measured water used for items washed by hand (water consumption of individual dishwashers was given in specifications) and recorded amount of detergent and number of tea towels used.

OBSERVERS' ACTIVITIES

First period. Two observers made four visits to the homes of each of the ten cooperators during the 30-day period. These visits were made to coincide with dishwashing following the evening meal.

During three of these visits detailed time records were taken of each step of the hand dishwashing process from the time the cooperator started to clear the table until the end of the cleaning-up process.

Fig. 1.—Time analyses of the dishwashing process were made by an observer on three occasions during both the hand and machine washing periods.

Timing was done by means of a flash board which flashed a light once every five seconds. (Figure 2). A special form was used for the recording of each five seconds of time spent for each phase of the dishwashing process. (See Appendix, page 38.) At the end of the period the total time was checked against a counter that recorded every 20 seconds.

On these same visits temperatures of the wash water were taken at the beginning and end of the washing period and of the tap water used for rinsing or of water in teakettle if water was heated by that means.

On each of the four visits swab rinse samples were taken of four each of plates, cups, glasses, and forks following the drying of these items. These samples were taken to the Bacteriology Department at The Ohio State University for culturing and bacterial count. (See method prescribed, page 20.)

Second period. During this period the observers made one or more trips to the different homes to observe the installation of the dishwashers and help the women with any problems they were meeting. They also assisted in making arrangements for installation and served as liason between manufacturers' representatives and the cooperators.

Third period. The two observers again made four visits to each of the cooperators' homes following their evening meals. Time was recorded in the same manner as during the first period on forms designed to include both hand and machine washing.

On these visits a maximum temperature thermometer was used to record water and drying temperatures in the dishwasher. This type of thermometer registered the highest temperature reached and remained

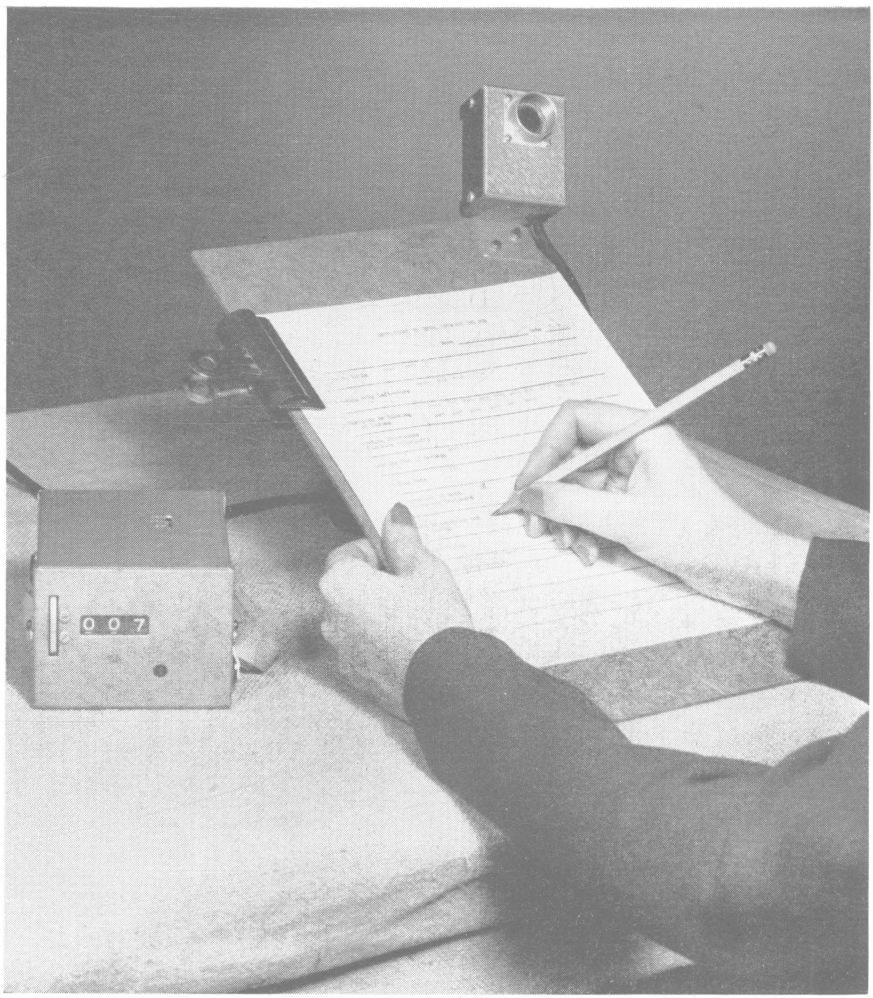

Fig. 2.—Timing device used for measuring phases of dishwashing process.

at that point until the mercury was shaken back to room temperature. Temperatures were recorded following the washing, rinsing, and drying cycles. Temperature was also taken of the tap water.

Following the completion of the machine's drying cycle swab rinse samples were again taken on plates, cups, glasses and forks and treated in the same manner as described under the first period of the study.

RESULTS OF THE STUDY

NUMBER OF DISHES WASHED

Frequently the estimates of the number of dishes a woman washes in a day, month or year have been dramatically pictured in various advertisements for detergents and dishwashers. This is the first occasion, to our knowledge, that actual detailed records have been kept by women over a period of time.

The total number of items washed by the ten cooperators during the 30-day (April-May) hand washing period ranged from 2652 to 5086, or from 88.4 to 169.5 items daily (Table 1). In terms of a year, this would mean 32,266 to 61,867 items—a "stack" of dishes too sizeable to picture.

TABLE 1.—Number of Items Washed During Hand and Machine Washing Periods

Cooperator	Items washed during a 30-day period		Average number of Items washed per day	
	Method		Method	
	Hand	Machine	Hand	Machine
A	3322 0	3221 0	110 7	107 3
B	2691 0	2650 0	89 7	88 3
C	3094 0	2978 0	103 1	99 3
D	4299 0	4780 0	143 3	159 3
E	4423 0	3936 0	147 4	131 2
F	3524 0	3367 0	117 5	112 2
G	2652 0	2384 0	88 4	79 5
H	4035 0	3064 0	134 5	102 1
J	4820 0	3597 0	160 7	119 9
K	5086 0	4368 0	169 5	145 6
Average	3794 6	3434 5	126 5	114 5

From conversation with manufacturers it was expected that more dishes would be used after a machine was available for washing; however, that assumption was not borne out by this study. During the 30-day machine washing period (June-July) the number of items washed ranged from 2384 to 4780 with an average of 79.5 to 159.3 daily. The use of fewer dishes might be attributed to differences in eating habits because of the hot weather during the last period and vacations away from home for various family members.

TIME SPENT WASHING DISHES

Dishwashing, as reported in previous studies,[7] has not been considered a particularly tiring task. Women have resented the time required for this repetitive task, however, and frequently maintain that it is boring and monotonous. Cooperators in this stury proved to be no exception. They, too, preferred to devote their time to other more enjoyable tasks and activities.

The compilation of daily time records showed that the actual time spent when washing dishes by hand ranged from 33.6 to 108 minutes or an average of 73.2 minutes per day—approximately one and one-quarter hours per day.

It would appear that these actual time figures are not too different from estimated time spent as reported in several previous studies. Arnquist and Roberts[8] in 1929 reported an average of 1.5 hours for 124 Washington women. The same year Whittemore and Neil[9] calculated 1 hour and 5 minutes were spent daily by 102 rural Rhode Island women; also in 1929 Wilson[10] reported 1 hour and 4 minutes for Oregon women; in 1940 Warren[11] reported an average of 1 hour and 5

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[7]Knowles, Eleanor Elaine. "The Most Tiring Household Tasks as Reported by 582 Homemakers, New York, 1937." (Unpublished Master's Thesis, Cornell University, Ithaca, N. Y., 1937).

[8]Arnquist, Inez F., and Roberts, Evelyn H. "The Present Use of Work Time by Farm Homemakers." Bul. No. 234, State College of Washington Agricultural Experiment Station, Pullman, Washington, 1929, p. 31.

[9]Whittemore, Margaret,and Neil, Bernice. "Time Factors in Business of Homemaking in Rhode Island. Bul. No. 221, Agricultural Experiment Station, University of Rhode Island, Kingston, Rhode Island, 1929.

[10]Wilson, Maud. "Use of Time by Oregon Homemakers. "Bul. No. 256, Agricultural Experiment Station, Corvallis, Oregon, 1929.

[11]Warren, Jean. "Use of Time and Its Relation to Home Management." Bul. No. 734, Agricultural Experiment Station, Cornell University, Ithaca, N. Y., 1940.

minutes for 502 New York women; and Muse[12] estimated that approximately one-sixth of homemaking time of 183 Vermont homemakers was spent in dishwashing or 1 hour and 7 minutes.

Figured on an annual basis, time spent by cooperators in this study averaged 445 hours or 63.1 eight-hour working days per year when hand washing and 218 hours or 27.1 eight-hour working days a year when machine washing dishes. This represents a time reduction of 36 eight-hour working days a year. Such a figure would be considered highly significant by industry where labor is given dollar value.

After the dishwashers were installed and the women had spent at least four weeks becoming accustomed to them, they again kept time records.

During this 30-day machine dishwashing period the daily time ranged from 19.7 minutes per day to 53.5 minutes or an average of 35.6 minutes per day; thus a reduction of 37.6 minutes or 51.3 percent was obtained.

[12]Muse, Marianne. "Time Expenditures on Homemaking Activities in 183 Vermont Homes." Bul. No. 530, Agricultural Experiment Station, Burlington, Vermont, 1946.

TABLE 2.—Comparison of Total Time Used for Dishwashing Process by Hand and Machine Methods During 30-day Period Using Adjusted Time Value

Cooperator	Method		Percent of time machine saves
	Hand	Machine	
	minutes		
A	2310.0	896.9	61.2
B	1334.0	601.0	54.9
C	1901.0	1340.7	29.5
D	2056.0	1053.2	48.8
E	3254.0	1813.4	44.3
F	2567.0	1556.4	39.4
G	1007.0	680.7	32.4
H	2399.0	1405.5	41.4
J	3174.0	1928.0	39.3
K	1942.0	966.4	50.2
Average	2194.4	1224.2	44.2

As previously noted, an average of 12 fewer items were washed per day during this period and it was evident that this number could affect the time factor; therefore, an adjusted time value was calculated. The mean time, or seconds-per-item, was determined by dividing the time used per day by the number of items washed. Had the same number of items been washed during both the machine and the hand washing periods, the average reduction of time would have been 44.2 percent rather than the actual 51.3 percent indicated above. (See table 3.)

INVESTIGATORS' OBSERVATIONS

The investigators believed that the best analysis of the dishwasher's function would be obtained by studying a breakdown of the dishwashing process. Since time and funds available did not warrant time and motion film analysis, a time indicating device (figure 2) was employed in order that observers might record the number of seconds required for each segment of the dishwashing process.

During three of the visits to the homes of the 10 cooperators following the evening meal in each of both the first and third periods, the steps of the dishwashing process timed and recorded were: clearing table,

TABLE 3.—Actual Time Saved by the Use of a Dishwasher as Compared to Time That Would Have Been Saved Had Equal Numbers of Items Been Washed During Both Periods

Cooperator	Time saved during 30 days		Time saved per day		Percent of time saved by machine	
	Actual	Computed	Actual	Computed	Actual	Computed
	hours		minutes			
A	24.1	23.6	48.2	47.1	62.6	61.2
B	12.3	12.2	24.6	24.4	55.2	54.9
C	10.4	9.4	20.8	18.7	32.7	29.5
D	16.1	16.7	31.6	33.4	46.2	48.8
E	27.4	24.0	55.0	48.0	50.6	44.3
F	18.2	16.0	36.3	33.7	42.4	39.4
G	7.0	5.5	13.9	10.9	41.4	32.4
H	23.5	16.6	47.1	33.1	58.8	41.4
J	30.7	20.8	61.5	41.5	58.1	39.3
K	18.4	16.3	36.7	32.5	56.7	50.2
Average	18.8	16.2	37.6	32.3	51.3	44.2

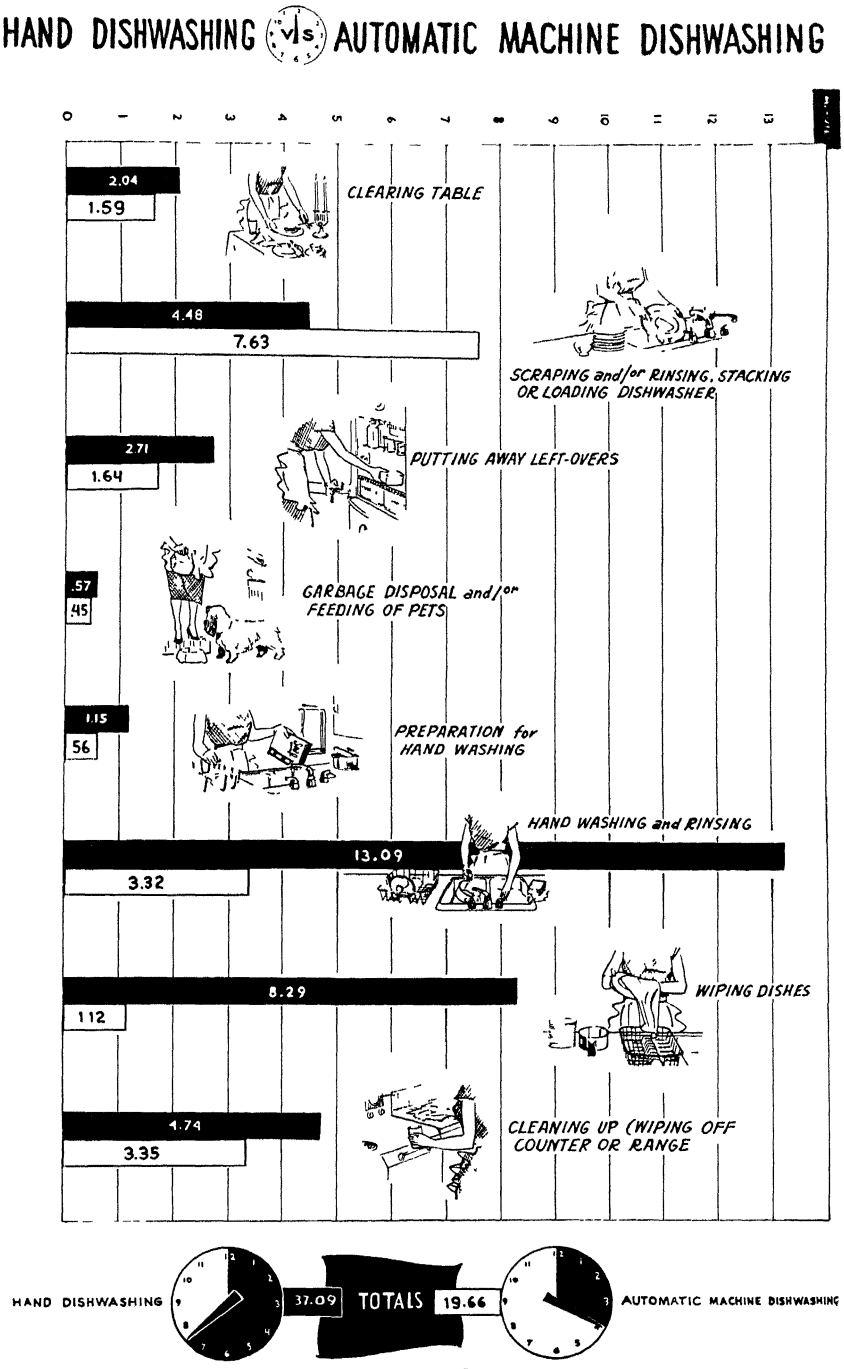
HAND DISHWASHING vs AUTOMATIC MACHINE DISHWASHING
0 1 2 3 4 5 6 7 8 9 10 11 12 13
2.04
1.59
CLEARING TABLE
4.48
7.63
SCRAPING and/or RINSING, STACKING OR LOADING DISHWASHER
2.71
1.64
PUTTING AWAY LEFT-OVERS
.57
.45
GARBAGE DISPOSAL and/or FEEDING OF PETS
1.15
56
PREPARATION for HAND WASHING
13.09
3.32
HAND WASHING and RINSING
8.29
1.12
WIPING DISHES
4.74
3.35
CLEANING UP (WIPING OFF COUNTER OR RANGE
HAND DISHWASHING
37.09
TOTALS
19.66
AUTOMATIC MACHINE DISHWASHING

Figure 3

scraping and/or rinsing dishes and stacking and/or loading dishwasher, putting away left-overs, disposing of garbage and/or feeding pets, and preparation for hand washing. (See typical record, Appendix, page 38.) Time recorded for interruptions, if any, was not included in the total time.

Washing, rinsing, and wiping, as anticipated, required the largest share of the cooperator's time when hand washing dishes. The average amount of time for these steps of the process was 21.38 minutes or 57.7 percent of the total time. (See table 4.) These same steps required 22.6 percent of the total time when machine washing.

The average dishwashing time spent by the 10 cooperators for three evening meals was 37.09 minutes for hand washing and 19.66 minutes for machine washing periods, respectively, or a reduction of 53 percent when a dishwasher was used. (Figure 3, page 17).

A larger portion of time was devoted to scraping and/or rinsing when the dishwasher was used, and more time was required for positioning and loading dishes in the machine than when merely stacking or placing them in dishwater when hand washing. (Figure 3).

A breakdown of the entire process by both methods may be seen in table 4.

TABLE 4.—Comparison of Time Spent for Each of the Steps Required in Hand and Machine Dishwashing Processes for Group of Ten Cooperators as Recorded During Three Observations

Steps in dishwashing process	Method			
	Hand	Machine	Hand	Machine
	Minutes		Percent	
Clearing table	2.04	1.59	5.5	8.1
Scraping and/or rinsing, and stacking or loading dishwasher	4.48	7.63	12.1	38.8
Putting away left-overs	2.71	1.64	7.3	8.4
Disposal of garbage and/or feeding of pets	0.57	0.45	1.5	2.3
Preparation for hand washing	1.15	0.56	3.1	2.8
Hand washing and rinsing	13.09	3.32	35.3	16.9
Wiping	8.29	1.12	22.4	5.7
Cleaning up	4.74	3.35	12.8	17.0
Totals	37.09	19.66	100.0	100.0

Just why hand washing, rinsing, and wiping required 22.6 percent of the total time when machine washing is attributed to several reasons such as:

Too many dishes for one load, so preferred to hand wash rather than hold over for next wash.

Items not suitable for machine washing such as electrical appliances, wooden bowls, and cutlery, odd shaped or too large items, iron skillets, plastic items affected by heat.

Some "hangover" on part of cooperator who had not yet decided that stemware or "good china" could be washed in the dishwasher.

Records kept during the 30-day machine washing period indicated that some cooperators washed as many as 25 percent of the items by hand.

SANITARY ASPECTS OF HAND VS. MACHINE DISHWASHING

Measure of cleanliness. Cleanliness of dishes, as appraised by the homemaker, is usually measured by the eye. If the glasses and silverware are free of film, retained food, and spots, and dishes are shining, they are considered clean. While such appearance may satisfy the homemaker, bacteria might still be present on the so-called clean dishes.

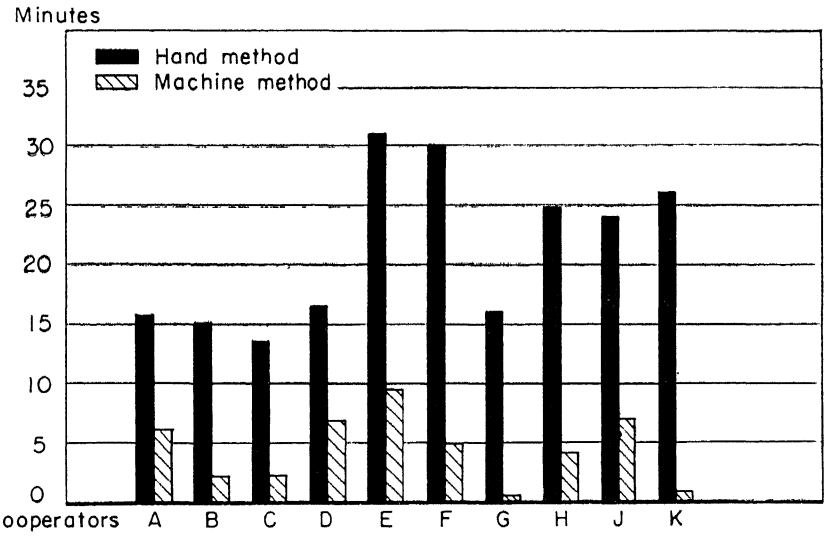

Fig. 4.—Average time spent in washing, rinsing and wiping dishes during hand washing period as compared to time used by hand washing, rinsing and wiping during the machine washing.

Transmission of disease by utensils in public eating places established the need for a definite method of measuring cleanliness. The swab rinse test has met this need by providing the means of counting the number of bacteria left on washed utensils. This test has been used for a number of years and still is the accepted method of measuring cleanliness.

The Ordinance and Code Regulating Eating and Drinking Establishments recommended by the U. S. Public Health Service lists the details for making the swab test in Public Health Bulletin No. 280.[13] In interpreting the results of the test it has been determined that the average plate count per utensil surface should not exceed 100. Higher counts are presumptive evidence of inadequate cleansing or recontamination by handling or during storage.

Techniques employed for this study. On four occasions each during both the hand and machine washing periods, swab tests were made on four items (plates, cups, glasses, and forks) which had been washed and dried. One swab was used for each group of four similar items. The swab from a freshly opened bottle of dilution water was squeezed against the side of the bottle to remove excess water, leaving it moist but not wet. The swab was then rubbed slowly and firmly over significant areas of the items according to recommended procedures.

The containers of swabs were kept refrigerated over night and taken to the Bacteriology Department at The Ohio State University on the following morning for culturing and counting.

Bacterial counts. Bacterial counts on plates following hand washing varied from 0 to 5820. From a total of 40 counts on plates, 32 were below 100 which is considered satisfactory according to the U. S. Public Health Standards. Eighteen of a total of 39 counts on cups showed less than 100; and 11 counts were from 225 to 6000. Twenty-eight of 40 water glass counts were less than 100 as were 32 of the 40 counts on forks (table 5).

During the machine washing period all plates, cups, and water glasses had counts below 100 and only 1 count from 40 forks exceeded that number. As can be noted in table 5 many of the counts were 0.

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[13]U. S. Public Health Service. "Ordinance and Codes Regulating Eating and Drinking Establishments." Public Health Bul. No. 280, U. S Government Printing Office, Washington, D. C., page 34, 1934.

TABLE 5.—Bacterial Counts Made on Plates, Cups, Glasses and Forks on Four Different Occasions During Both Hand and Machine Washing Periods

Cooperators	Method	1st Test				2nd Test			
		Plate	Cup	Glass	Fork	Plate	Cup	Glass	Fork
		(Number of bacteria)				(Number of bacteria)			
A	Hand	83	1970	44	19	3	20	30	31
	Machine	0	5	1	0	1	26	0	0
B	Hand	1	3	15	0	10	17	10	62
	Machine	3	2	0	0	22	41	5	15
C	Hand	26	*	2635	0	3	0	213	1
	Machine	4	9	2	2	35	52	45	15
D	Hand	36	183	50	237	10	5	26	8
	Machine	2	6	0	0	4	0	1	2
E	Hand	111	172	74	11	35	457	44	19
	Machine	3	2	0	1	3	2	16	1
F	Hand	5820	29	9	6	107	339	143	72
	Machine	0	0	4	0	0	*	0	1
G	Hand	138	1281	834	103	136	255	56	94
	Machine	1	3	2	6	0	2	5	0
H	Hand	18	428	19	60	2	156	3	35
	Machine	2	*	1	0	0	0	1	1
J	Hand	815	524	837	394	36	163	39	163
	Machine	14	87	43	24	1	7	3	0
K	Hand	2	1806	826	12	9	6000	13	39
	Machine	0	0	1	2	1	7	2	1
		3rd Test				4th Test			
A	Hand	35	125	7	9	15	33	12	12
	Machine	1	1	0	0	5	6	1	0
B	Hand	3	2	10	9	5	3	1	0
	Machine	0	2	0	0	5	6	1	0
C	Hand	43	5	10	12	12	8	13	3
	Machine	5	18	29	1	15	8	22	20
D	Hand	153	91	42	473	23	5	192	99
	Machine	4	4	4	1	7	2	36	10
E	Hand	85	198	195	35	58	2400	421	173
	Machine	2	1	7	0	0	0	7	0
F	Hand	1	115	0	14	2	3	1	7
	Machine	15	4	4	53	6	2	1	112
G	Hand	76	178	1134	14	13	4370	1542	56
	Machine	2	5	0	15	16	1	1	0
H	Hand	7	428	0	4	17	80	0	21
	Machine	6	0	0	88	0	1	0	1
J	Hand	45	84	100	333	365	3865	1315	368
	Machine	7	5	9	2	15	6	2	0
K	Hand	3	6	4	2	4	11	78	3
	Machine	1	4	0	0	1	1	10	0

*No cups washed

The statistical difference in the bacterial counts on hand and machine washed dishes was tested by the Statistical Laboratory of The Ohio State University and the results showed that the count on the dishes washed by machine was significantly less than that on those washed by hand.

Individual reports showed only one cooperator to have bacterial counts higher during the machine than during the hand washing period. This cooperator used water from a rain water cistern and added a liquid chlorine bleach to the wash water when dishes were hand washed, but the chlorine solution was not used during the machine washing period.

TEMPERATURE USED IN DISHWASHING

On three occasions temperatures of wash water taken at the beginning of the hand washing period varied from 122° F. to 98.0° F.; at the end of the washing period it varied from 120.5° F. to 93.6° F. Most of the women added hot water during the wash period so temperature drops were negligible. Temperatures for rinsing varied from 125.5° F. to 197.7° F.

No direct relationship between bacterial count and water temperature could be established. More data would be necessary for such a determination.

During the machine washing period, temperatures of the last wash water (when more than one was employed), the last rinse, and the highest temperature reached during the drying cycle were measured on three occasions by placing a maximum temperature thermometer in the silver basket of the machine. Temperatures of last wash water varied from 114.6° F. to 160.6° F.; rinse water, 129° F. to 164° F.; and temperature of the drying cycle ranged from a low of 140° F. to a high of 192.6° F. depending upon the brand of machine.

There was very little variation of drying temperatures within the same brands but considerable variation among brands. There were not sufficient bacterial counts and temperature recordings to attempt to show statistical relationships between them.

QUANTITY OF WATER USED FOR DISHWASHING

Each cooperator measured the amount of water used for washing and rinsing on four occasions. Little or no relationship could be observed between amount of water used and number of items washed (table 6). The amounts varied from 7.9 to 32.5 quarts per washing. Water used for pre-rinsing was not included.

TABLE 6.—Comparison of Number of Items Washed and Amounts of Water Used by Ten Cooperators for One Washing by Hand and Machine Dishwashing Methods*

Cooperator	Items				Water (quarts)			
	Hand	Machine			Hand	Machine		
	Total	Total	By hand	By machine	Total	Total	By hand	By machine
A	59.5	57.8	10.5	47.3	32.5	41.2	16.0	25.2
B	65.3	72.8	3 5	69.3	21.6	26.5	1.3	25.2
C	51.3	93.8	21.5	72.3	7.9	37.8	9.8	28.0
D	61.8	78.5	5.3	73 2	22.3	43.8	15.8	28.0
E	54.0	68.0	12.0	56.0	25.3	37.0	9.0	28.0
F	62.5	67.0	8.5	58.5	21.0	32.8	4.8	28.0
G	39.8	82.5	0.0	82.5	23.0	32.0	0.0	32.0
H	66.5	72.8	11.5	61.3	16.3	36.5	8.5	28.0
J	47.0	94.0	8.8	85.2	9.6	45.0	13.0	32.0
K	80.5	80.5	3.8	76.7	23.0	29.5	1.5	28.0

*Average of four measurements.

The amount of water used by the dishwashers varied from 25 to 32 quarts as indicated by manufacturers. In addition to this amount, the women recorded the quantity used for supplementary hand washing when the machine was used. In all cases, considerably more water was used during the third or machine washing period than during the first period when the women hand washed.

The observers noted that in most cases the women tended to "fill the sinks as full" when washing the few items during the time the dishwasher was used as they had previously when all items were hand washed.

QUANTITY AND COSTS OF DETERGENTS

The quantities of detergent used were measured during both the first and third periods. Costs were computed on the basis of market price of various brands used. Costs were higher in six cases after the dishwasher was employed. Increases ranged from 2 cents to 45 cents for the 30-day period. Savings for the other four cooperators ranged from 4 to 50 cents when the dishwasher was used. (See table 7.)

During the second or experimental period the cooperators were provided with several different detergents to "try out" but during the third 30-day test period all were provided with a special formula to reduce the number of variable factors that might affect bacterial count.

TABLE 7.—Comparison of Costs of Detergents Used by Ten Cooperators in Hand and Machine Dishwashing During 30-day Periods

Cooperators	Method			
	Hand washing period	Machine washing period		
	Total	Hand (Supplementary)	Machine	Total
A	$0.50	$0.16	$0.36	$0.52
B	0.32	0.22	0.33	0.55
C	0.30	0.22	0.18	0.40
D	1.45	1 18	0 72	1.90
E	0 46	0.14	0.44	0.58
F	0.59	0.25	0.30	0.55
G	1.03	0.19	0.34	0.53
H	0.79	0.18	0.21	0.39
J	0.35	0 30	0.11	0.41
K	0.46	0 03	0.14	0 17

The amount of detergent used by each homemaker was somewhat dependent upon the water conditions in the home. Those having cistern water used as little as one teaspoonful per dishwasher load while others found as much as two tablespoonfuls necessary for satisfactory results.

NUMBER OF TEA TOWELS USED

A comparison of the number of tea towels used during the two dishwashing periods showed that all but one cooperator reduced the number of tea towels to be washed to approximately one-half the number used when hand washing. One cooperator used one-third as many. (See table 8.)

BREAKAGE OF DISHES

Breakage was such a minor item as to be hardly worth mentioning. Only two items were broken in the dishwasher from a total of 34,345 items washed by the 10 cooperators during the 30-day period whereas, during the handwashing period, eleven items out of 37,946 were broken. One cooperator had some chipping of plates in the dishwasher. She believed that this problem was caused by plates protruding through the lower rack so as to bump the side of the machine as the rack was pulled out.

TABLE 8.—Comparison of Numbers of Tea Towels Washed During 30-day Hand and Machine Dishwashing Periods

Method of washing dishes	Number of Tea Towels Washed									
	Cooperators									
	A	B	C	D	E	F	G	H	J	K
Hand	57	19	26	71	24	29	57	33	82	22
Machine	29	10	31	45	8	14	35	18	41	11

DISHWASHER INSTALLATION COSTS

Installation costs for the dishwashers varied to a marked degree as shown by the following figures:

Cooperator	Cost	Cooperator	Cost
A	$100.00	F	$83.25
B	167.06	G	53.41
C	71.06	H	85.49
D	47.50	J	18.46
E	103.48	K	37.18

Problems encountered in the home rather than the brand of the machine were responsible for differences in costs. For example, the installation in th home of cooperator B required a vent and a new drain connection through the foundation of the house which had no basement whereas cooperator J was in the process of remodeling her kitchen and the installation involved only the sliding of the under-counter model in place and making the necessary connections.

Installation of one model having a new quick-connection feature, the first to be installed in the community, encountered complications with city codes. These codes prohibited the drainage of the water through the food waste disposer. The plumber, the local distributor and the cooperator spent considerable time working out this problem. It was recognized that manufacturers' fine developments for easy and inexpensive installation for the customer frequently are not acceptable to local unionized labor. Antiquated city codes and unskilled inspectors can complicate and affect costs of installation.

Prospective buyers of dishwashers should obtain estimates of cabinet work, plumbing and electrical wiring involved which can add as much as 40 to 50 percent to the initial cost as shown in the cases of these cooperators.

PROBLEMS ENCOUNTERED BY COOPERATORS IN THE USE OF THEIR DISHWASHERS

Need for pre-rinsing. One of the manufacturers specifically asked that cooperators merely "dump" or scrape but not rinse dishes prior to washing. Prior to the 30-day test period cooperators tried this recommendation. They concluded that the practice was satisfactory if dishes were to be washed immediately but if they were to stand until after the next meal it was necessary to rinse off such foods as egg, cereal, orange juice, peanut butter and milk. Some cooperators, particularly those with food waste disposers, rinsed everything under the faucet, saying it was a quicker method than scraping.

Spotting of glasses and silverware. In all except three homes some spotting of glasses and silverware was evident in varying degrees. In two of these three homes cistern rain water was used for the hot water supply; the third cooperator had a mechanical water softener which conditioned the local water supply.

Three of the seven cooperators who had complained of spotting also had mechanically softened water from their own wells, and four used Columbus city water. While Columbus uses river water, hardened in the purification process and resoftened to approximately 4-5 grains, it is somewhat alkaline in nature. In homes where a mechanical water conditioner was used more spotting of dishes was observed as the time for reconditioning the device approached. It was also noted that better grade glassware, particularly the crystal type, showed less spotting under the same conditions than did cheap glassware.

After trying the various available brands of dishwasher detergents each woman had a definite preference for a particular brand but not necessarily the same brand. They believed a certain brand or brands seemed to perform better than others with the particular water conditions in their home.

Design and materials to be washed. Cooperators found that some of their present dishes and equipment were poorly designed or of unsuitable material to be washed in the dishwasher.

Drying temperatures of some machines were too high for certain plastics and caused melting or distortion in shape. Painted, colored aluminum water tumblers lost their paint. Glued handles on knives

and forks came off. One set of dishes had such deeply recessed plates and saucers that loading was made difficult and interfered with good washing action. Deep depressions in the bottoms of cups and glasses did not allow water to drain away. Wooden handles on pans, knives and forks lost their paint finish and roughened.

Cooperators indicated that they discarded as many unsuitable items as possible and when items were replaced these problems would be kept in mind.

CHANGES IN WORK HABITS

Cooperators were unanimous in their feeling that dishwashers saved them time and effort. They said having a dishwasher had made it possible to spend more time with family, in community activities, in the garden and helping with crops, watching television after the evening meal, and with guests after guest meals.

All cooperators liked the ease of having neater kitchen which the dishwasher provided. Four cooperators were able to wash nearly everything for the day in the dishwasher with one operation. Six cooperators used the dishwasher twice during the day. Of a total of 300 days for the 10 cooperators, on only 15 days were the dishwashers used three times. Thus it was advantageous to have the machine for storage of soiled dishes between meals. Feeling that the dishes were more sanitary and having fewer tea towels to wash also pleased the women.

Washing of canning jars and jelly glasses was considered an extra advantage of their dishwashers. Since the formal record keeping ended, one cooperator with a new infant has used the dishwasher for sterilizing bottles.

Comments on instruction books indicated that they were quite adequate. Some specific suggestions for additional information were: the need to rinse certain foods from dishes, particularly when they were not to be washed immediately after use; an indication of the types of items and materials which probably would be affected by dishwasher action; and some discussion of water pressure needs. Some women participating in the study experienced poor dishwashing results when water pressures were low and did not realize that an inadequate amount of water was the cause.

SUMMARY

A preliminary survey of 163 dishwasher users indicated that they could provide little information as to actual dishwashing time spent before and after dishwashers had been installed, installation and service

costs and other factors which would be particularly helpful in answering questions of other homemakers as to the value of ownership, selection, use, and care of the appliance.

As a result of this survey it was believed that actual, detailed information from 10 women would be more revealing than estimates of many times that number. With this assumption, and recognizing the limitations with so small a number, 10 families were chosen to participate in an intensive study. All families were composed of four to six members, owned their own home, had running hot water, and had never owned a dishwasher. The number was equally divided into rural and urban families.

During a 30-day period when the 10 homemakers kept detailed records, each hand washed from 2,652 to 5,086 items by hand, or from 88 to 169 items with an average of 127 per day. During a 30-day machine washing period they averaged 114.5 items a day. The latter period was during the early summer months when meals were lighter than during the hand washing period (spring) and various family members were away on vacations.

When the dishwasher was used some women washed as many as 20 to 25 percent of items by hand; others, as few as one item by hand per day. Reasons for hand washing were that items were too large, odd-shaped, of a material not suitable for the machine, or there were too many items for one load.

On only a few occasions were the dishwashers used more than once or twice a day.

The cooperators' hand dishwashing records showed actual time spent ranged from 33.6 to 108 minutes with an average of 73.2 minutes per day as compared to a variation of from 19.6 to 53.3 minutes or an average of 35.6 minutes per day when the machine was used. The time released by the use of the dishwasher was from 32.7 to 62.2 percent or an average of 51.3 percent.

Because fewer dishes were washed during the machine washing period an adjusted time value was calculated by dividing time consumed by number of items washed. Had the same number of items been washed during both periods, the time released would have been an estimated 44.2 percent.

When observers timed each cooperator on three different occasions they found, as might be expected, that the clearing of table, putting away leftovers, disposal of garbage, and cleaning up were manual parts of the task not aided by the dishwasher and required 42.3 percent of the

total time. The actual washing, rinsing, and wiping required 57.7 percent of the time while during the machine washing period the time for these processes was reduced to 22.6 percent.

Just how much time a dishwasher will release is dependent upon the user's definition of dishwashing. If time is counted for the entire process these cooperators, with the use of dishwashers, reduced their time by approximately one-half. If dishwashing is considered to be washing, rinsing, and wiping only, the dishwasher reduced the time to about one-fifth that spent when handwashing.

Bacterial counts on plates, cups, glasses, and forks were significantly lower for those washed by the dishwasher than for those washed by hand; however, the latter were remarkably low in bacterial count showing that the cooperators had unusually good handwashing standards. The dishwasher more than met the safety margin established by the U. S. Public Health Service.

In general more water was used for dishwashing during the machine washing period because some hand washing usually supplemented that of the machine. For this supplementary washing practically as much water was used as had been previously for the entire process. This probably also accounts for the fact that the costs of detergents were higher in six homes during the machine washing period.

The number of tea towels washed was reduced to one-half during the machine washing period.

Only two items were broken by 10 women when machine dishwashing 34,345 items as compared to 11 from a total of 37,946 items washed by hand.

Installation costs varied from $18.48 to $157.06 in a case of a difficult installation where a plumber replaced rusted pipes through a foundation to septic tank.

CONCLUSIONS

A dishwasher is a large, long-time investment for most families. Its value to the family will depend upon how effectively it is used. For the greatest return it should be used to its fullest capacity.

A mechanical dishwasher will not ordinarily accommodate large items such as platters, bowls, pressure cookers and preserving kettles. It must be recognized that some items may necessarily be washed by hand.

Without knowing the results of their own records, the cooperators in this study all said the appliance had saved them much effort and had released time for family, garden, community and other activities. Several mentioned feeling freer when they had guests for meals.

Cooperators found changing of habits from hand to machine washing both easy and pleasant. They found direction books and post-sale demonstrations quite adequate.

Contrary to the beliefs of some mothers that a dishwasher would deprive the children of a valuable home responsibility, these cooperators found that the children took more interest in the task and had great pride in ownership.

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APPENDIX

QUESTIONNAIRE USED IN PRELIMINARY SURVEY

THE OHIO STATE UNIVERSITY

School of Home Economics

Columbus 10, Ohio

1. Name . . . . . Address . . . . . Telephone . . . . .

2. Age of Homemaker: ..... under 20
   ..... 20 to 29
   ..... 30 to 39
   ..... 40 to 49
   ..... over 50

3. Number of members in family group: .....

4. Brand name of dishwasher .....

5. Date purchased: .....
   (approximate)

6. Why did you buy a dishwasher? .....

7. Why did you buy this particular brand? .....
.....

8. Did you: .....install it when the house was being built?
   ..... install it as a separate appliance after the house was built?

9. Is it: .....built into the sink unit?
   .....a separate unit?

10. If you had it installed do you recall: Installation cost: .....
Initial cost: .....

11. Were there any particular installation problems? ...yes .. no

12. If there were, what were they? .....
.....

13. Have you had any service calls? ....yes ... no. If so, what was the trouble? .....
.....

14. What is the approximate service expenditure to date? .....

15. Do you use: .....your own water system?
.....city water?
Do you consider the water: .....soft, ...medium hard,
.....hard, ...very hard

16. Do you have a mechanical softener? .....yes .....no.
Or do you use a packaged softener? .....yes .....no.

17. If your own system, is it from .....a well .....a cistern?

18. How large is your hot water tank? .....gallons

19. Have you noted any increase in the cost of heating water since you have had a dishwasher? .....yes .....no.

20. Do you wash all dishes and utensils in your dishwasher?
..... always .....frequently .....seldom .....never

21. Do you wash utensils in the dishwasher ..... with the dishes,
.....separately?

22. How many times a day do you wash dishes in the dishwasher? .....1, ... 2, ... 3.

23. What dishes or utensils do you hand wash? ....
.....

24. Why do you not wash these items in the dishwasher? ....
.....

25. Do you: ... rinse dishes before putting them into the dishwasher?
... merely scrape them without rinsing?

26. Do you use more dishes for meals since you purchased your dishwasher? .....yes, ...no.

27. What detergent do you use? ..... How much per load?
..... Have you used other brands of detergents?
.....yes, ...no. If yes, which do you like best? ....
..... Why? .....
.....

28. Are you completely satisfied with your dishwasher? .....yes,
..... no.

29. If not, what are some of your problems? .....
.....

30. Did anyone demonstrate the use of your dishwasher to you?
..... yes, ... no. Did you have to rely on your instruction book? ..... yes, ... no.

31. What ideas or suggestions do you have that might be helpful to new users of your brand of dishwasher or that the manufacturer might add to his direction book?
.....

32. Were the directions complete and easily followed? .. yes, . no.

33. Do you believe that the dishwasher has played any part in reducing infectious colds among the members of the family?

.....

34. Have you ever used the dishwasher to sterilize:

.....baby bottles? ..... canning equipment?

35. Do you feel the dishwasher saves time? .....yes, ... no.

If yes, how much does it save you daily since getting the dishwasher? .....

36. Who used the dishwasher?

Homemaker ..	daily ..	occasionally
Husband ...	daily...	occasionally
Children ...	daily...	occasionally
Maid ....daily...		occasionally
Others ....daily...		occasionally

37. What suggestions would you make to the manufacturer for your dishwasher's improvement? (Write the rest of your suggestions on the back of this page.)

OPERATIONS IN TOTAL DISHWASHING JOB
(Hand Dishwashing)

Name_____ Date_____

	Seconds*	Total
Clearing Table		
Scraping or Rinsing Dishes		
Putting Away Left-overs		
Getting Rid of Garbage		
Feeding Pets		
Preparation of Dishwashing Equipment		
Actual Washing of Dishes		
Rinsing of Dishes		
Wiping of Dishes		
Cleaning-up Process		
Total		

*One mark indicates 5 seconds

OPERATIONS IN TOTAL DISHWASHING JOB
(Machine)

Name D Date 8/17

	Seconds*	Total
Clearing Table	𝍸 𝍸 𝍸	75
Putting Away Left-overs	𝍸 𝍸 ///	65
Scraping or Rinsing of Dishes	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ///	315
Loading Dishwasher (include detergent)		
Getting Rid of Garbage	𝍸 /	30
Feeding Pets		
Preparation of Hand-dishwashing Equipment	𝍸 ///	40
Hand Dishwashing and Rinsing	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ///	340
Hand Wiping	𝍸 𝍸 𝍸	75
Cleaning-up Process	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	400
Total		1340 Sec. 22.33 Min.

*Each mark indicates 5 seconds.

Sample of Daily Record Kept By Homemakers During The 30-Day Machine Washing Period

Time

Name _____

Date _____

1st Washing No. Working	2nd Washing No. Working	3rd Washing No. Working	4th Washing No. Working
Dishes for which meal	Dishes for which meal	Dishes for which meal	Dishes for which meal

Was more than one dishwasher load required for any meal?
If so, which one?

	1st		2nd		3rd		4th	
	M	H	M	H	M	H	M	H
Cereal, Soup Bowls								
Cups								
Cream Pitcher								
Glasses								
Jelly, Pickle, etc.								
Plates								
Platters, Chop Plates								
Salad, B&B, Saucers								
Sauce Dishes								
Serving Dishes								
Forks								
Knives								
Spoons								
Serving Spoons								
Ash Trays								
Baking Dishes-Large								
Medium								
Small								
Baking Sheets								
Beaters (Rotary)								
Bowl Covers, Plastic								
Bags								
Bread Pans								
Cake Pans								
Can & Bottle Opener								
Coffee Maker								
Covers & Lids								

	1st		2nd		3rd		4th	
	M	H	M	H	M	H	M	H
Food Grinder								
Forks (cooking)								
Ice Cream Dipper								
Ice Cube Trays								
Jars								
Jello Molds								
Knives-Large								
Paring								
Ladle								
Lunch Box								
Measuring Cups								
Measuring Spoons								
Milk Bottles								
Mixing Spoons								
Mixing Bowls-Large								
Medium								
Small								
Muffin Pans								
Pastry Blender								
Peeler								
Pie Pans								
Pitchers								
Potato Masher								
Pressure Saucepan								
Refrigerator Dishes								
Roasting Pans								
Scissors								
Scrapers								
Shakers								
Skillets-Large								
Medium								

	1st		2nd		3rd		4th	
	M	H	M	H	M	H	M	H
Spatulas-flat								
Spatulas or turners								
Thermos								
Trays								
Vases								
Whips								
Breakage								
No. of People Served								
How Were Hand-Washed Dishes Dried?								

Indicate any pieces that were not washed or dried satisfactorily and what food was on the dish or pan.

Did you use the dishwasher for any other purpose than washing dishes, such as warming dishes, sterilizing jars, etc.?

Sample Of Daily Record Kept By Homemaker During 30-Day Hand Washing Period

Name _____

Date _____

Dishwashing Record

	1st Washing		2nd Washing		3rd Washing		4th Washing	
	No.	Time Spent	No.	Time Spent	No.	Time Spent	No.	Time Spent
Homemaker								
Husband								
Children								
Others								

	No. 1st	No. 2nd	No. 3rd	No. 4th
Dinner Plates				
Luncheon Plates				
Salad Plates				
B & B Plates				
Cereal & Soup Bowls				
Sauce Dishes				
Cups				
Saucers				
Vegetable Dishes				
Platters & Chop Plates				
Cream Pitcher				
Jelly, Pickle, etc.				
Tumblers				
Ice Tea Glasses				
Fruit Juice Glasses				
Goblets				
Sherbets				
Stemmed Juice				
_____				
_____				
_____				
_____				
Knives				
Forks				
Spoons				
Serving Spoons				
_____				
_____				

	No. 1st	No. 2nd	No. 3rd	No. 4th
Pitchers				
Baking Dishes-Large				
Medium				
Small				
Shakers				
Wooden Bowls				
Trays				
Refrigerator Dishes				
Mixing Bowls-Large				
Medium				
Small				
Sauce pans-Large				
Medium				
Small				
Double Broiler				
Skillets-Large				
Meidum				
Coffee Maker				
Tea Pot				
Food Grinder				
Baking Sheets				
Muffin Pans				
Cake Pans				
Bread Pans				
Pie Pans				
Roasting Pans				
Broiler				
Pressure Saucepan				
Grater				

	No. 1st	No. 2nd	No. 3rd	No. 4th
Cooling Racks				
Grill or Griddle				
Jello Molds				
Covers or Lids				
Jars				
Measuring Cups				
Measuring Spoons				
Knives-Large				
Paring				
Forks-cooking				
Mixing Spoons				
Pastry Blender				
Peeler				
Tongs				
Whips				
Beaters (Rotary)				
Potato Masher				
Ladle				
Can & Bottle Opener				
Scrapers				
Spatulas-Flat				
Scissors				
Spatulas or Turners				
Bowl Covers				
Biscuit, Cooky Cutter				
Ash Trays				
Strainers				
_____				

	No. 1st	No. 2nd	No. 3rd	No. 4th
Baby Supplies				
_____				
_____				
_____				
Dairy Supplies				
Milk Bottles				
_____				
_____				
Interruptions				
Number				
Time Used				
_____				
Time Between Meal and Washing of Dishes (Min.)				
_____				
How Were Dishes Dried?				
_____				
No. of People Served				
_____				
Breakage				

FORM USED TO RECORD ADDITIONAL INFORMATION

NAME.....

ADDITIONAL INFORMATION ON AUTOMATIC DISHWASHER PHASE

What help did you receive in learning to operate your dishwasher? Was it adequate?

Do you feel the direction book which accompanied your dishwasher is adequate? If not, what would you like to have included?

Do you have any suggestions you would like to make for changing the design of your dishwasher?

Did you scrape or rinse your dishes prior to placing in dishwasher?

What was the cost of installation of the dishwasher? Indicate cabinet work separate from dishwasher if you can.

By whom was your dishwasher installed?

What problems did you have on the installation? Did you have to have any special work done?

How much detergent did you use during the 30 days?:

Hand-dishwashing: Brand..... Amount..... Cost.....

Machine-dishwashing: Amount.....

How much water did you use in hand washing and rinsing plus any rinsing for dishwasher on each of four occasions:

1st week ... date ..... No. of Washing .....

2nd week ... date ..... No. of Washing .....

3rd week .... date ..... No. of Washing .....

4th week .... date ..... No. of Washing .....

How many tea towels did you wash?

1st week ..... 3rd week.....

2nd week ..... 4th week.....

What have you liked about having a dishwasher?

Is there anything you have disliked about using a dishwasher?

CONTENTS

* * * *

FEATURES OF THE FIVE DISHWASHERS INCLUDED IN THIS STUDY

Features as Indicated by Manufacturers for 1953 Models	Dishwasher I	Dishwasher II	Dishwasher III	Dishwasher IV	Dishwasher V
Time of complete cycle	34 minutes	47 minutes	35 minutes	50 minutes	37 minutes
Time of washing and rinsing	18 minutes	17 minutes	11½ minutes	27 minutes	14½ minutes
Time of drying period	16 minutes	28 minutes	23½ minutes	23 minutes	22½ minutes
Amount of water per cycle	6.3 gallons	7 gallons	7 gallons	8 gallons	7 gallons
Pre-rinse	1 minute	2 pre-rinses	None	Yes	Yes
Number of washes	1—10 minutes	1—5½ minutes	1—5 minutes	2—5 minutes	1—5 minutes
Number of rinses	2 power—1½ minutes plus 1 spray rinse—½ minute	3—1½ minutes each	2 power—1 minute each	2 power, each 1 minute	2 power, each 1⅞ minutes
Amount of water circulated per minute	50 gallons	50 gallons	40 gallons	70 gallons	100 gallons
Capacity	Service for 6	Service for 6 to 8	Service for 6 to 8	66 pieces china and glassware + silverware	Service for 8
Finish on cabinet	Baked enamel	Baked enamel—alkali resistant	Top—porcelain enamel—other baked enamel	Calgloss (baked on enamel)	Steel covered with porcelain enamel
Finish on inner tub	Porcelain enamel	Porcelain enamel	Porcelain enamel	Porcelain enamel	Steel covered with porcelain enamel
Material in dish racks	Steel covered with vinyl plastic	Steel covered with vinyl plastic	Chrome-plated steel*	Vinyl plastic	Steel covered with plastisol
Material in impeller	Plastic	Plastic	See special features	Bakelite	Die-cast aluminum
Heating unit for wash and rinse water	1000 watts	750 watts	None	Yes, 825 watts	No
Heating unit for drying	1000 watts	750 watts	1000 watts	Yes, 825 watts	Yes, 950 watts
Independent racks	Yes	No	Yes	Yes	No
Adjustable height in top rack	No	No	Yes	Yes	No
Safety switch on door opening	Yes	Yes	Yes	Yes	Yes
Door gasket	Yes	Yes	Rubberized gasket	No	Has lid gasket
Signal light	Yes, during all phases	Yes	Yes, during all phases	No	Yes, during drying phase
Drain pump	Yes	Yes	No, but available	Yes, on Quickonect	Yes
Can cycle be interrupted	Yes	Yes	Yes	Yes, on Quickonect	Yes
Can control be operated manually and reset at any phase	Yes	Yes	Yes	No, on gravity drain	To eliminate drying period
Motor	⅓ h.p.	⅓ h.p.	¼ h.p.	¼ h.p.	1/6 h.p. for impellor 1/30 h.p. for pump
Dimensions—					
Height to work surface	34½" and 36"	34½" and 36"	34½", 36", and 36" + 4" splashback	34½", 40", 42½"	34½" and 36"
Width	24" and 48"	24" and 48"	24", 48"	27" and 48"	24" and 48"
Depth, closed	24" and 25"	25"	24½" and 25"	25"	26⅛"
Depth, open		48"	42 9/16" and 42 13/16"	42"	42½"
Other special features	Removable, revolving top rack	Detergent dispenser for either powder or liquid.	Revolving wash arm provides washing action. Arm is cast iron on bronze bearing.		Portable model available

*Vinyl coated racks available.