MILK DISTRIBUTION SYSTEMS IN OHIO

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INTRODUCTION

Retail milk distribution methods vary greatly among the major

cities of Ohio. In the Akron market for instance, over one third of the

Class I milk sold in 1954 was marketed through stores in gallon jugs.

In other markets, such as Cincinnati, such sales were negligible; and

the one quart glass container was dominant. The cities of Dayton, Canton

and Toledo exhibit similar differences in pricing and methods of delivery

Ohio is therefore an ideal laboratory in which to study the operation

of many different distribution systems and to ascertain if one type leads

to greater milk consumption than another.

Dairying in Ohio is an important industry when judged from the

viewpoint of producers, processors, handlers and consumers. In 1958,

Ohio farmers grossed over 190 million dollars from the sale of milk and

thus any factors affecting its consumption are of vital concern to them

and all who participate in its distribution.

With this in mind, the Department of Agricultural Economics

at The Ohio Agricultural Experiment Station interviewed 7,413 families

in Akron, Canton, Cincinnati, Cleveland, Dayton, Ironton, Youngstown, and

Toledo between September 1954 and April 1956. Later, in order to study

the effect of time, 930 families in the Cleveland and Dayton markets

were re-interviewed in 1958 and 1959.

Three publications and several unpublished works have been

prepared from these data.[1] This bulletin brings together the information obtained from the earlier studies. The effect of time on consumers' milk purchases will be published in a later bulletin.

Objectives

Specifically, the objectives of this study were:

1. To study and analyze the various market milk distribution systems in Ohio.

2. To determine the per capita consumption of milk in the different cities of Ohio.

3. To determine consumer preference for various sizes and types of milk containers.

4. To determine factors which influence the quantity of milk purchased by consumers.

Methodology

The first phase of this study was concerned with determining the characteristic of milk distribution systems in effect in the eight Ohio fluid milk markets. Prices, type of containers in use, and methods of distribution were ascertained.

The second phase involved the interviewing of consumers in the Akron and Dayton markets both by personal interview and by telephone. The results of these two methods were analyzed, and it was found that there was no significant difference between them. Therefore, in the six succeeding cities, all the interviews were conducted by telephone.

In the first four markets surveyed (Akron, Cleveland, Dayton

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[1]For example see: Mitchell, G. and Baumer, E. F., A Progress Report on Selected Aspects of Four Ohio Milk Distribution, Ohio Agricultural Experiment Station, 1957.

and Ironton) the sample included 1 percent of the population in the market. A sequential analysis was run for the Akron market, and it was found that the sample size could be reduced to 0.1 percent. As a result, in the following four markets (Cincinnati, Youngstown, Toledo and Canton) the sample size was reduced.

Each family was classified according to family income, family size, age, type of container used and place of purchase.

Characteristics of The Markets Studied

Markets, as used here, include the cities proper and those areas continguous to the cities which were served by the same dairies. Seven of the largest markets in the state and one relatively small market (Ironton) were included in the sample (Table 1). The average household size, according to the 1950 census, in these 8 cities ranged from 3.11 persons in Cincinnati to 3.55 in Youngstown. Two cities, Cincinnati and Ironton, had less than 35 percent of their labor force employed in manu-facturing, whereas in all the rest between 40 and 50 percent were so employed.

Type of Containers and Milk Prices

Glass containers were available in three sizes; quart, two quart and gallon. The magnitude of their use varied considerably. Gallon jugs were not home delivered in any city. In Canton and Cleveland, gallon jugs were not sold in the city proper, whereas in other cities the number of retail outlets handling gallon jugs were relatively low. In Akron, the number of stores handling gallon containers was higher than in any other city.

Table I

Population, Average Household Size, Median Income,
Families Interviewed and Time of Interview,
Eight Selected Ohio Milk Markets

Market	Population[a]	Average House-hold Size[a]	Median Income[a]	Employed in Mfg.[a]	Time of Interview	Families Interviewed
	(number)	(number)	($)	(%)	(date)	(number)
Akron	366,765	3.34	3,251	48.4	1954	1,000
Canton	173,917	3.32	3,069	47.4	1956	800
Cincinnati	813,292	3.11	2,881	33.4	1955	816
Cleveland	1,383,599	3.31	3,446	40.5	1955	2,003
Dayton	346,864	3.31	3,382	42.9	1955	1,044
Ironton	16,333	3.23	2,687	30.8	1955	152
Toledo	364,344	3.23	3,556	38.7	1956	800
Youngstown	298,051	3.55	3,273	49.8	1956	800

[a]Derived from the U. S. Census, 1950, Department of Commerce, Washington, D. C.

Paper containers of one and two quart size were home delivered and sold in stores in all cities. Usually, however, one type--either glass or paper, dominated as a method of packaging.

With the exception of Ironton, home delivered announced prices were generally higher than store prices. The price of milk sold in multiple quart containers was usually lower on a per quart basis than that sold in one quart containers (Table 2).

Average prices paid were difficult to ascertain due to the range of prices for the same product, discounts offered, percent of people or companies participating in discounting, the proportion of milk sold by type of outlets, the multiplicity of container sizes and types, product differentiation and many other factors.

Announced discounts on home delivery were in effect at the time of the survey in Akron, Cleveland, and Canton. Not all companies or customers however, participated in this schedule of quantity discounting.

In Akron, discounts by some companies were reported on the following schedule: 1¢ a quart on 60 units per month, 2¢ a quart on 90 units per month and 3¢ a quart on 120 units per month. An announced discount of 1¢ on 60 quarts and 2¢ on 90 quarts or more per month was made by a majority of Canton dairies. Many Cleveland dairies had a home delivery volume discount of 1¢ a quart if 75 or more units were purchased a month.

Toledo and Cleveland had every other day home delivery (Sunday included) whereas the other six markets were on a three day a week basis.

Table 2

Range of Published Prices for Regular Standardized Milk in Eight Ohio Markets
According to Method of Delivery and Size of Container,
and Estimated Weighted Average Price Paid Per Quart, 1954-56

Markets	One Quart		& Two Quart		Gallon	Date of Study	Estimated Weighted Average Price Per Quart
	Store	Home	Store	Home	Store		
Akron	20-21¢	21¢	32-36¢	36-38¢	61-62¢	Sept., Oct. 1954	17.78¢
Canton[a]	17-22	22	33-45	40	65	February, 1956	20.29
Cincinnati[a]	21-24	22-24	40-42	44-47	74	November, 1955	23.15
Cleveland	19-22	20-21	31-38	37	58	Mar, Apr, 1955	19.37
Dayton[a]	19-21	21	35-41	41	65	Jan, Feb, 1955	21.28
Ironton[a]	23	22-24	44-46	43-46	83	November, 1954	23.41
Toledo	19-22	22	34-44	44	79	January, 1956	21.11
Youngstown[a]	18-23	23-24	33-40	39-42	71	Mar, Apr, 1956	20.53

[a]Homogenized price 1¢ a quart higher than standardized milk by most dairies.

Household Characteristics

The average number of persons in the households studied was approximately 3.39. By household, it is meant people living and eating in the same residence. The persons living in institutions or eating all meals outside the home were excluded from the study. Average family size ranged from 3.28 persons in Cleveland to 3.64 in Youngstown.

A family of two persons was most common. Size of family ranged up to 17 persons but over 90 percent of the households were composed of 5 persons or less.

Table 3

Number of Families in Various Size Groups and Average Family
Size Studied in Eight Ohio Markets, 1954-56

Size of Family	Cities Studied									
	Akron	Cinci.	Cleve.	Day.	Iron.	Toledo	Can.	Youngs-town	Tot.	Prop.
1	57	80	146	60	6	61	40	34	484	6.5
2	327	236	607	320	45	238	237	190	2200	29.7
3	235	165	447	224	41	177	174	176	1638	22.1
4	194	167	415	179	35	146	147	189	1471	19.9
5	126	82	242	121	9	102	104	118	904	12.2
6	56	53	86	50	10	44	65	52	416	5.6
7 & over	49	33	60	46	5	32	34	41	301	4.0
Average Family Size	3.42	3.33	3.28	3.35	3.37	3.38	3.51	3.64	3.39	

Approximately two-thirds of the families interviewed had children 10 years of age or under. Young people between the age of 11 to 20 years were found in 28.4 percent of the families. Adults over 50 years of age were present in over three-tenths of the families (31.6 percent) interviewed. However, of the 25,140 persons in this study, the largest age group (48.6 percent of the total) was people between the ages of 21 and 50.

Table 4

Number of Persons Studied in Four Age Groups,
Eight Ohio Markets, 1954-56.

| City | Age Groups | | | | | Proportion of Total |
	0-10	11-20	21-50	50 and over	Total	
Akron	684	544	1761	577	3566	14.4
Canton	704	402	1238	462	2806	11.1
Cincinnati	595	369	1311	441	2716	10.7
Cleveland	1300	903	3301	1072	6576	26.2
Dayton	750	439	1671	489	3349	13.3
Ironton	120	55	227	107	509	2.0
Toledo	583	390	1296	433	2702	10.7
Youngstown	705	389	1406	416	2916	11.7
Total	5441	3491	12211	3997	25140	100.0
Proportion	%21.6	13.9	48.6	15.9	100	xxxxx

Individual families were asked to place themselves in one
of five annual income groups. These five income groups were (a)
$1,000-2,500, (b) $2,501-4,000, (c) $4,001-5,500, (d) $5,501-7,000,
and (e) $7,001-and over. Over 90 percent of those interviewed placed
their family in an income group. Less than 1 percent of the total
households reported incomes of less than $1,000 per year.

Generally it was more difficult to obtain income information
from older persons with incomes other than a regular salary check.

Table 5

Distribution of Households by Annual Income,
Eight Ohio Milk Markets, 1954-56.

Markets Studied	Under $1,000	$1,000-2,500	$2,501-4,000	$4,001-5,500	$5,501-7,000	$7,001 & over
			Per Cent			
Akron	.3	11.0	25.1	30.2	24.1	9.3
Cincinnati	.3	12.0	21.4	24.9	19.0	22.4
Cleveland	1.1	11.6	23.3	29.5	18.2	16.3
Dayton	.7	8.1	17.4	32.3	21.4	20.0
Ironton	1.3	11.3	32.5	27.8	17.2	9.9
Toledo	.5	11.0	18.6	31.4	22.0	16.4
Canton	.9	7.1	16.8	31.5	25.1	18.7
Youngstown	.3	6.6	13.4	33.5	29.2	17.0
Average	.7	9.9	21.7	30.4	20.5	16.8

Total Milk Purchased

During the week studied, the 7,415 families comprised of 25,140 persons purchased 76,492 quarts of milk or an average of 10.3 quarts per family (Table 6). On a per capita basis consumption was highest in Youngstown; namely, 1.0 pint per persons per day and lowest in Ironton with 0.79 pints per person per day.

Of the 76,492 quarts purchased, 5,133 quarts or 6.7 percent was bought outside the home by 32 percent of the households surveyed. Skim milk, buttermilk, and chocolate milk made up only a small proportion of the total; namely, 3,162 quarts.

Purchases of cream amounted to 1,093 quarts, evaporated milk totalled 3,140 cans and dried milk 433 packages. About 20 percent of the homemakers interviewed purchased cream during the week, 12 percent purchased buttermilk, 15 percent chocolate and 13 percent evaporated (Table 7).

Table 6

Number of Families, Total Weekly Milk Purchases and
Daily Per Capita Consumption,
Eight Ohio Markets, 1954-56

Market	No. of Families	Total Milk Purchased	Weekly Purchases per family	Per Capital/ Consumption
	No.	Quarts	Quarts	Pints per day
Akron	1,044	11,433	10.95	0.9627
Cincinnati	816	7,112	8.72	0.8238
Cleveland	2,003	19,852	9.91	0.9182
Dayton	1,000	10,119	10.08	0.9195
Ironton	152	1,349	8.88	0.7904
Toledo	800	8,166	10.21	0.9335
Canton	800	8,852	11.06	0.9619
Youngstown	800	9,609	12.01	1.0086
Total	7,415	76,492	10.32	0.9289

1/There were a total of 25,140 persons in the 7,415 families. The
standard deviation (measure of dispersion) ranged from .4107 in Ironton
to .5295 in Akron.

Table 7

Purchases of Selected Milk Products During Week Studied
Eight Ohio Markets, 1954-56

Product	Families Buying	Quantity Purchased
	Percent of Total	
Cream	19.6	1,093 qts.
Skim	3.7	893 qts.
Buttermilk	12.4	1,492 qts.
Chocolate	15.3	777 qts.
Evaporated	13.3	3,140 cans
Dried Skim	1.2	146 pkgs.
Dried Milk	2.4	287 pkgs.
Outside Home	31.8	5,133 qts.

Home and Store Delivery

A considerable range existed in the proportion of total
milk purchased at the door and at the store between the markets
studied. In Dayton, less than one-fourth of the milk consumed was
sold through stores. However, it is noticeable that in no market
had one method completely taken over although one usually predominated.

Table 8

Place of Purchase as a Percent
of Total Fluid Milk Sold
in Eight Ohio Cities,
1954-56

Store Purchase	City	Home Delivery
63	Akron	37
46	Canton	54
38	Cincinnati	62
37	Cleveland	63
22	Dayton	78
41	Ironton	59
36	Toledo	64
69	Youngstown	31

It was observed that with the exception of Youngstown, house-
holds buying both at the store and at home had the highest consumption
per capita. With the exception of Toledo (approximately 20 percent),
14 percent or less of the households in each city purchased milk both
at store and at home the week of the study. Persons who buy both at
store and at home have obtained milk a higher number of times than
the other two groups, those who purchase at the store exclusively and
those who buy at home exclusively.

In four markets namely, Akron, Cleveland, Canton and Youngstown, the households buying exclusively at the store had higher per capita milk consumption than did those buying at the home exclusively. In the other four markets, the reverse was true, those buying at home exclusively had the higher per capita consumption. However, in general, purchases were related to family requirements, or in other words to the size of family.

Table 9

Average Daily Per Capita Milk Consumption, Purchased by
Three Different Methods, Eight Ohio Markets,
1954-56

City	Method of Delivery		
	Store Only	Home Only	Store & Home
	(Pints Per Day)		
Akron	1.03	.86	1.04
Canton	.94	.90	1.08
Cincinnati	.77	.80	1.05
Cleveland	.91	.90	1.08
Dayton	.81	.95	1.05
Ironton	.76	.79	1.22
Toledo	.86	.89	1.11
Youngstown	1.04	.90	1.02

Households who purchased both at store and at home had the largest families. With the exception of Youngstown, Akron and Ironton the average size of households was larger among those who bought at the house only then among those households who purchased at the store only. Again individual markets differed (Table 10).

Table 10

Average Family Size According to Type of Milk
Delivery in Eight Ohio Markets, 1954-56

	Type of Delivery		
City	All Store	All Home	Home & Store
Akron	3.45	3.39	3.94
Canton	3.38	3.59	4.01
Cincinnati	3.22	3.40	4.00
Cleveland	3.31	3.42	3.94
Dayton	3.04	3.50	4.04
Ironton	3.37	3.37	4.25
Toledo	3.19	3.30	4.14
Youngstown	3.70	3.41	4.04

FREQUENCY OF PURCHASES

The most frequent number of milk purchases for home con-
sumption was three times per week. Over one-eight (13.8 percent) of
the families bought milk five times or more per week. However, this
percentage (families buying milk five times or more weekly) ranged
from 36 percent in Ironton to less than 6 percent in Dayton.

Table II

Percentage of Families Buying Milk for Home Consumption
By Number of Weekly Purchases,
Eight Ohio Markets, 1954-56

No. of Weekly Purchases	Percent of Families
1	8.4
2	13.0
3	57.5
4	13.3
5	1.9
6	4.6
7 and over	7.3

As the number in the family increased the frequency of delivery

increased. Chart I indicates an association between the number of

deliveries per week as family size increased from 1 to 4 members.

Chart I

Average Family Size by Number of Times Milk Purchased Per Week
Eight Ohio Markets, 1954-56

Family Size   Family Size

Frequency of Purchases Per Week
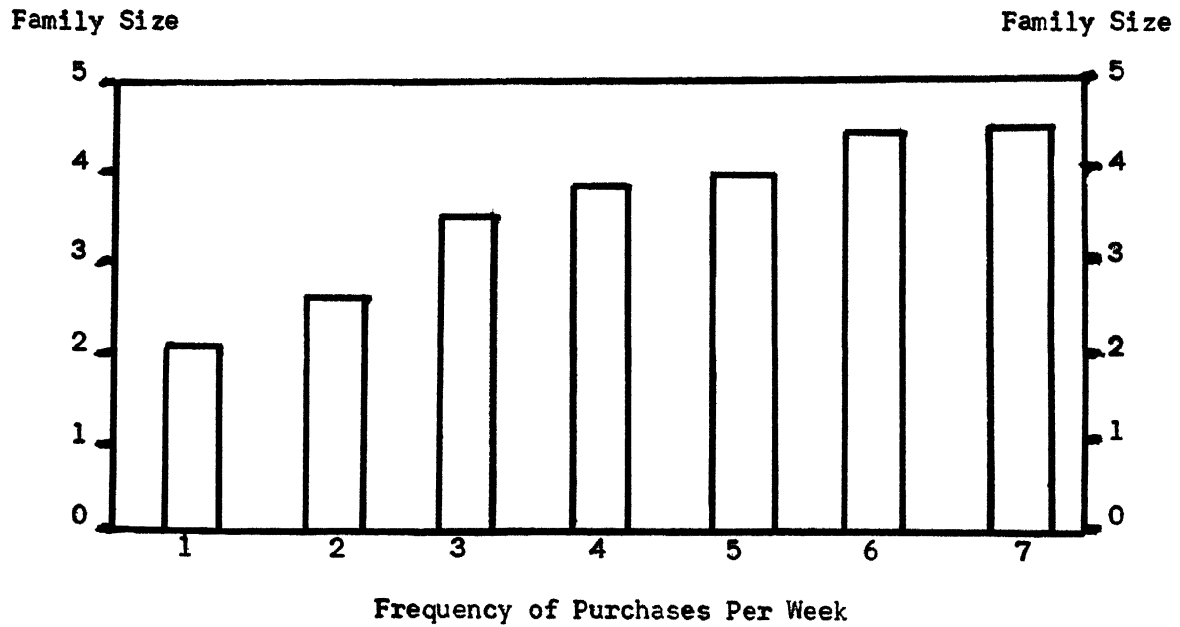
The average number of quarts of milk purchased per family increased as

the frequency of delivery increased. Deliveries per week appear to be strongly

correlated with total number of quarts consumed in the family unit.

Chart II

Average Number of Quarts of Milk Purchased Per Week and Number of Times
Purchased, Eight Ohio Markets, 1954-56
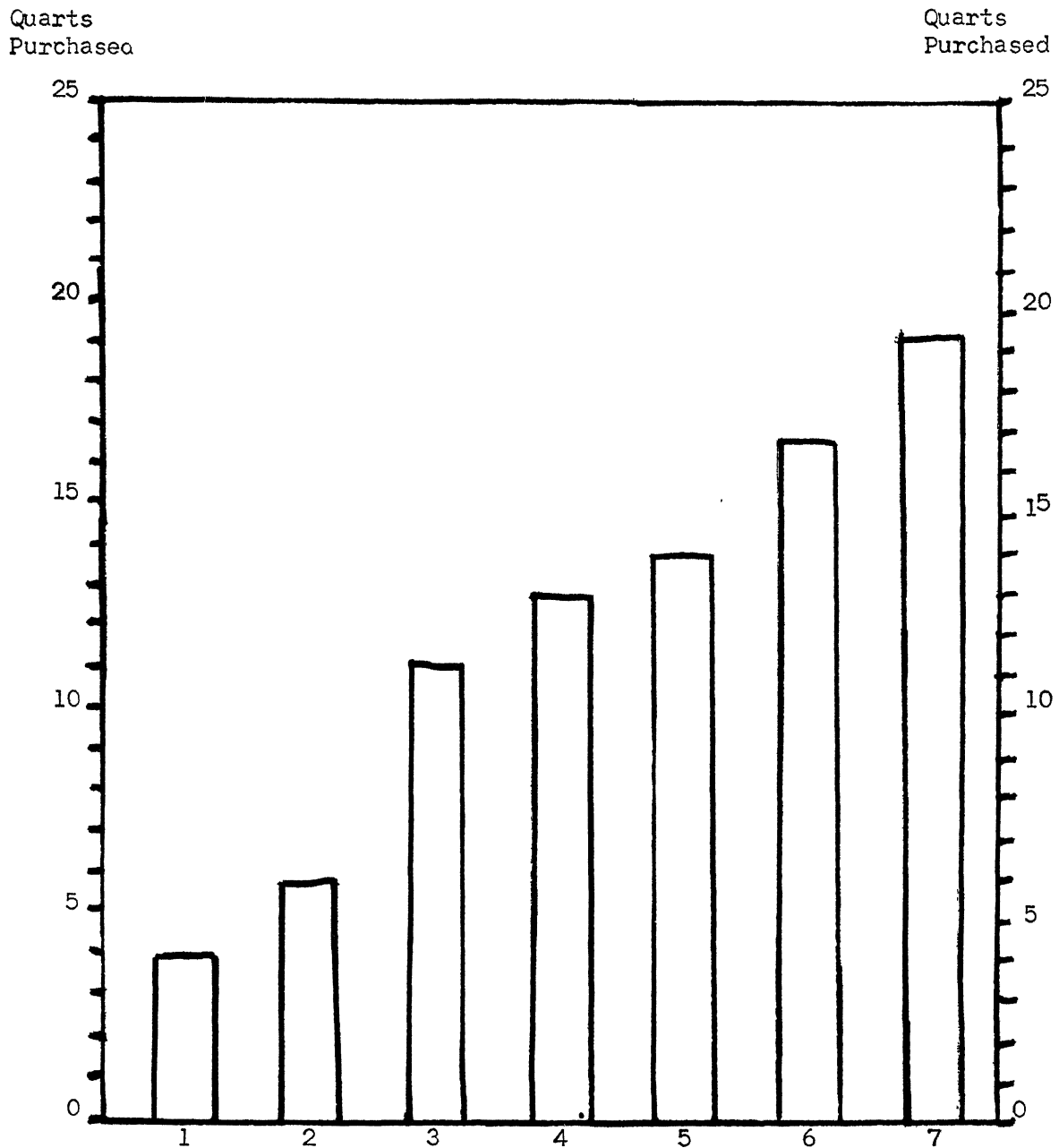
Family income was higher in those groups receiving milk three times or more per week than in those families receiving milk twice or less per week. Those groups receiving milk four times or over per week showed no significant income difference from those families receiving milk three times per week.

Type and Size of Container

Glass container predominated in all markets. However, the use of paper containers has risen since World War II from practically nothing to significance in every market. Often, paper or glass will predominate in one method of delivery and one size. For example, all gallon containers in this study were glass and were sold through stores. In Cincinnati and Toledo, over two-fifths of the milk sold was home delivered and packaged in one quart glass.[2]

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[2]These percentages have changed considerably in these markets since this study was made.

Table 12

Percentage of Fluid Milk Sold by Type of Container in
Eight Ohio Markets, 1954-56.

Glass	Market Studied	Paper
81	Akron	19
82	Canton	18
75	Cincinnati	25
72	Cleveland	28
70	Dayton	30
55	Ironton	45
66	Toledo	34
70	Youngstown	30

Large variations existed between the markets studied in the percent of milk sold by different sizes of containers. Approximately three-fourths of the milk sold was in two quart containers. In four markets - Dayton, Ironton, Toledo, and Cincinnati, gallon jugs accounted for 2 percent or less of the total volume. However, in Akron, over one-third of the total fluid milk sold was in gallon containers. With the exception of Akron, one size of container in the individual market tended to predominate and control over 50 percent of sales. It should be noted that the availability of various sizes and types of containers varied considerably between markets at the time this study was made.

Table 13

Proportion of Total Fluid Milk Sales by Size of Containers
in Eight Ohio Markets, 1954-56.

	Container Size		
Markets	Gallon	Two Quart*	One Quart
	-Percent-		
Akron	34	27	39
Canton	13	54	33
Cincinnati	1	34	65
Cleveland	5	26	69
Dayton	2	20	78
Ironton	2	24	74
Toledo	1	25	74
Youngstown	4	74	22

*Includes two connected single quarts.

Generally, the larger the average family size the larger the size of container purchased. The users of gallon jugs had larger families than did two-quart purchasers and they in turn had larger families than one-quart users. Families who purchased no regular fluid milk at home or at stores averaged less than two persons per family (Table 14).

Table 14

Average Size of Family Purchasing Milk in Various
Sizes of Containers in Eight Ohio Markets,
1954-56.

| | Size of Container | | |
Market	Gallon	Two Quart	One Quart
Akron	3.83	3.57	3.21
Canton	4.00	3.95	3.30
Cincinnati	4.42	3.95	3.39
Cleveland	4.26	3.66	3.22
Dayton	4.41	3.89	3.32
Ironton	5.0	3.48	3.29
Toledo	4.42	3.96	3.25
Youngstown	3.96	4.02	3.31

Table 15 shows the percentage distribution of milk sales by both type and size of container and by type of delivery. These purchase do not include purchases for other than household consumption such as schools, restaurants, etc.

Generally, persons purchasing milk in the one quart container had the lowest per capita consumption of the three container groups. Gallon jug users generally had the highest per capita milk consumption. This was not however, the case in Dayton, Ironton and Cincinnati where gallon jugs made up a small part of the market (Table 15).

It should be noted that in this analysis of container size that a household purchasing milk in more than one size container would be listed under each size purchases.

Generally, the households who used the largest container which was readily available (over 5 percent of the total milk sold) had the highest per capita milk consumption and as previously stated also had th largest families.

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Table 15

Percentage Distribution of the Sales Volume of Milk by Size and Type of Container
and by Type of Delivery for Eight Selected Ohio Mkts., 1954-56.

Market	Gallons a/	Whole, Fluid Milk								All Other Fluid Milk Products b/	Total
		Half-Gallons				Quarts					
		Home Delivered		Store		Home Delivered		Store			
		Glass	Paper	Glass	Paper	Glass	Paper	Glass	Paper		
Akron	32.57	4.17	4.76	8.66	7.90	25.55	1.13	6.86	4.11	4.29	100.00
Canton	12.34	31.02	0.54	18.37	2.19	15.14	5.17	5.23	6.83	3.17	100.00
Cincinnati	0.87	11.33	1.45	10.90	9.20	44.71	1.52	7.57	8.03	4.42	100.00
Cleveland	4.67	6.32	0.65	3.26	15.07	51.88	0.99	2.98	9.82	4.36	100.00
Dayton	1.70	4.19	6.30	1.13	7.04	56.76	6.72	2.38	8.44	5.34	100.00
Ironton	1.78	7.56	1.04	3.56	10.08	25.57	6.97	3.11	33.06	7.27	100.00
Toledo	1.48	0.42	1.62	3.18	18.29	55.50	3.65	5.06	6.51	4.29	100.00
Youngstown	4.16	11.31	3.04	37.26	19.18	14.36	1.21	2.71	3.28	3.49	100.00

a/ All gallons are sold in stores and are glass jugs.
b/ Includes chocolate, skim, buttermilk and in most cases, fluid cream.

Table 16

Daily Per Capita Consumption of Fluid Milk by Size of
Container Purchased in Eight Ohio Cities
(Pints)

| | Container | | |
City	Gallon	Two Quart	One Quart
Akron	1.16	.98	.86
Canton	1.15	1.03	.86
Cincinnati	.75	.99	.79
Cleveland	1.14	.99	.90
Dayton	.77	1.05	.91
Ironton	.62	1.05	.75
Toledo	1.11	1.03	.86
Youngstown	1.28	1.09	.92

Knowledge of Retail Milk Prices

Thirty percent of the 7,414 families interviewed knew the
approximate price they paid for milk, 36 percent did not know, 23 percent
gave the wrong price and 11 percent did not answer this question. If
consumers reported within two cents the correct price of milk, they were
considered as knowing the price.

Table 17

Consumers Knowledge of Retail Milk Prices,
Eight Ohio Cities, 1954-56

City	Knew Approximate Price	Don't Know	Wrong Answer	No Answer	Total Surveyed
	Number of Families				
Akron	348	388	230	71	1044
Canton	208	399	132	61	800
Cincinnati	135	396	232	53	816
Cleveland	563	606	578	256	2003
Dayton	340	310	185	165	1000
Ironton	52	69	1	29	151
Toledo	302	280	139	77	800
Youngstown	291	223	215	67	800
Total	2239	2671	1712	779	7414

For further analysis the records were sorted into two groups,
(1) those who knew the correct price and (2) those who either did not
or gave the wrong answer. The most significant difference between the
two groups was the place of purchase.

Table 18

Comparisons of Selected Characteristics, Those Knowing the Price
of Milk and Those Not Knowing
Eight Ohio Cities

	Knew Price	Didn't Know Price
Frequency of Purchase (No.)	3.09	2.70
Home Delivery (Percent)	39.0	62.0
Store Purchase (Percent)	61.0	38.0
Family Size (No.)	3.40	3.40
Daily Per Capita Consumption (Pints)	0.88	0.86

Those consumers who knew the price purchased 61 percent of their total supply at the store whereas the group who did not know the price purchased only 38 percent at this source. Since most of their milk was home delivered, they probably paid most of their bills on a monthly basis. If for the most part consumers do not know what the cost of fluid milk is, the question arises as to "how significant are changes in prices upon the consumption of milk?" In general previous studies suggest that the price elasticity is low. This lack of price knowledge may be one of the reasons why it is so.

MILK CONTAINERS - CONSUMERS LIKES AND DISLIKES

Part of the consumer's dollar which is spent on dairy products goes for services such as acceptable milk containers. The size, shape and kind of packaging used for these containers has undergone many striking changes in the past few years. New sizes of glass containers have appeared and the use of paper containers has become widespread. These modifications are largely the result of the change in technology, in methods of marketing, health regulations, transportation, and consumer buying habits. Since we live in a dynamic economy it may be expected that modifications and changes will continue.

Specifically, the objectives of this part of the study were to ascertain: (1) Consumers stated preference for size and type of milk container. (2) Consumers stated likes and dislikes for type and size of milk container. (3) The factors that influence consumers in the choice of these containers.

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Preferences

Consumers in the eight markets were asked "what container would you prefer if the price per quart was the same." The interviewer then would read off the various sizes and types of containers. The various sizes and types of containers were rotated in order to nullify any effect of their position in the question.

There was a wide range of preference in all cities. With the exception of Youngstown and Canton where two quart glass containers had the highest preference, the one quart glass was the most preferred container. In no market did preference for one container exceed 57 percent of the households interviewed.

The majority of consumers (over 60 percent) preferred the container they were presently using. In the aggregate, the glass one quart had a higher acceptance among its users than any of the other containers. For the average of all markets, the gallon jug is preferred less by its users than any other container. The reasons for this are discussed later.

Home buyers of milk tend to prefer the one-quart glass more than store buyers. Families buying at the store only, exhibited a greater preference for the larger size of container than those consumers buying at home only.

Table 19

Consumers Stated Preference as a Percent of the Families
Studied for Type and Size of Milk
Containers, Eight Ohio Markets, 1954-56

| Market | Paper | | Glass | | | No |
	1 Quart	2 Quart	1 Quart	2 Quart	Gallon	Preference
Akron	9.6	17.0	40.6	16.1	12.9	3.8
Canton	22.2	7.7	29.7	30.0	5.8	4.6
Cincinnati	17.9	11.7	49.9	18.5	.6	1.4
Cleveland	22.6	19.0	43.5	10.4	2.2	2.3
Dayton	20.6	13.2	56.9	5.3	2.9	1.1
Ironton	30.8	7.5	43.9	11.0	0.0	6.8
Toledo	16.5	19.1	54.7	3.8	.4	5.5
Youngstown	7.4	23.3	23.3	42.2	1.4	2.4
Average	18.46	14.81	42.81	17.17	3.27	3.48

Table 20

Percent of Consumers Preferring the Present Container Purchased,
Eight Ohio Markets, 1954-56

| Market | Paper | | Glass | | | |
	1 Quart	2 Quart	1 Quart	2 Quart	Gallon	Average
Akron	37.4	55.8	68.7	53.8	40.2	51.2
Canton	61.8	62.1	68.6	62.6	52.8	61.6
Cincinnati	61.1	64.0	71.6	74.4	00.0	54.2
Cleveland	55.2	63.0	64.0	49.7	39.1	54.2
Dayton	47.1	58.7	76.1	36.2	82.4	60.1
Ironton	49.3	72.7	68.4	77.0	00.0	53.5
Toledo	37.0	66.5	78.7	50.0	16.7	49.2
Youngstown	41.5	54.5	69.1	77.1	30.4	54.5
Average	48.8	62.2	70.3	60.1	32.7	

Glass containers were preferred by a majority of the families in the study. However, with the exception of Ironton, more families preferred milk in paper containers than received it that way.

Family income appears to have little correlation with container preference. As family size increased and the weekly quantity of milk consumed by family increased, preference for larger containers increased.

Likes & Dislikes

An analysis of the respondents stated likes and dislikes of the one quart glass, half gallon glass, gallon glass, and paper containers was made on the basis of the type of container presently used, per capita income, consumption per family and place of purchase. Following is a summary of the findings.[3]

THE ONE QUART GLASS CONTAINER

Likes

Thorough sterilization, ease of handling, habit, and taste appeal were the principle reasons given for liking this type and size of container. Whether segregated on the basis of container presently used, place of purchase, per capita income, or per capita consumption, these were the principle reasons, and accounted for between 59 and 66 percent of the total in all cases.

As weekly consumption rose, ease of handling became more important to consumers and habit as a reason for liking the one quart glass container declined. To the lower income groups, though, sterilization was of more importance than to the higher income groups to whom habit, thorough sterilization, and ease of handling was of almost equal importance.

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[3]The more detailed information prepared on this aspect of the investigation has been omitted from this bulletin because of limited space and the limited audience for such material. The information in chart and tabular form is available, however, for anyone having need for such details.

Dislikes

Dislikes for the one quart container were centered chiefly around inconvenience factors associated with the container. These factors were breakage, accumulation, washing and disposal. These factors accounted for between 77 and 88 percent of all the reasons given; in other words, respondents had more definite views about their dislikes than their likes.

Washing and damaging problems were most acute in the minds of glass container users, while paper users were more concerned with bottle accumulation and return of bottles. The higher income groups also tended to emphasize these reasons more than those consumers in the lower income groups.

HALF GALLON GLASS CONTAINER

Likes

As might be expected, there was considerable variation in the reasons given for liking the half gallon glass container. However, whether sorted on the basis of present use, place of purchase, per capita income or consumption, all emphasized economy as the main reason for liking the half gallon glass container. Present users of glass also considered ease of handling an important reason. They also stressed factors such as sanitary, easy to pour, and appearance as reasons for liking the half gallon glass container. It is noted that in some markets the half gallon and gallon container had not been in use any extended time before this study was made.

Dislikes

Difficulty in handling was considered by consumers to be the most important reasons for disliking the half gallon glass container. Store purchasers and users of paper had relatively few dis-

likes for this container. Problems associated with storing the container in the refrigerator were mentioned by a large group. Income apparently had little to do with the dislikes of consumers for the half gallon glass. All income groups gave "hard to handle" and "takes up too much space" with about the same frequency. Dislikes such as washing, returning and bottle accumulation decreased as weekly consumption rose.

GALLON CONTAINERS

Likes

The economies associated with large purchases was the principal reason given for liking the gallon jug. As incomes of consumers increased, this reason became less important. Paper users also considered this of less importance, probably because gallon units were not available in paper and they were not as familiar with such sized units. As weekly consumption rose, "economy" was given more often as a reason for liking the gallon glass container.

Dislikes

Problems associated with handling and storing accounted for over 70 percent of the reasons given by consumers for disliking the gallon glass container. At the time of the survey, there was practically no milk delivered to houses in this type of unit. Families with higher incomes stressed inconvenience more as a reason for disliking the glass jug than lower income consumers. Inconvenience as used here includes such reasons as "hard to open, pour and handle." These reasons together with the rate of consumption are reasons why the gallon jug did not dominate in the markets where it was available.

PAPER CONTAINERS

In this discussion of the paper container, the one quart and two quart units are treated together. It was impossible to separate these two sizes since in several markets the "twin pack" was in common use. Both consumers and interviewers had difficulty in such situations in the interpretation of questions and answers.

Likes

Reasons given by respondents for liking the paper containers can be broadly summarized as "convenience." This can be further defined as, (1) ease of disposal; (2) no bottle accumulation; (3) deposit eliminated and (4) no bottle washing. These factors were further separated on the basis of the container presently used, place of purchase, size of weekly consumption and per capita income. Generally speaking, ease of disposal and no bottle washing were the principal reasons for liking this type of container.

Dislikes

Reasons for disliking the container generally fell into four categories–(1) inconvenience (hard to open, pour and handle), (2) paper taste, (3) paraffin falls off and (4) leakers.

Paper taste was not considered as much of a problem by those now using paper, those buying at the store only or those using larger quantities of milk per week. Leakage and "paraffin falls off" were considered more of a factor by those buying in paper, buying at the store or buying larger quantities.

FACTORS AFFECTING CONSUMPTION

Theoretical Framework

The theory of demand provides the theoretical framework for estimating the influence of factors such as income, price and family consumption on fluid milk consumption. Demand may be defined as a schedule showing the various quantities which will be purchased by various individuals at different prices in a given market at a given time. When a product such as fluid milk is differentiated into different brands, and size of units the concept of total demand becomes less precise but it still may be regarded as the framework of explaining consumer demand for milk.[4]

The amount of milk a consumer will buy is naturally dependent upon a number of other factors besides price. Some of these factors are income, preference, family requirements, and the availability of substitutes.

The proportional change in the quantity of a product purchased with a given change in consumer income is known as income elasticity. Historically, basic foods such as milk have had low positive income elasticities. In other words, the increase in consumption is less than proportional to the increase in income.

Price elasticity of demand is defined as the relationship between a given percentage change in the price of a commodity and the consequent percentage change in the quantity purchased. If the demand for a product is elastic, the change in quantity purchased is greater

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[4]For a full discussion of product differentation, see Chamberlain, E.S., Towards a More General Theory of Value, Oxford University Press, 1957, p. 105.

than the proportional change in price whereas if the change in con-
sumption is less than the proportional change in price, it is inelastic.
This is important to producers since their total income is less with
an increase in supply if the demand for the product is inelastic. In
general, the several studies which have been made of consumer response
to price have indicated that the price elasticity of milk is inelastic
ranging from - 0.06 to - .48.[5]

Income

To facilitate analysis consumers were placed in six income
groups as follows, (1) under $1,000, (2) $1,000 to 2,500, (3) $2,501
to 4,000, (4) $4,001 to 5,500, (5) $5,501 to 7,000 and (6) $7,001 and
over (Table 5). In those cities where the number of families with
incomes of less than $1,000 was insignificant this category was dropped
from the analysis.

There appeared to be little relationship between the size
of consumers income and the place of milk purchase. In general home
delivered milk was higher priced on a per quart basis than store pur-
chased milk but about 50 percent of the consumers in each income group
had their milk home delivered (Table 21). In other words, many other
factors along with income and price seem to determine the shopping habits
of milk consumers.

One might think that the lower income groups would buy fluid
milk in its lowest priced form, namely in half gallon and gallon con-
tainers at the store. This did not however appear to be the case
(Table 22). One of the reasons why consumers with incomes of $2,500
or less bought milk in higher priced units (on a per quart basis) may

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[5]U.S.D.A., The Demand and Price Structure for Dairy
Products, Technical Bulletin 1168, p. 109.

be the fact that they did not on the average consume as much per person as those groups enjoying higher incomes.

This is evident in Table 23 and Chart 3 which indicates that the mean per capita consumption of those groups earning between $1,000 and $2,500 per year was .779 pints per day compared with .910 pints per day for those in the $2,501 to $4,000 range and .9640 pints per day for those families with incomes between $4,001 and $5,500. When tested statistically, the mean per capita consumption in the two highest income groups was found not to vary significantly from that of the $4,001 to $5,500 group. As illustrated in Chart 3 the curve is concave, indicating an increase in consumption at a decreasing rate at the higher income levels until if perhaps decreases for the highest income group.

Table 21

The Relation of Family Income and Place of Purchase
Eight Ohio Markets, 1954-56

Income Group	Place of Milk Purchase		
	Home Delivered	Store Purchases	Home & Store
		- Percent-	
Under $1,000	51.3	43.6	5.1
$1,000-2,500	45.8	49.9	4.3
2,501-4,000	43.0	49.9	7.2
4,001-5,500	48.6	42.2	9.2
5,501-7,000	50.5	41.2	8.3
7,001 & over	49.6	42.5	7.9

Table 22

Percent of Milk by Volume Purchased by Two Methods,
by Income Groups, Eight Ohio Markets, 1954-56

| Income Groups | Percent of Total Milk Purchased | |
	Home Delivered 1 Qt.	Store Purchase ½ Gal. & Gal.
Under $1,000	51.6	19.6
$1,000-2,500	41.2	27.7
2,501-4,000	35.3	35.6
4,001-5,500	40.5	32.9
5,501-7,000	40.6	32.8
7,001 - over	49.4	23.2

Table 23

Family Income and Daily Per Capita Consumption,
Eight Ohio Markets, 1954-56

| Family Income | Mean Per Capita Consumption |
	Pints Per Day
Under $1,000	.6950
$1,000-2,500	.7799
2,500-4,000	.9100
4,001-5,500	.9640
5,001-7,000	.9797
7,001 & over	.9505

CHART III

FAMILY INCOME AND PER CAPITA MILK CONSUMPTION
EIGHT OHIO FLUID MILK MARKETS

CONSUMPTION IN PINTS PER DAY

1.0

.9

.8

.7

.6

.1

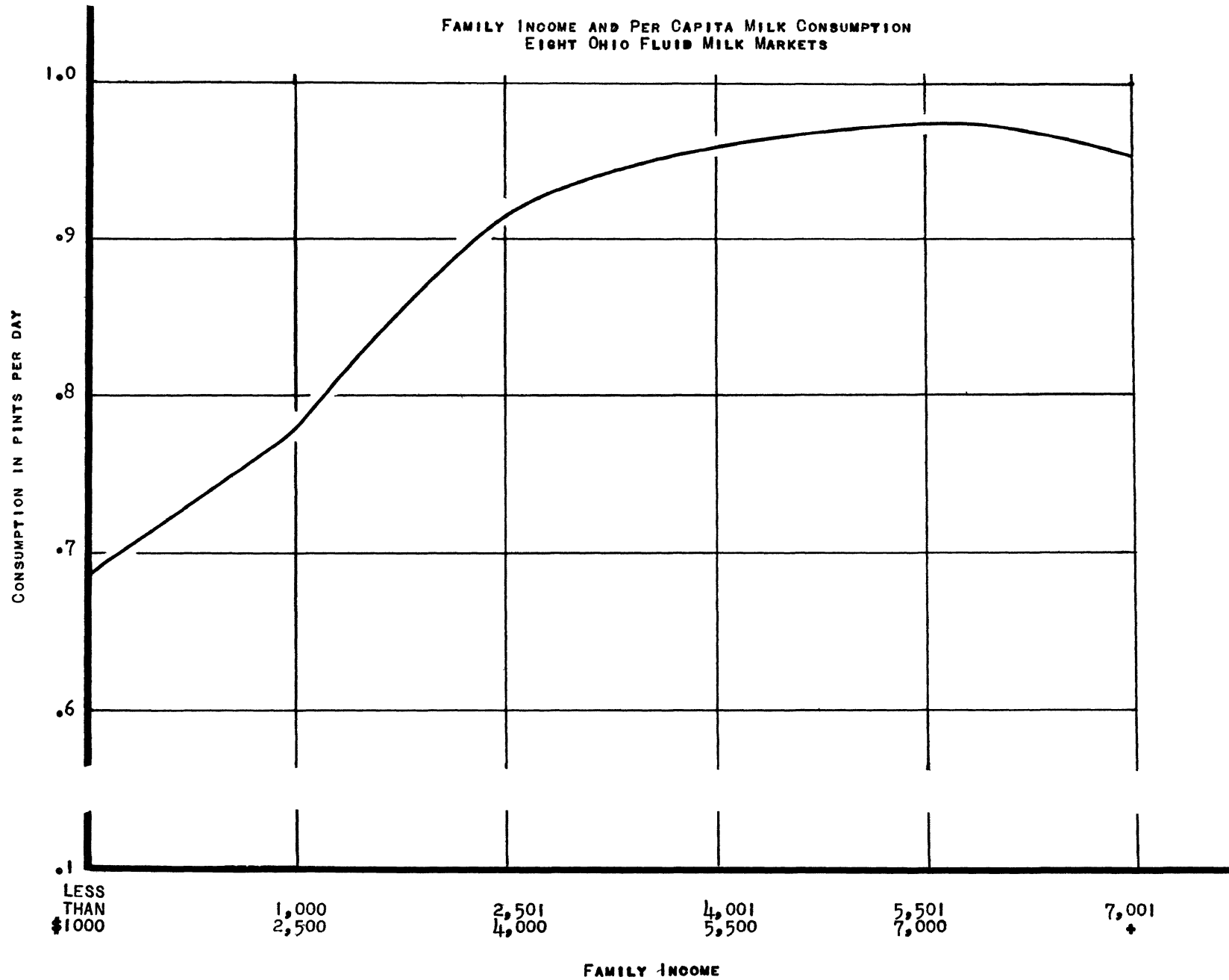| LESS THAN $1000 | 1,000 2,500 | 2,501 4,000 | 4,001 5,500 | 5,501 7,000 | 7,001 + |

FAMILY INCOME

34

Table 24

Mean Daily Per Capita Consumption of Milk by Given
Annual Family Income, Eight Ohio Milk Markets, 1954-56

Family Income	(Pints Per Day) Per Capita Consumption							
	Akron	Cincinnati	Cleveland	Dayton	Ironton	Toledo	Canton	Youngstown
Under $1,000	1	1	.73	.73	1	1	.51	1
1,000-2,500	.87	.68	.75	.89	.58	.77	.74	.83
2,501-4,000	.93	.81	.92	.90	.72	.92	.89	.97
4,001-5,500	1.00	.87	.97	.91	.84	.92	.99	1.08
5,501-7,000	1.10	.89	.98	.99	.80	.93	1.01	.99
7,001&over	1.02	.80	.98	.93	.92	1.04	.96	.97
No reply	.86	.75	.79	.78	--	.95	.71	.78

[1] Insufficient number for valid sample.

Table 24 illustrates the mean per capita consumption by income groups in the cities studied. A test of significance was made to see if the average daily per capita consumption varied significantly (at the 5 percent level) between various family income groups within the same market. In the Cincinnati, Cleveland, Toledo and Canton markets there was a significant difference whereas in Akron, Dayton, Ironton, and Youngstown no significant differences were found.

Size, Age of Family, and Per Capita Consumption[6]

Is there any relationship between size of family, age composition of the household and per capita milk consumption? In order to answer this question the records of those households of family size 2 to 6 were analyzed on the basis of family size and then on the basis of age; that is, adults under 50 years; adults over 50 years, and children under 10 years and over 10 years of age (Tables 25, 26 and chart 4).

The means for each family group were computed along with the standard error of the mean. At the 95 percent confidence interval there was a significant difference in the per capita consumption between families of size two, three and four. However, the difference in the per capita consumption of family sizes 5 and 6 was not significantly different than that of family size 4.

Table 25

Family Size and Per Capita Milk Consumption,
8 Ohio Markets, 1954-56

Family Size	Mean Per Capita Consumption	Standard Error
	Pints Per Day	
2	.7355	.227
3	.9331	.298
4	.9979	.308
5	1.0410	.413
6	.9895	.583

Per Capita
Consumption
(pints)

1.2@

1.10

1.00

.90

.80

.70

2   3   4   5   6
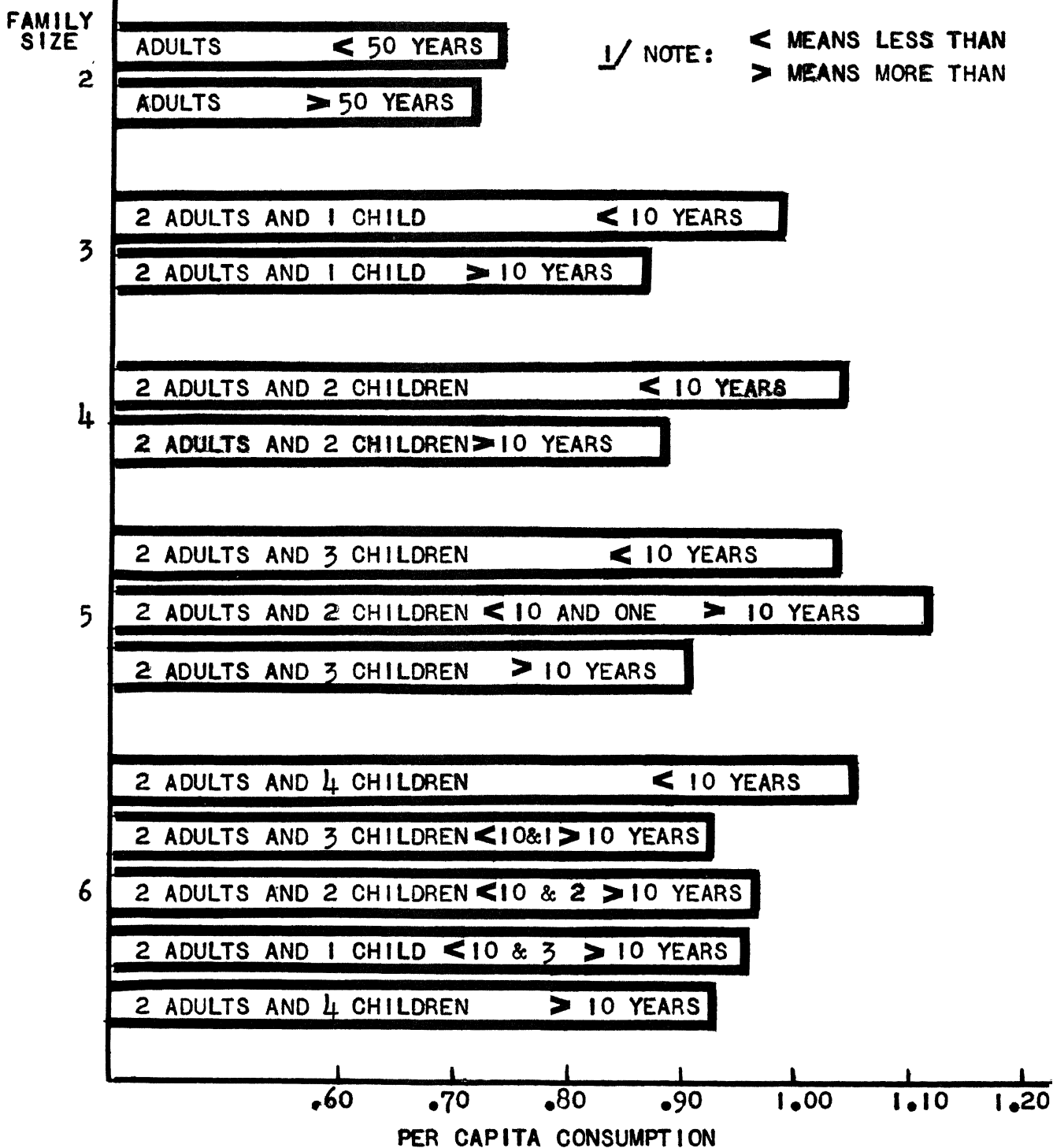
Family Size, No. of Persons
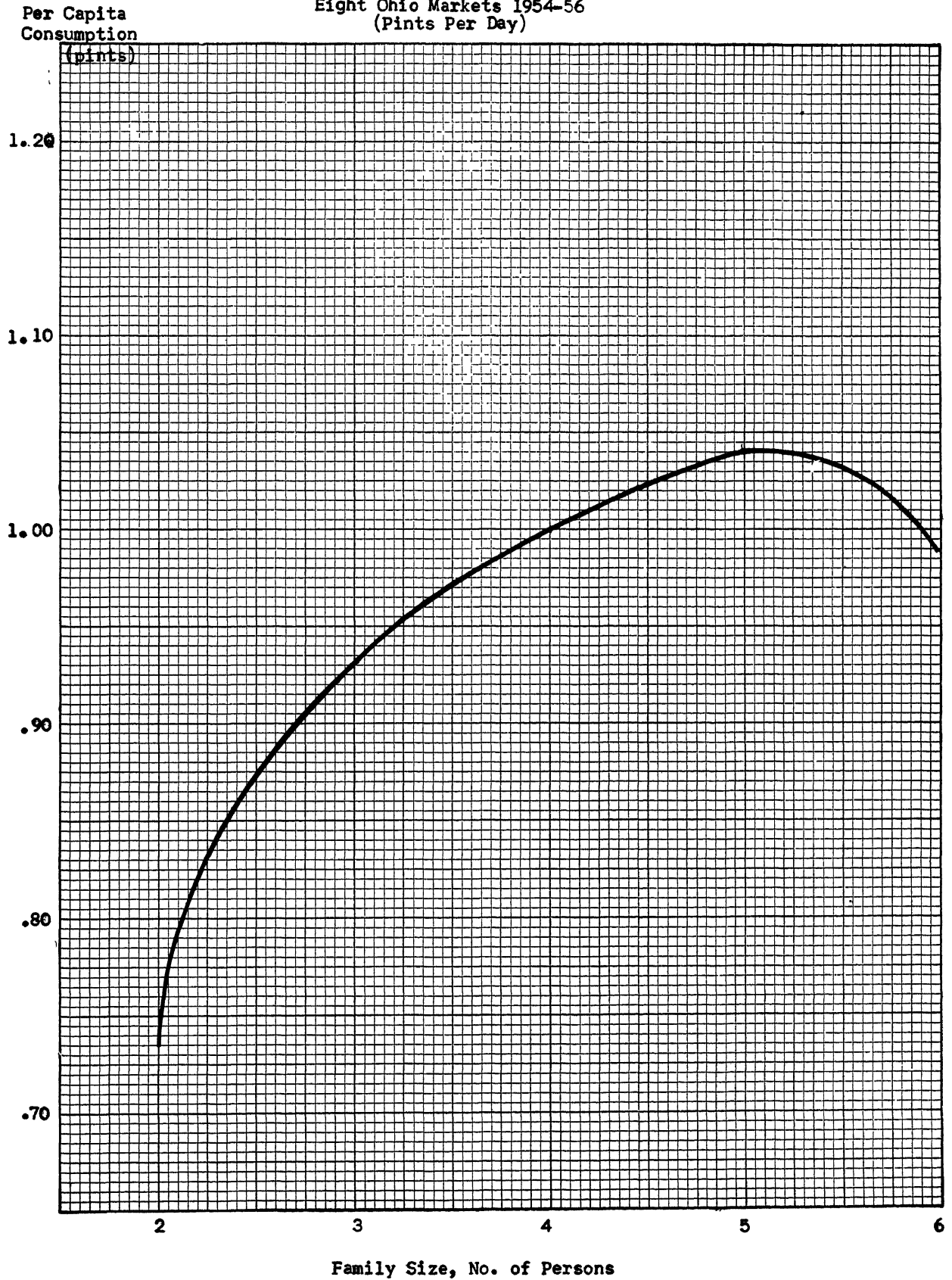
When further analyzed on the basis of family size and age there was a significant difference (F test) in the per capita consumption between families of three with one child under ten years of age and those with a child over tan years of age. In the next group, a family of four with two children under ten had a significantly higher mean per capita consumption than a family of four with two children over ten; namely, 1.04 pints per day compared with .89 pints per capita per day. Within families of five and six however, there was not a significant change in per capita consumption with a change in age composition, Table 26 and Chart 5.

Table 26

Mean Per Capita Consumption by Size of Family
and Age of Family, 8 Ohio Markets, 1954-56

| | | Children | | | .05t Times[2] |
Family Size	Adults	Less Than 10 Years of Age	More Than 10 Years of Age	Mean Per Capita Consumpt.	the Standard Error
				Pints Per Day	
3	2	1	0	.9817	.0405
3	2	0	1	.8675	.0438
4	2	2	0	1.0432	.0373
4	2	0	2	.8900	.0552
5	2	3	0	1.0417	.0516
5	2	2	1	1.1196	.0832
5	2	0	3	.9073	.1225
6	2	4	0	1.0534	.0984
6	2	3	1	.9306	.1223
6	2	2	2	.9724	.1230
6	2	1	3	.9597	.1526
6	2	0	4	.9339	.2958

[2] The mean this value equals the 95 percent confidence limits.

CHART V
FAMILY SIZE, AGE OF FAMILY, 1/ PER CAPITA CONSUMPTION
EIGHT OHIO MARKETS, 1954-56

FAMILY SIZE

1/ NOTE:
< MEANS LESS THAN
> MEANS MORE THAN

2
- ADULTS < 50 YEARS
- ADULTS > 50 YEARS

3
- 2 ADULTS AND 1 CHILD < 10 YEARS
- 2 ADULTS AND 1 CHILD > 10 YEARS

4
- 2 ADULTS AND 2 CHILDREN < 10 YEARS
- 2 ADULTS AND 2 CHILDREN > 10 YEARS

5
- 2 ADULTS AND 3 CHILDREN < 10 YEARS
- 2 ADULTS AND 2 CHILDREN < 10 AND ONE > 10 YEARS
- 2 ADULTS AND 3 CHILDREN > 10 YEARS

6
- 2 ADULTS AND 4 CHILDREN < 10 YEARS
- 2 ADULTS AND 3 CHILDREN < 10 & 1 > 10 YEARS
- 2 ADULTS AND 2 CHILDREN < 10 & 2 > 10 YEARS
- 2 ADULTS AND 1 CHILD < 10 & 3 > 10 YEARS
- 2 ADULTS AND 4 CHILDREN > 10 YEARS

.60 .70 .80 .90 1.00 1.10 1.20

PER CAPITA CONSUMPTION

Income, Family Size and Age Composition

In order to consider the influence of these three factors independently of one another a single equation least squares approach was used where:

Y = dependent variable, per capita milk consumption per day.

X_1 = Family income, Groups 1 to 5.

X_2 = Number of Children under 10 years of age - 0 to 6.

X_3 = Family Size, - 1 to 8.

The resulting regression equation was:

$$Y = .7897 + .0172X_1 + .0952_2 - .0157X_3.$$

The net regression coefficients for family income and family size were significant at the .01 level and that for the number of children at the .001 level (Table 27).

Table 27

Statistical Values Related to the Demand for Fluid Milk,
All Households, 1954-56.

Variable	Mean	Regression Coefficient	Standard Deviation	"t" Value
X_1	.0313	.017	.0053	.0327
X_2	.0075	.0952	.0081	.1171
X_3	.0339	-.0157	.0060	-.0262
Y	.8621			

From the equation per capita milk consumption is the sum of the net amount associated with each independent variable plus the value of "a" (.7897). This means that per capita milk consumption increases .0172 pints per person per day with an increase of $1,500 in family income.

With every increase of one child under ten milk consumption increased .0952 pints per day and with every increase of one in the total family it decreased .0157 pints per capita per day.

The number of children under 10 was the most important factor in this group. For example in 1 year the addition of 1 child under 10(other factors held constant) would add 17 quarts to the annual per capita consumption in a household whereas the addition of $1,500 income would add 3 quarts per household. An increase in family size without regard to age would reduce milk consumption by about three quarts. As one would expect the rate of family formation, the views of parents regarding family size and family income appear to be important factors influencing the demand for milk.

The Influence of Price

Consumer milk pricing is important to the producer not only for its effect on the derived demand for his product but also for the continuity of his market. Processors are also interested in pricing for manifold reasons, including the maintenance of their market share and to maximize profit. Consumers are interested in milk pricing in order to weigh possible alternative buying procedures and to, consequently, maximize their pleasure or want satisfaction.

As previously discussed, certain practices relative to prices were pointed out. These points of interest were:

(1) Less than two-fifths of the households contacted knew the exact price paid per unit within two cents.

(2) Low income families don't buy the lowest price milk (based on a per quart out of pocket cost) to the exclusion of higher price milk.

(3) Generally, milk purchased at the store is cheaper than milk delivered at the home. (Assuming that consumers don't go to the

store just for milk). Families buying at the store do not buy significantly larger amounts per person than do families buying at home.

(4) Larger size of containers generally sell at a lower price per quart than do containers of a smaller size. Users of the larger containers usually have a higher per capita consumption than do users of smaller or one quart container. However, purchasers of the multiquart containers generally have a larger size of family than do purchasers of the smaller size containers.

Although the difficulties are complex in ascertaining price/quantity relationships, the importance of this relationship is strategic to an understanding of the economics of the industry. The following chart shows the relationship of the average price per quart of milk with the average per capita annual consumption of milk by individual markets. It does indicate that milk is an inelastic product with respect to price.

Chart (5) also illustrates the relationship of the average price per quart of milk to the average weekly per capita consumption by individual markets. A quadratic regression equation was fitted to the data and was found to explain 83 percent of the variation between cities and was significant at the .01 level. The equation was as follows:

$$Y = 9.7593 + 1.3652X - .0353X^2 \quad [7]$$

This equation indicates that if the price of milk was 21.11 cents per quart then per capita consumption (Y) would equal 3.33 quarts per week.[8]

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[7]This equation is the result of using data from the eight selected cities. The addition or deletion of cities could alter the shape of this curve.

[8]$Y_c = -9.7593 + 1.3652 (21.11) - 0353 (21.11)^2$

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The actual consumption in Toledo at this price was 3.26 quarts per week.
This chart indicates that in the markets studied there was a relationshi
between the price of milk and its consumption. For example the elastici
between Youngstown and Toledo was - .54. In other words an increase in
price of 10 percent was accompanied by a decrease of 5.4 percent in the
quantity consumed.

However, the reader is cautioned that the elasticity com-
puted here is between different markets, not between consumers in the
same market. Each market has different characteristics as was indicated
in Table 1. At a different time and under different circumstances the
elasticity could be quite different but the data is in keeping with
previous studies which have shown fluid milk to be an inelastic product.

CHART 6
WEEKLY PER CAPITA MILK CONSUMPTION IN EIGHT OHIO MILK MARKETS
AS RELATED TO ESTIMATED AVERAGE PRICE PAID, 1954-56

PRICE PAID PER QUART
(CENTS)

WEEKLY PER CAPITA MILK CONSUMPTION IN QUARTS
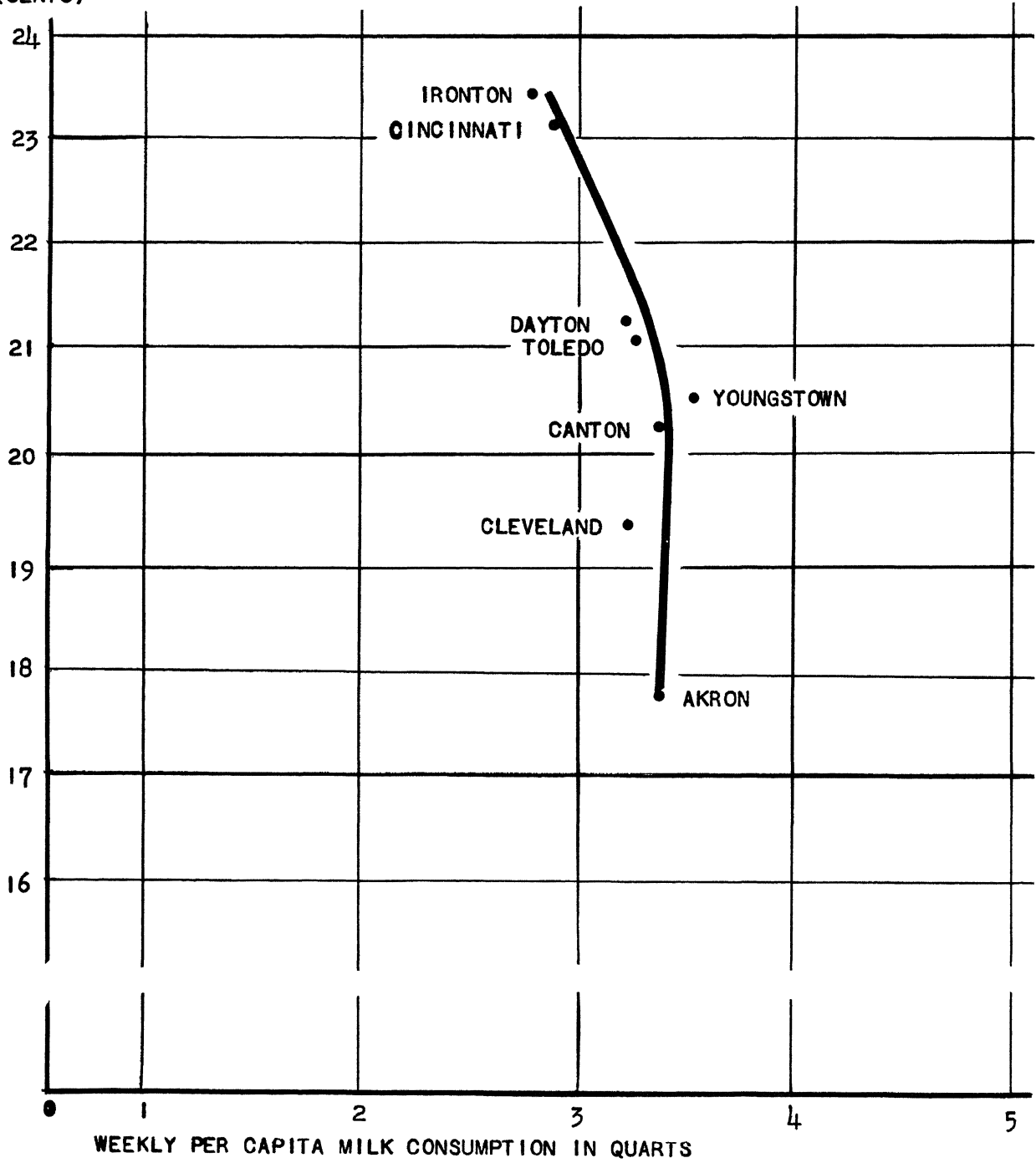
SUMMARY AND CONCLUSIONS

This study of eight Ohio milk markets was made to ascertain differences in the various milk market systems and their consequences. The analysis revealed that markets exhibited variation both within and between markets in regard to types of milk containers, size of milk containers, methods of delivery and per capita milk consumption. Some of the findings were as follows:

1. In all cities at least 1/5 of the fluid milk purchased was bought at the store with one market Youngstown buying 69% of their milk at the store.

2. Generally families buying at store only, preferred the larger sized container to a greater extent than those who had all their milk home delivered.

3. The place of purchase had no consistent effect upon per capita consumption. Households who bought both at the store and at home generally had the highest per capita consumption and the highest number of deliveries per wee

4. Per capita milk consumption tended to go up as family size went up from one to five and then tended to dimini: slightly.

5. In general, families purchasing in large sized containe] were the larger sized families.

6. Of the total families interviewed a larger number ex- pressed preference for glass containers than paper containers however paper containers were preferred by more families than were presently using this type of containe

7. Consumers tended to prefer the container they were presently using. Although their preference never exceeded 83 percent.

8. Income had little influence on container preference or useage.

9. When this study was made and within the income scales used, per capita consumption tended to increase as incom went up. The rate of increase decreased as incomes passed the $4,750 level. After this level of income differences in per capita milk consumption was not statistically significant.

10. The majority of families did not know within two cents of the price of milk. Those who knew the price purchased most of their milk at the store.

11. Of the age groups 0-10, 11-20, 21 to 50, and 51 and over, the age groups of 0-10 had the most effect on increasing per capita milk consumption while the age group of over fifty years of age had the effect of decreasing consumption.

12. Differences between per capita milk consumption among families can only be partially explained by family income, family size and family makeup of various age groups.

13. Both family consumption and containers used are associated with family requirements.

Both between and within markets, there is evidence that consumer behavior with respect to milk distribution systems differ considerably. In no case had the entire marketing system turned to only one type or one size of milk container, one type of delivery or one price. Neither did one income group or one size of family turn entirely to one method of delivery or one size of container. Evidentally both from the viewpoint of the distribution firm and the consumer, a variety of services and product differentiation is desired. Both price competition and quality competition were present in the markets studied. Neither from an intra-market or inter-market analysis could these markets be considered homogenous throughout.

In none of the eight cities had the lowest out of pocket priced milk taken over the entire milk market. Although relative price of milk is a major factor, there are obviously other factors which influence the buying decisions of consumers. Some of these were family size, age composition, income and family preferences.

Both family consumption and container used appeared to be associated with family requirements. This study indicated that after a level of consumption equivalent to .9 to 0.1 pint per person per day

was reached it becomes increasingly difficult to obtain higher consumption levels. Seemingly other goods and/or services are generally considered as superior by consumers after a certain level of milk consumption is obtained. Thus, a relatively low price elasticity for fluid milk was found for the short time period studied.

From this study, it would appear that total expenditures for fluid milk would not increase with price reductions to consumers. However, producers and processors might be affected differently both as groups and individuals with an expansion of total volume of milk sold. As the incomes of the present low income groups expand some increase in fluid milk consumption may be forthcoming.

This study is based on a cross-sectional or instantaneous study of the markets involved. Further research based on the study of the same markets over time might reveal different results. Studies over time when various methods of marketing and milk price had changed, would aid in establishing relationships between marketing systems and consumption. One such study was made in Cleveland (1958) and in Dayton (1959) by R. H. Pollock and the authors. Studies of individual families might aid in establishing the reasons behind the large variations between family consuming units.