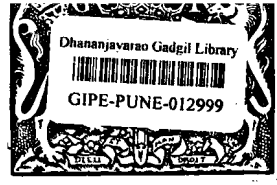


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MINISTRY OF AGRICULTURE AND FISHERIES

# Report of the REORGANISATION COMMISSION FOR PIGS AND PIG PRODUCTS



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## PART VII.—GENERAL EFFICIENCY RECOMMENDATIONS: BACON CURING.



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## MINUTE OF APPOINTMENT.

In accordance with Section 15 of the Agricultural Marketing Act, 1931, we hereby constitute—

COL. THE RT. HON. G. R. LANE FOX, P.C., J.P., D.L.,
SIR WILLIAM S. HALDANE, W.S.,
H. G. HOWITT, Esq., D.S.O., M.C., F.C.A.,
LT.-COL. SIR WYNDHAM PORTAL, Bart., M.V.O., D.S.O., and
THE HON. JASPER RIDLEY,

as an Agricultural Marketing Reorganisation Commission for Great Britain, and charge it with the duty of preparing, in accordance with the provisions of the Act, a scheme or schemes (applicable in England and Scotland) for regulating the marketing of pigs and any pig products, and we direct that the Commission, in the course of preparing any scheme as aforesaid, shall—

(*a*) Investigate the extent to which its operation could be facilitated by co-operation between the board administering it and any corresponding body in Northern Ireland;

(*b*) investigate the manner in which its operation could be facilitated by the quantitative regulation of imports of pigs and bacon and by similar or different measures affecting other pig products;

(*c*) investigate the manner in which such regulation could best be undertaken in the public interest;

(*d*) investigate any other matter affecting the operation of any such scheme; and

(*e*) make recommendations with respect to the matters investigated.

We further appoint Col. The Rt. Hon. G. R. Lane-Fox, P.C., J.P., D.L., to be Chairman; Mr. J. B. Baber, M.C., T.D., to be Secretary; and Mr. A. R. Manktelow to be Assistant Secretary of the Commission.

(Signed) JOHN GILMOUR,
Minister of Agriculture and Fisheries.

(Signed) ARCHIBALD SINCLAIR,
Secretary of State for Scotland.

21*st April*, 1932.

## FOREWORD.

Much has been written on the subject of the average consumption of liquid milk per person in various countries of the world. There appears to be general agreement on one point, that the amount is smaller in Great Britain than anywhere else. This assertion is usually backed by comparative figures which appear to prove the truth of it. For two of the countries commonly quoted in this connection, it can be stated that no national data exist, though estimates have been made for certain cities or local areas. With regard to Great Britain, no national data appear to exist. Certainly, the average milk consumption in Scotland was not known even approximately. The present inquiry was undertaken to secure the information.

The authors show the difficulty of arriving at the real figure. They subject to critical review methods, including their own, which have been used to find the figure. They point out the chief fallacies which lead to error and which must be avoided or corrected.

In the present inquiry the average liquid milk consumption has been recorded for a large number of Scottish households in all the large cities, all the important towns, many smaller places, and a number of rural and industrial districts.

Four main sources of information were available, co-operative societies, private retailers, health visitors and nurses, and Education Authorities. The figures provided by these various agencies covered every variety of district and community, urban, rural, industrial, and agricultural.

It will be seen that consumption varies greatly in different localities. In the large burghs the figures are in the aggregate lower than in the county districts. In individual burghs they vary from 0·27 pint in Hamilton to 0·70 pint in Perth. In counties the variation is also great, from 0·30 pint in Lanark to 1·03 pint in Aberdeen. The averages for the aggregates are (1) large burghs 0·417; (2) counties exclusive of large burghs 0·550; and (3) Scotland as a whole 0·479 pint per head per day.

The map shows the average milk consumption in the individual counties. Also it illustrates that the country, so far as milk consumption is concerned, falls into three broad regions—the border counties, the industrial belt, and those north of this belt. The variations have been related to certain indices of environmental and health conditions, and it is shown that milk consumption per head of population tends to be lower than average in areas where overcrowding and mortality are heaviest.

The Department's cordial thanks are extended to all those—co-operative societies, private retailers, and local authorities and their public health and educational staffs—who so willingly gave their help in collecting the data which were essential for the purpose of this investigation.

J. L. BROWNLIE.

DEPARTMENT OF HEALTH FOR SCOTLAND,
EDINBURGH, *October* 1933.

## MILK CONSUMPTION IN SCOTLAND.

### Introductory.

The statement is often made that the consumption of liquid milk per head of the population in the British Isles is extremely low when compared with various other countries. Occasionally actual figures are given usually to the effect that in Canada the consumption is double, in the United States of America three times as much, and in Denmark and Sweden six times as much. Such statements are based upon an estimated average consumption in Great Britain of from one-third to one-half of a pint per head per day. We are not aware of the statistical basis upon which these definite figures are quoted. We are, however, officially informed that as far as the United States of America are concerned, and also as far as Denmark is concerned, there are no figures in existence to warrant these conclusions. (See Appendices II and III, pages 28, 30.)

Some information on the subject was collected for the Ministry of Food during the War and was published in the final report of the "Astor" Committee; but the times were abnormal and the figures limited. (See Appendix IV, page 30.)

In Scotland no sufficient evidence has hitherto been available to justify any general and definite statement of the milk consumption, though individual local authorities have from time to time made estimates for their own area. It was to supply that evidence that this national investigation has been carried out.

The year 1931 was specially suitable for the purpose because the general census was taken during that year. The figures in this report can therefore be related to the present number of the people. The average number of persons per household for each area was not available at the time of analysis; so that to relate the figures obtained from co-operative societies and retail dairymen to the number of persons covered by these returns we have been compelled to rely on the average number of persons per household found from the health visitors and/or schools inquiries.

### Fallacies to be avoided.

It can be readily realised that to arrive at a reliable statement of the average consumption of any article of diet for a population of millions is an extremely difficult thing. The conditions of life amongst such a large number of people will vary immensely as will their habits. In a country like Scotland we find the crowded industrial areas; the scattered population of the Highlands; the small towns, some industrial and some centres of agriculture; the country districts, some with scattered mining villages and some entirely given over to farming. One great city, Glasgow, stands out

by itself for population and diversity of occupation among its inhabitants.

It is probably impossible to obtain a perfectly accurate figure for the average consumption of milk per head per day for these millions of people living such diverse lives. Even if it were possible such a figure would be true only for the time at which it was obtained and would vary with many factors, economic, seasonal, and others, at different times. But such an exact figure, interesting though it might be, is not the most important thing. What is of much greater importance is to know whether the average consumption is equal to, more than, or less than, the amount believed to be advisable; how the amount consumed varies in cities and rural areas, and in different parts of the country and in different parts of the same area. These facts are of value to those whose duty it is to plan and carry out the policy of legislation which deals with national nutrition, and this special inquiry has been planned in the hope of providing this information in respect of milk.

In the endeavour to arrive at reliable figures for the purpose in view there are certain methods of calculation which, though at first sight obvious—and often used—are in reality very fallacious.

It seems quite simple to say that if a city of 40,000 people uses 40,000 pints of milk per day the average consumption is one pint per head of the population. It is almost certainly nothing of the kind. In that city there may be a margarine factory using a thousand gallons of milk per day, and exporting all the margarine elsewhere, which at once brings down the average by one-fifth. There may be biscuit factories, chocolate factories, bakers, ships, trains, animals, and places outside the city all partly or wholly supplied from the 40,000 pints coming into the city. When all these are allowed for, if it were possible to do that accurately, the average consumption in such a place will be found to be very much less than one pint per head. The simple calculation of the amount of milk divided by the number of the population is quite useless except in some small isolated communities where all the milk is known to go for household use.

Again, in certain of the larger towns especially, a number of people take a certain amount of milk daily in the morning from the same retailer, but later in the day add to this by purchasing a further small quantity, as required, from street vendors.

Still other people deal with two retailers. Such considerations apply more or less to many places in Scotland and have to be borne in mind in reading statistical results. They make it necessary to approach such an inquiry from various angles, so that the results obtained from one line of investigation may be compared with those obtained otherwise. It follows also that the results must be sought for over as wide an area as possible, from all kinds of places, from every grade of the population, and from as many random sample households as possible. In that way only can a reliable figure be

obtained, and in that way we have in this inquiry endeavoured to avoid as many fallacies as possible.

It should be noted that this inquiry deals with the consumption of liquid milk only. It takes no account of the amount of milk consumed in the form of cheese, butter, cream, margarine, or the many foods into which milk enters in various proportions. Neither does it deal with imported dried or condensed milks, except where these have been a special subject of investigation by a local public health authority, for example, in Glasgow.

**Lines of Inquiry.**

Since such a large proportion of the population of Scotland is contained in the four large cities of Glasgow, Dundee, Edinburgh, and Aberdeen, it seemed advisable to consider them first. Conferences were held with the Public Health officials and lines of inquiry to be followed up were agreed upon. The following were the principal sources of information, and with some variations and additions were employed for the whole country.

**(1) Co-operative Societies.**

In nearly all the towns of any size the largest distributors of milk are the co-operative societies. They also keep very accurate figures relating to their business. They gave most ready assistance and no less than 84 of these societies, scattered all over Scotland, supplied details of their average milk distribution. They were asked to supply figures for a given average day showing (*a*) the total amount of milk handled that day; (*b*) how it was disposed of; (*c*) the amount supplied to households; and (*d*) the number of households supplied. The month of April was selected for this part of the inquiry as it was important that the returns should refer to a period when the population was as normal and stationary as possible, and not to the holiday or tourist season. It was also the month in which the census was taken.

**(2) Registered Dairies.**

Local authorities all over the country were asked to obtain a return similar to that of the co-operative societies from all their registered dairymen. This was also done in the month of April, and most dairies gave the information required.

**(3) Health Visitors and Nurses.**

A number of Health Visitors and Nurses in various parts of Scotland were asked to ascertain from each house visited *in the ordinary course of their work* (*a*) the number of persons in each house; (*b*) the number of adults, over 15 years; (*c*) the number of children in each house, under 15 years, and (*d*) the amount of milk taken daily *in each house*. Nearly all the medical officers regard this line of

inquiry as very valuable, most reliable, and strictly accurate. From the various parts of Scotland no less than 15,187 households containing 80,242 persons were thus recorded. This was done over a period of some ten months.

**(4) Returns from Schools.**

With the consent and approval of the Scottish Education Department a number of Head Masters and Mistresses of all kinds of schools all over the country were asked to ascertain from their senior scholars the same facts as those recorded by nurses and visitors, namely, total persons in house, number of adults and children, and the amount of milk taken per day. This inquiry was carried out in the autumn after the summer holidays, and therefore covers a different period of the year. The returns were checked for reliability in various ways. From this source of information returns were obtained covering no less than 66,149 families containing 393,726 persons.

It is a matter of opinion which of these various lines of inquiry has given the most strictly accurate returns. We are of opinion that returns of the Health Visitors and Nurses, which are the result of house-to-house personal visitation and inquiry, are very reliable indeed. The returns from the senior scholars of the schools are also likely to be very accurate, and in many cases were carefully supervised by the teachers. Many of the co-operative milk distributing firms keep very accurate records of their sales, and the same is true of many registered dairymen, and where there was reason to doubt this the return was omitted. As a consequence, and taking into consideration the large number of persons recorded and their general distribution throughout Scotland, the margin of error cannot be great. It is well, however, to consider further the possible manner in which such estimates may mislead.

**Possible Fallacies in the Lines of Inquiry adopted.**

In obtaining a figure to represent the average consumption of milk either for the country as a whole or for any of its subdivisions, it is essential to keep in mind the possible fallacies which may arise in the sampling methods adopted and vitiate the findings obtained. In the present inquiry data were, as previously explained, obtained principally from four sources, and we must be clear on the inherent defects of each and all of these lines of approach to the problem at issue.

**(1) Co-operative Societies.**

The basic data from this source were lists showing the total amount of milk supplied to a particular number of families on a representative day. This method of judging the amount of milk consumed is subject to several possible sources of error.

(*a*) The societies are not found in each of the individual areas of Scotland, being unrepresented in the returns from scattered rural districts of the north and only slightly represented in the border counties of the south. The returns we have obtained from this source are, in fact, derived principally from the industrial belt of the country and from the larger aggregates of population elsewhere. Unless, therefore, there were no substantial differences in the milk consumption in the several areas of the country, and in particular unless there is little divergence in this respect between urban and rural communities, such findings would be misleading as an index of the consumption in the country generally. In view of the results presently to be set forth, this limitation of co-operative society returns to certain defined areas of the country will result in an average value for *per capita* consumption of milk per day which is almost certainly an underestimate. There may be a compensating factor here in that, in the areas so covered by these co-operative activities, the families are over-average in size and composed of young children, among whom milk is a greater source of food supply than in adults. It is not clear, however, that this is so.

(*b*) A perhaps more important source of vitiation is that, even in communities where co-operative methods are the rule, there are many families whose total milk supply is derived from more than one source, e.g. co-operative society and retail dairymen. Obviously, therefore, the total milk turn-over of a particular society divided by the total families or total persons to whom it is delivered may be a gross distortion of the actual per family or *per capita* consumption. Here again the error will be in the direction of underestimation.

(*c*) Co-operative activities may appeal only, or more particularly, to a special section of a given community. If, for example, within a given area the source of supply were selective in respect of social class or some similar factor differentiating families which may affect or be related to the amount of milk consumed, the findings, based on society returns, would certainly not be a true reflex of general community conditions. How far in actual practice selection of this nature operates, we simply do not know.

(*d*) Since in the vast majority of these data provided by co-operative societies we have only been able to obtain the total number of *families* to which a certain amount of milk was supplied (this same factor applies in the case of returns from retail dairymen), to arrive at the *per capita* consumption of milk, we have utilised the results from the remaining two sources, health visitors and schools, to provide an indication of the average size of family in that area. Obviously, if selection of a special kind pertains to the co-operative figures (or conversely to the health visitor or school figures), the value of the *per capita* figures so calculated may again be diminished from this source of error. (The recent census figures of size of family in individual areas were not utilised for this purpose, since at the time of analysis these were only published for a small pro-

portion of the total districts; and in any case the same objection as stated here is applicable with equal force.)

**(2) Retail Dairymen.**

In estimates made from this source of information, distortion may arise because—

(*a*) the figures given may, as in the case of co-operative societies, represent only a fraction of the actual total milk consumed by a given family, owing to overlapping in the sources from which the supply is derived; and

(*b*) the *per capita* figures are only exact in so far as the school and health visitor data provide an accurate measure of average size of family.

It will be noted from Table 1 and later tables that the total households covered by the retail dairies' and co-operative societies' inquiries numbered 830,665, and that the total (estimated) persons within these households are 4,759,265. It is quite obvious accordingly that, as pointed out above, the families comprising these two series of data are not independent. The possibility of adding the total amount of milk distributed from these two sources and dividing by the Census population to arrive at an average *per capita* consumption figure has been considered, but has had to be rejected for the following reasons :—

(1) In some areas figures from one or both sources are not available, and, even where both are available, it is not certain that all retail dairies and co-operative societies are included.

(2) There is probably overlapping of data from these sources from different areas, e.g. a retail dairyman on the outskirts of a burgh may have included in his returns households which happen to be just beyond the boundary.

For such reasons as these it is clear that the possibility mentioned above cannot be further entertained.

**(3) Health Visitors and Nurses.**

Here the principal possible vitiating factor is in the selection of families visited. The activities of a health visitor are not equally operative in all strata of a given community. In the case of health visitors attending a family subsequent to the birth of an infant there is undoubtedly social selection of those visited. This arises from two sources: (*a*) the selective nature of the birth rate itself (even if all births were visited), and (*b*) this selection being further intensified by visitation being carried out to a less extent among better-class homes. Where visitation follows on notification of sickness in any member of a family, selection must again arise since the incidence of illness is by no means random. Thus it may happen that the sample of families in the returns from health visitors may contain an undue proportion of the most fertile or the most morbid type of family, so that the average thus obtained cannot be regarded

as representative of community conditions. On the other hand, such returns are not subject to the other important sources of error, in that the total family consumption of milk and the actual size of the family are accurately obtainable.

**(4) Schools.**

Provided the individual schools in a district are adequately represented in the total, this appears to afford a more reliable source of information than any of the other methods we have adopted. The main factor in selection is that in such a sample of the population, families in which there are no children of school age are automatically excluded.

One general source of error may be mentioned. In the school and health visitor returns it is possible that there is omission of certain cases where free milk is supplied to children in necessitous families. This, if appreciable, is probably most operative in the depressed areas of the industrial belt and might conceivably distort the picture of geographical differences.

It may be finally emphasised, however, that whatever the defects in the present data, the results probably underestimate the average milk consumption of the several areas or of the country as a whole.

## AVERAGE MILK CONSUMPTION OF SCOTLAND AND THE AGGREGATES OF LARGE BURGHS AND COUNTIES.

TABLE 1.—AGGREGATE MILK RETURNS FOR THE WHOLE OF SCOTLAND.

| | Retail Dairymen. | Co-operative Societies. | Health Visitors. | Schools. |
|---|---|---|---|---|
| Number of households | 488,839 | 341,826 | 15,187 | 66,149 |
| Number of persons | 2,781,429* | 1,977,836* | 80,242 | 393,726 |
| Total amount of milk (pints) | 770,926 | 457,880 | 39,133 | 212,659 |
| Average per household (pints) | 1·577 | 1·340 | 2·577 | 3·215 |
| Average per person (pints) | 0·277* | 0·232* | 0·488 | 0·540 |

The aggregate returns supplied from the four sources in the whole of the country are collected in Table 1. It may be repeated that, since in the great majority of instances the number of households only, not the number of persons in these households, could be fur-

* As explained above, the total number of persons in the households supplied by retail dairymen and co-operative societies was obtained by assuming that the average size of household in each area was the same as the combined figure found in the health visitor and school inquiries. The 1921 Census figures for Scotland show that the average size of household (4·4548) is appreciably lower, and, if this figure be taken, the average *per capita* consumption figures for households supplied by retail dairymen and co-operative societies are 0·354 and 0·301 pint respectively.

nished by the retail dairymen and co-operative societies, the average *per capita* consumption figure given in this and succeeding similar tables under the headings relating to these two sources is based upon the assumption that the average size of the households is equal to that found in the health visitor and school returns. The extensive numerical basis of these averages is obvious; but the discrepancies in the results from the different sources are wide and sufficient to direct attention to the possible distortion which may have occurred rather than to the mere numbers on which the results are based. The figures for daily consumption per household found from the data supplied by registered dairymen and co-operative societies are approximately only half as high as those from the remaining two sources of information. In these we find that the nurse-health visitor returns show an average of 2·58, the school returns one of 3·21 pints per household per day.

The average *per capita* consumption figure from health visitor sources is 0·49 and from schools 0·54 pint per day, those from the first two sources being, of course, only half as large, namely, one-quarter of a pint per head per day. From the previous discussion of the possibilities of bias in estimates derived by the four methods adopted, it seemed legitimate to conclude (1) that in point of accuracy the data obtained from health visitors and schools would be more reliable than those from retail dairymen and co-operative societies, and (2) that even from these more reliable sources any inaccuracy likely to be introduced would most probably be in the direction of an under- rather than an over-estimate of the true proportion. The discrepancy between the school and health visitor findings, the former being some 11 per cent. in excess of the latter average, seems to indicate that the selection previously pointed out as liable to occur in sampling through the medium of health visitors and nurses, may have actually occurred. The average size of household in the data from schools (5·95), however, is greater than the corresponding size of those included in the health visitor series (5·28) which, *a priori*, is the opposite to what we should expect from the nature of the selection indicated. The point will be referred to in greater detail later. A general Scottish figure of half a pint per head of population per day can be regarded, therefore, as probably not too large, and is obviously appreciably higher than has generally been thought. Previous comparable information of the consumption of liquid milk is not at all extensive, being usually in the form of indirect estimates, and often much less reliable than that presented here. The estimate made by the Local Food Committee in January 1918 for Great Britain (quoted by the Astor Committee, Cmd. 483) was 0·25 pint per head per day, the range being from 0·1 pint in Inverness to 0·31 in London. This is roughly only half as large as the figure we have reached for Scotland, although it has to be remembered that this Committee's figure related to Great Britain and not to Scotland only, and that the decidedly abnormal conditions towards the end

of the War very probably affected appreciably the consumption of milk in the general population. For Great Britain again, estimated consumption data were given by the Ministry of Agriculture. For the year 1921 this was 0·31 pint, and for 1922, between 0·33 and 0·36 pint per head per day. The recent Report of the Reorganisation Commission for Milk (Economic Series No. 38) concluded from a review of the available published statistics that the average daily *per capita* consumption lay between one-third and two-fifths of a pint.

In Tables 2 and 3 are given the corresponding data for the aggregate of burghal and county local authority areas respectively. (The burghal local authorities are those of "large burghs"; all with total populations in excess of 20,000 persons. The county local authorities are those of counties including all burghs, except large burghs, within their boundaries.)

TABLE 2.—MILK RETURNS FOR THE AGGREGATE OF LARGE BURGHS.

| | Retail Dairymen. | Co-operative Societies. | Health Visitors. | Schools. |
|---|---|---|---|---|
| Number of households . . | 343,588 | 234,044 | 5,401 | 21,899 |
| Number of persons . . | 1,994,895 | 1,363,136 | 30,523 | 143,490 |
| Total amount of milk (pints) . | 520,938 | 320,356 | 11,990 | 56,083 |
| Average per household (pints) | 1·52 | 1·37 | 2·220 | 2·56 |
| Average per person (pints) . | 0·261 | 0·235 | 0·393 | 0·391 |

TABLE 3.—MILK RETURNS FOR THE AGGREGATE OF COUNTIES.

| | Retail Dairymen. | Co-operative Societies. | Health Visitors. | Schools. |
|---|---|---|---|---|
| Number of households . . | 149,251 | 107,782 | 9,786 | 44,250 |
| Number of persons . . | 786,534 | 614,700 | 49,719 | 250,236 |
| Total amount of milk (pints) . | 249,988 | 137,524 | 27,143 | 156,576 |
| Average per household (pints) | 1·721 | 1·276 | 2·774 | 3·538 |
| Average per person (pints) . | 0·318 | 0·224 | 0·546 | 0·626 |

From these results it will be observed that, as found for the country generally, the highest figures are those derived from the health visitor and school returns; that the school is appreciably higher than the health visitor figure in the county but substantially equal in the burghal aggregates, and the co-operative societies lower than the retail dairymen figure, both of the latter, however, being probably underestimates of the true state of affairs.

The daily household consumption of milk in the aggregate of large burghs is, except in the figure derived from co-operative societies, lower than that in the aggregate of counties, the daily *per capita* consumption being likewise smaller. The two more reliable figures indicate a *per capita* milk consumption in large

burghs of 0·39 pint per day, whereas in counties the consumption exceeds half a pint per head per day (0·55 to 0·63 pint). It may be noted that the co-operative society figure in counties is below the retail dairymen figure by a much greater amount relatively than in burghal areas, the defect in the former case amounting to 30 per cent., in the latter to only 10 per cent. The lower figure given by the health visitor than the school data already shown for Scotland apparently applies solely to counties. The difference in these groups of counties between the two figures, amounting to an excess in the school compared with the health visitor figure of 15 per cent., is certainly rather high. It should be noted that the average size of household from these two sources of information differs less in counties than in large burghs, the figures being these: in counties the households in the health visitor sample average 5·08, those in schools 5·66 persons, the corresponding averages for burghs being 5·65 and 6·55 persons.

Although the foregoing statements must be examined later with greater particularity, the general results collected in the three preceding tables may be summarised at present as follows:—

(1) The average consumption of liquid milk in Scotland at the time when this inquiry was carried out approximates to half a pint per head per day.

(2) Consumption is lower in the aggregate of large burghs than in the rest of the country.

(3) Information obtained from milk distributors in a manner such as we have adopted here rather underestimates the true position.

(4) The nurse-health visitor source is open to some suspicion, more particularly in counties.

**Correlation between the Estimates from the Four Sources.**

The whole series of figures received from individual local authority areas are given later in Tables 5 and 6. From the figures contained therein, coefficients of correlation have been calculated between the results derived from the various sources of information in large burghs, counties, burghs *plus* counties, and geographical counties (i.e. inclusive of the appropriate large burghs). If the sample of the population comprised in the figures from each of these sources were a reliable indication of the amount of milk consumed in individual areas of the country we should find, in addition to a correspondence between the general averages obtained, a high degree of correlation between the individual values for the separate areas. As already shown in the average figures, there is reason to suspect the utility of estimates based on returns given by distributors. This is supported by the coefficients of correlation given below (Table 4). The size of the coefficient is an indication of the extent to which the average *per capita* consumption figures based upon the data from the four sources correspond with one another, the greater the coefficient the closer the correspondence and vice versa.

TABLE 4.—CORRELATION BETWEEN THE ESTIMATES FROM THE DIFFERENT SAMPLES.

| | 1 Counties excluding Large Burghs. | 2 Large Burghs. | 3 Counties. + Large Burghs (1 & 2). | 4 Counties including Large Burghs. |
|---|---|---|---|---|
| Health visitor—school | ·80 ± ·05 | ·33 ± ·15 | ·78 ± ·04 | ·89 ± ·03 |
| ,, —retail dairymen | ·53 ± ·10 | ·23 ± ·16 | ·61 ± ·07 | ·60 ± ·09 |
| ,, —Co-operative societies | ·12 ± ·19 | ·52 ± ·13 | ·37 ± ·11 | ·31 ± ·18 |
| School—Retail dairymen | ·33 ± ·13 | ·37 ± ·15 | ·49 ± ·08 | ·40 ± ·12 |
| ,, —Co-operative societies | ·47 ± ·15 | ·53 ± ·12 | ·43 ± ·10 | ·48 ± ·14 |
| Retail dairymen—Co-operative societies | ·03 ± ·20 | ·19 ± ·17 | ·36 ± ·11 | ·28 ± ·19 |

The coefficient involving any two series of values is based on the total number of areas in which each of the particular pair is available. The numbers therefore vary, and are in no case very large, especially when dealing with burghal areas alone.

In county areas, exclusive of large burghs, there is a high degree of association between the figures found from the school and health visitor returns, the coefficient reaching a value of 0·80. This is the largest found between the various pairs in this group of districts. Next in order are the correlations between the health visitor and the corresponding retail dairymen returns, and, of a slightly smaller size, between the schools and co-operative societies. It will be observed that the relation between school and retail dairymen findings, although positive, is small and statistically insignificant; but between health visitor and co-operative societies and more particularly between dairymen and societies there is no relationship of any moment. The geographical variations of milk consumption in counties, it is suggested, are fairly well represented by either the health visitor or the school method of sampling.

In large burghs where, as previously stated, the number of areas with the different pairs of estimates available is small, none of the coefficients obtained is high. The two highest are the figures from co-operative societies in association with the health visitor and school returns. The relation between the latter two series of results is positive though disappointingly small.

If we consider the whole series of local authority areas together, the health visitor-school coefficient takes highest place with a value of 0·78, the next in order of importance being those involving health visitor and retail dairymen figures, schools and retail dairymen, and schools with co-operative society returns. In every case, however, the coefficients are positive and significant; but, with the

possible exception of the first-named, health visitors and schools, where the geographical variations indicated by the two sets of data correspond to a very appreciable extent, it is obvious from the numerical values of the remaining coefficients that quite wide differences in the geographical variations of milk consumption exist when different methods of assessment are utilised.

The final series of coefficients is calculated on the figures for county areas inclusive of their appropriate large burghs. The indications are similar to those already mentioned in connection with the findings obtained when the large burghs and counties are treated as discrete geographical units. The correlation between the health visitor and school figures is satisfactorily high.

From Table 4 it is clear that in every instance the geographical differences of milk consumption indicated by the returns from the several sources are positively correlated one with another, to a degree, however, which varies widely; that the health visitor and school figures are so closely related that areal differences shown by the first are very similar to those indicated by the second; and that the relation between the figures from the remaining two sources is so slight in degree that considerable suspicion must attach to their use as indicative of the real variations throughout the country.

**Geographical Variations of Milk Consumption.**

It has already been pointed out that in the aggregate of large burghs the average values found from the four different sources are consistently lower than the corresponding figures from the aggregate of counties. Within these two large aggregates, however, appreciable diversity is found in the individual areas.

The data contained in Table 5 show the wide range of values for milk consumption in individual burghal areas. Based on the school figures, these vary from the lowest values of 0·27 and 0·29 pint in Hamilton and Airdrie and 0·30 in both Coatbridge and Motherwell & Wishaw to the highest returns of 0·51, 0·59, and 0·71 which are found in Arbroath, Falkirk, and Perth respectively. The health visitors' investigations indicate the smallest consumption in Greenock, Edinburgh, and Dundee with *per capita* figures of 0·31, 0·33, and 0·34 pint, and the highest in Clydebank, Coatbridge, and Perth, where the returns are 0·49, 0·52, and 0·61 pint. From co-operative societies the figures show lower averages generally and a much smaller range. The lowest are 0·16 pint per head in Airdrie and Motherwell & Wishaw and 0·17 in Kirkcaldy; the highest, 0·30 in Clydebank and 0·31 in both Aberdeen and Perth. Data collected from retail dairymen show *per capita* consumption figures varying from 0·18 pint in Dundee, 0·21 in Kirkcaldy, and 0·22 in Airdrie to 0·34 in Kilmarnock, 0·47 in Rutherglen, and 0·51 in Falkirk. It will be noticed that the figure from this source in Rutherglen (0·47) is higher than either of the values found by health visitors or schools inquiries, and is the only instance where the results found from

## Table 5.—Average Milk Consumption in Large Burghs.

| Burgh. | No. of Households. | | | | No. of Persons. | | | | No. of Pints. | | | | Average per Household. | | | | Average per Person. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. |
| Aberdeen . . | 19,734 | 21,667 | 350 | — | 122,153 | 134,119 | 2,165 | — | 32,375 | 41,800 | 1,023·5 | — | 1·64 | 1·93 | 2·92 | — | ·27 | ·31 | ·47 | — |
| Arbroath . . | 6,661 | 385 | 20 | 165 | 34,837 | 1,909 | 101 | 886 | 8,424 | 544 | 37 | 440 | 1·26 | 1·49 | 1·85 | 2·67 | ·24 | ·28 | ·37 | ·51 |
| Dundee . . | 41,510 | 5,276 | 458 | 6,250 | 323,363 | 41,100 | 2,388 | 49,834 | 59,326 | 8,612 | 817 | 18,327 | 1·43 | 1·63 | 1·78 | 2·93 | ·18 | ·21 | ·34 | ·37 |
| Ayr . . | 9,933 | — | — | — | — | — | — | — | 14,344 | — | — | — | 1·44 | — | — | — | — | — | — | — |
| Kilmarnock . . | 9,359 | — | 25 | — | 57,277 | — | 153 | — | 19,288 | — | 58 | — | 2·06 | — | 2·32 | — | ·34 | — | ·38 | — |
| Clydebank . . | 14,435 | 9,166 | 200 | 140 | 81,702 | 51,880 | 1,065 | 861 | 23,068 | 15,760 | 519 | 373 | 1·60 | 1·72 | 2·60 | 2·66 | ·28 | ·30 | ·49 | ·43 |
| Dumbarton . . | 7,515 | 3,340 | 100 | 359 | 46,067 | 20,474 | 613 | 2,200 | 11,384 | 5,840 | 282 | 997·5 | 1·51 | 1·75 | — | 2·69 | ·25 | ·29 | ·46 | ·44 |
| Dumfries & Maxwell-town . . | 5,835 | — | 24 | 132 | 33,726 | — | 142 | 760 | 10,272 | — | 51·5 | 387 | 1·76 | — | 2·15 | 2·78 | ·30 | — | ·36 | ·48 |
| Dunfermline . . | 6,736 | 12,000 | 100 | 320 | 37,452 | 66,720 | 612 | 1,722 | 10,668 | 12,400 | 222 | 856 | 1·58 | 1·03 | 2·22 | 2·68 | ·28 | ·19 | ·36 | ·50 |
| Kirkcaldy . . | 16,015 | 14,500 | 220 | 438 | 89,364 | 80,910 | 1,183 | 2,489 | 18,985 | 13,440 | 434·5 | 1,012 | 1·19 | ·93 | 1·98 | 2·31 | ·21 | ·17 | ·37 | ·41 |
| Inverness . . | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Airdrie . . | 6,359 | 856 | 25 | 535 | 41,206 | 5,547 | 174 | 3,457 | 9,008 | 896 | 63 | 1,008 | 1·42 | 1·05 | 2·52 | 1·88 | ·22 | ·16 | ·36 | ·29 |
| Coatbridge . . | 12,000 | 5,525 | 25 | 631 | 77,040 | 35,471 | 125 | 4,087 | 18,328 | 8,648 | 65 | 1,237·5 | 1·53 | 1·57 | 2·60 | 1·96 | ·24 | ·24 | ·52 | ·30 |
| Glasgow . . | — | 64,806 | 2,638 | 5,122 | — | 386,244 | 15,343 | 30,875 | — | 90,236 | 5,956 | 13,104·5 | — | 1·39 | 2·26 | 2·56 | — | ·23 | ·39 | ·42 |
| Hamilton . . | — | 1,300 | — | 418 | — | 8,970 | — | 2,885 | — | 2,080 | — | 784 | — | 1·60 | — | 1·88 | — | ·23 | — | ·27 |
| Motherwell & Wishaw | 14,742 | 15,200 | 70 | 1,407 | 95,086 | 98,040 | 416 | 9,108 | 25,864 | 16,088 | 193 | 2,769·5 | 1·75 | 1·06 | 2·76 | 1·96 | ·27 | ·16 | ·46 | ·30 |
| Rutherglen . . | 6,356 | 3,830 | 243 | 344 | 35,339 | 21,295 | 1,078 | 2,183 | 16,736 | 5,568 | 472·5 | 821·5 | 2·63 | 1·45 | 1·94 | 2·39 | ·47 | ·26 | ·44 | ·38 |
| Edinburgh . . | 126,427 | 39,690 | 25 | 3,532 | 707,991 | 222,264 | 183 | 19,729 | 174,728 | 53,872 | 60·5 | 8,630·5 | 1·38 | 1·36 | 2·42 | 2·44 | ·25 | ·24 | ·33 | ·44 |
| Perth . . | 12,102 | 6,000 | 20 | 432 | 62,688 | 31,080 | 90 | 2,251 | 18,840 | 9,568 | 55 | 1,588 | 1·56 | 1·59 | 2·75 | 3·68 | ·30 | ·31 | ·61 | ·71 |
| Greenock . . | 15,920 | 5,473 | 419 | 917 | 92,495 | 31,798 | 2,270 | 5,489 | 25,416 | 7,744 | 696 | 2,085 | 1·60 | 1·41 | 1·66 | 2·27 | ·27 | ·24 | ·31 | ·38 |
| Paisley . . | — | 10,300 | 414 | 403 | — | 61,285 | 2,258 | 2,605 | — | 12,800 | 921·5 | 922 | — | 1·24 | 2·23 | 2·29 | — | ·21 | ·41 | ·35 |
| Port Glasgow . . | — | 2,050 | — | 154 | — | 12,341 | — | 927 | — | 2,668 | — | 283·5 | — | 1·30 | — | 1·84 | — | ·22 | — | ·31 |
| Falkirk . . | 8,231 | 12,700 | — | 45 | 33,500 | 51,689 | — | 183 | 16,968 | 11,792 | — | 107·5 | 2·06 | ·93 | — | 2·39 | ·51 | ·23 | — | ·59 |
| Stirling . . | 3,718 | — | 25 | 155 | 23,609 | — | 164 | 979 | 6,916 | — | 63 | 407·5 | 1·86 | — | 2·52 | 2·63 | ·29 | — | ·38 | ·42 |
| Totals . . | 343,588 | 234,044 | 5,401 | 21,899 | 1,994,895 | 1,383,136 | 30,523 | 143,490 | 520,938 | 320,356 | 11,990 | 56,083 | 1·52 | 1·37 | 2·17 | 2·56 | ·26 | ·24 | ·393 | ·39 |

# Table 6.—Average Milk Consumption in Counties.

| County, less Burghs. | No. of Households. | | | | No. of Persons. | | | | No. of Pints. | | | | Average per Household. | | | | Average per Person. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. | R.D. | Co-op. | H.V. | S. |
| Aberdeen* | — | — | — | 8,861 | — | — | — | 46,400 | — | — | — | 47,731 | — | — | — | 5·39 | — | — | — | 1·03 |
| Argyll | 4,240 | — | 306 | 1,188 | 23,998 | — | 1,506 | 6,956 | 7,868 | — | 866·5 | 4,619·5 | 1·86 | — | 2·83 | 3·89 | ·33 | — | ·58 | ·66 |
| Angus | — | — | 77 | 1,309 | — | — | 527 | 7,530 | — | — | 239 | 4,902·5 | — | — | 3·10 | 3·75 | — | — | ·45 | ·65 |
| Ayr | 19,885 | 11,690 | 2,494 | — | 102,209 | 60,087 | 12,822 | — | 31,000 | 14,854 | 6,426 | — | 1·56 | 1·27 | 2·58 | — | ·30 | ·25 | ·50 | — |
| Banff | — | — | 25 | — | — | — | 138 | — | — | — | 85 | — | — | — | 3·40 | — | — | — | ·62 | — |
| Berwick | 2,006 | — | 91 | 690 | 11,033 | — | 530 | 3,214 | 2,952 | — | 193 | 1,736 | 1·47 | — | 2·12 | 2·94 | ·27 | — | ·38 | ·54 |
| Bute | 3,038 | — | 701 | 223 | 13,370 | — | 2,908 | 1,280 | 6,236 | — | 1,787·5 | 771 | 2·05 | — | 2·55 | 3·46 | ·47 | — | ·61 | ·60 |
| Caithness | — | — | — | 684 | — | — | — | 3,905 | — | — | — | 3,391·5 | — | — | — | 4·96 | — | — | — | ·87 |
| Clackmannan | 2,734 | 11,333 | 75 | 1,135 | 15,721 | 65,165 | 409 | 6,543 | 5,043 | 14,560 | 186·5 | 2,976·5 | 1·84 | 1·28 | 2·51 | 2·62 | ·32 | ·22 | ·46 | ·45 |
| Dunbarton | 3,749 | 3,010 | 775 | 571 | 21,407 | 17,187 | 4,433 | 3,258 | 7,232 | 4,408 | 2,018·5 | 1,401·5 | 1·93 | 1·46 | 2·60 | 2·80 | ·34 | ·26 | ·46 | ·49 |
| Dumfries | 2,500 | — | 636 | 336 | 13,450 | — | 3,334 | 1,892 | 3,698 | — | 1,793·5 | 1,195·5 | 1·48 | — | 2·82 | 3·56 | ·27 | — | ·54 | ·63 |
| East Lothian | — | 3,800 | — | 2,814 | — | 22,344 | — | 15,379 | — | 6,400 | — | 6,777·5 | — | 1·68 | — | 2·59 | — | ·29 | — | ·44 |
| Fife | 17,679 | 11,497 | 698 | 2,286 | 100,240 | 65,188 | 3,469 | 13,512 | 30,716 | 17,192 | 1,496·5 | 6,312·5 | 1·74 | 1·50 | 2·14 | 2·75 | ·31 | ·26 | ·43 | ·47 |
| Inverness | — | — | — | 40 | — | — | — | 324 | — | — | — | 236 | — | — | — | 5·90 | — | — | — | ·73 |
| Kincardine | — | — | — | 863 | — | — | — | 4,500 | — | — | — | 3,248 | — | — | — | 3·76 | — | — | — | ·72 |
| Kirkcudbright | 3,553 | — | 80 | — | 19,400 | — | 437 | — | 5,359 | — | 287 | — | 1·51 | — | 3·34 | — | ·28 | — | ·61 | — |
| Lanark | — | 15,187 | 460 | 3,321 | — | 96,893 | 2,386 | 21,747 | — | 18,620 | 1,040 | 6,306 | — | 1·23 | 2·26 | 1·90 | — | ·19 | ·44 | ·29 |
| Midlothian | 11,967 | 24,668 | 825 | 1,494 | 53,021 | 137,154 | 1,806 | 8,510 | 16,180 | 30,928 | 735 | 3,627·5 | 1·35 | 1·25 | 2·26 | 2·43 | ·30 | ·23 | ·41 | ·43 |
| Moray & Nairn | 6,690 | — | 202 | 747 | 39,806 | — | 1,126 | 4,521 | 16,528 | — | 676·5 | 3,072·5 | 2·47 | — | 3·35 | 4·11 | ·42 | — | ·60 | ·68 |
| Orkney | 1,778 | — | 65 | 301 | 10,490 | — | 346 | 1,815 | 3,380 | — | 253 | 1,456 | 1·90 | — | 3·97 | 4·84 | ·32 | — | ·75 | ·80 |
| Peebles | 2,346 | 320 | 50 | 748 | 9,384 | 1,725 | 230 | 4,073 | 5,104 | 400 | 147 | 2,362 | 2·18 | 1·25 | 2·94 | 3·16 | ·54 | ·23 | ·64 | ·58 |
| Perth | 9,115 | 244 | 1,295 | 1,879 | 46,669 | 1,249 | 6,361 | 9,905 | 15,090 | 328 | 4,219·5 | 6,859 | 1·66 | 1·34 | 3·26 | 3·65 | ·32 | ·26 | ·66 | ·69 |
| Renfrew | 29,386 | 7,141 | 25 | 418 | 173,965 | 42,275 | 139 | 2,483 | 45,656 | 7,994 | 64·5 | 1,002·5 | 1·55 | 1·12 | 2·58 | 2·40 | ·26 | ·19 | ·46 | ·40 |
| Ross & Cromarty | 3,472 | — | 450 | 530 | 19,408 | — | 2,278 | 3,202 | 7,716 | — | 1,613 | 2,515 | 2·22 | — | 3·58 | 4·75 | ·40 | — | ·71 | ·79 |
| Roxburgh | 1,895 | 3,000 | 52 | 3,316 | 9,570 | 15,150 | 210 | 16,815 | 4,803 | 5,088 | 111·5 | 10,420 | 2·53 | 1·70 | 2·14 | 3·14 | ·50 | ·34 | ·53 | ·62 |
| Selkirk | 5,513 | 4,000 | 80 | 514 | 27,234 | 19,760 | 359 | 2,575 | 10,630 | 3,840 | 225 | 1,598 | 1·93 | ·96 | 2·81 | 3·11 | ·39 | ·19 | ·63 | ·62 |
| Stirling | 5,714 | 5,110 | 159 | 1,160 | 34,798 | 31,120 | 799 | 7,229 | 10,781 | 5,024 | 381·5 | 2,864·5 | 1·88 | ·98 | 2·40 | 2·47 | ·31 | ·16 | ·48 | ·40 |
| Sutherland | 721 | — | 465 | 761 | 3,771 | — | 2,124 | 4,282 | 1,511 | — | 1,693 | 3,560 | 2·10 | — | 3·64 | 4·68 | ·40 | — | ·80 | ·83 |
| West Lothian | 5,414 | 6,782 | 150 | 6,736 | 27,070 | 39,403 | 795 | 39,211 | 8,944 | 7,888 | 388 | 18,290·5 | 1·65 | 1·16 | 2·59 | 2·71 | ·33 | ·20 | ·49 | ·47 |
| Wigtown | 497 | — | 50 | 375 | 2,719 | — | 247 | 2,078 | 1,312 | — | 228·5 | 1,548·5 | 2·64 | — | 4·57 | 4·13 | ·48 | — | ·93 | ·75 |
| Zetland | 1,359 | — | — | 1,237 | 7,801 | — | — | 7,097 | 2,289 | — | — | 5,625·75 | 1·68 | — | — | 4·55 | ·29 | — | — | ·79 |
| Totals | 145,251 | 107,782 | 9,786 | 44,250 | 786,534 | 614,700 | 49,719 | 250,236 | 249,988 | 137,524 | 27,143 | 156,576 | 1·72 | 1·28 | 2·77 | 3·54 | ·32 | ·22 | ·55 | ·63 |

* In this area the results of the inquiries made via retail dairymen, nurses, and health visitors were given jointly (see Appendix VI, p. 32). These joint returns relate to 42,109 persons, the total amount of milk consumed daily being 44,162 pints, the average *per capita* consumption therefore being 1·05 pints per day.

retail dairymen or co-operative societies exceed those from either of the remaining two sources.

The variations in counties (Table 6) are greater than those in large burghs. In the data collected from school children the smallest averages are found in Lanark with an average consumption of only 0·29 pint per head, in Renfrew and Stirling with 0·40 pint, and in Midlothian with 0·43. The heaviest consumption indicated in data from this source is found in Orkney with 0·80, Sutherland with 0·83, Caithness with 0·87, and Aberdeen with 1·03 pint per head per day. The health visitors' inquiries in these areas show a range of values from the lowest of 0·36 in Berwick, 0·41 in Midlothian, and 0·43 in Fife to the highest of 0·71 in Ross & Cromarty, 0·75 in Orkney, 0·80 in Sutherland, 0·93 in Wigtown. Returns from co-operative societies are available for fewer counties. In every case, however, the figure so derived is lower than in the corresponding data from health visitors or schools. They range from 0·16 pint in Stirling and 0·19 in Selkirk, Renfrew, and Lanark to 0·29 in East Lothian and 0·34 in Roxburgh. Retail dairymen figures likewise are consistently lower than the corresponding school and health visitors' data, and vary from 0·26 in Renfrew and 0·27 in both Dumfries and Berwick to 0·48 in Wigtown, 0·50 in Roxburgh and 0·54 in Peebles.

From the data amassed for each individual area, it will be observed that from certain of these no information from one or more sources is available. The returns of co-operative societies and retail dairymen, on general *a priori* considerations and from scrutiny of the actual figures received, we have decided to regard for our present purposes as misleading and certainly of less moment than those from schools and health visitors; but with regard to the two latter which, from the point of view of accuracy, are regarded as the most reliable, an important consideration is raised by the fact that the average values given previously for Scotland and the two large aggregates on the health visitors and schools data are not derived from exactly the same geographical units. For the Scottish rates as a whole there was an appreciably higher average *per capita* consumption figure registered by the schools (0·540) than by the health visitors data (0·488). In the aggregate of large burghs the excess was almost negligible, the respective figures being 0·391 and 0·393 pint, the whole of the schools excess being from the county district figures where the averages were 0·546 and 0·626. It was suggested that possibly the factor of selection of families might have arisen in the health visitors data to vitiate the findings obtained by this method; but detailed scrutiny of the individual areas in Tables 5 and 6 supplies a simple probable explanation of the discrepancies, which, if correct, would remove to a great extent the suspicion attaching to the health visitor method of sampling. In the counties we note that no health visitors data were forthcoming from Aberdeen,[1] Caithness, East Lothian, Inverness, Kincardine, and Zetland areas,

[1] See footnote to Table 6.

the *per capita* consumption figures of which are respectively 1·03, 0·87, 0·44, 0·73, 0·72, and 0·79; that is, with the exception of East Lothian, they are all districts with high average consumption of milk. In particular, the high average of Aberdeen County and the exceedingly high proportion which this sample is of the total families examined through the schools make an enormous difference to the general average for the aggregate.

Quite apart from selection of families, discrepancy in the average values derived from these two sources may arise from (1) the representation of certain areas in only one of the two series, these areas being widely different in respect of milk consumption from the general average, and/or (2) the inappropriate weighting of the samples. If from the data collected in Tables 5 and 6 we base the average from each source only on those districts from which information from both sources is available we shall be able to observe how much of the difference is attributable to (1) above. The requisite figures are given in Table 7 below, the average *per capita* values for all areas being added for comparative purposes.

TABLE 7.—SHOWING THE HEALTH VISITORS AND SCHOOLS DATA FROM (1) AREAS WITH BOTH SERIES OF DATA AVAILABLE, AND (2) ALL AREAS.

| | LARGE BURGHS. | | COUNTIES. | | SCOTLAND. | |
|---|---|---|---|---|---|---|
| | H.V. | S. | H.V. | S. | H.V. | S. |
| No. of households | 5,026 | 21,282 | 7,187 | 29,951 | 12,213 | 51,233 |
| No. of persons | 28,205 | 139,495 | 36,322 | 172,631 | 64,527 | 312,126 |
| Total amount of milk (pints) | 10,626·5 | 53,940·5 | 20,365 | 89,566·75 | 30,991·5 | 143,507·25 |
| Average per person | 0·377 | 0·387 | 0·561 | 0·519 | 0·480 | 0·460 |
| Average per person (all areas) | 0·393 | 0·391 | 0·546 | 0·626 | 0·488 | 0·540 |

It will be observed from this table that the differences between the consumption figures from the two sources are appreciably diminished by basing the averages only on areas from which data from both sources have been obtained. In burghs the differences are in both instances negligible, the school being only 1 per cent. lower when all areas are considered and 3 per cent. higher when only areas with estimates available from both sources are considered. In counties and in the whole series of local authority areas, however, the reductions are appreciable, in the former from a 15 per cent. excess to a 7 per cent. deficit, and in the latter from an 11 per cent. excess to a 4 per cent. deficit. The findings in Table 7 suggest that an appreciable part of the differences found in the results from the schools and health visitors' inquiries can be accounted for by the fact that we have available for certain areas with high average milk consumption data from schools, but not from health visitors.

The influence of weighting on the crude averages must now be examined. It will be appreciated that in the presence of such wide variations as have previously been shown to exist in the different geographical areas, the averages given for either Scotland as a whole or for any such aggregates as burghs or counties may appreciably be altered by undue weighting of any particular district or series of districts. To remove this source of possible error, the areal averages derived from the health visitors or school sources have been weighted according to the respective Census (1931) population and the derived averages for Scotland, the aggregate of large burghs and the aggregate of counties are compared in Table 8 below with the corresponding unweighted values which have already been given. The values given here are not restricted to areas with estimates available from both sources, but are based on the whole of the information.

TABLE 8.—SHOWING FOR SCOTLAND, LARGE BURGHS, AND COUNTIES THE WEIGHTED AND UNWEIGHTED AVERAGES FROM HEALTH VISITORS AND SCHOOLS.

| | Health Visitors. | | Schools. | |
|---|---|---|---|---|
| | Unweighted. | Weighted. | Unweighted. | Weighted. |
| Burghs . | 0·393 | 0·391 | 0·391 | 0·418 |
| Counties . | 0·546 | 0·512 | 0·626 | 0·558 |
| Scotland . | 0·488 | 0·444 | 0·540 | 0·481 |

From these figures it will be observed that the weighted averages differ somewhat from the unweighted. The figures derived from the health visitors in burghs are substantially the same, the unweighted being in excess of the weighted figure by only 0·5 per cent. In counties, however, the influence of weighting is somewhat greater, resulting in a lowering of the average consumption figure by 6 per cent. In the whole series of local authority areas together allowance for the varying size of the several populations reduces the crude average figure by 9 per cent., the weighted Scottish figure being 0·444 pint per head. The school figures are influenced to a greater degree than are the health visitors' by this process. In burghs the crude average is increased by 7 per cent. to a value of 0·418 pint, in counties a reduction of 11 per cent. is effected, the corrected figure being 0·558 pint, and in the local authority areas as a whole the corrected figure (0·481) is 10 per cent. less than the crude.

The corrected figures from the two different sources of information show for the whole of Scotland a closer approximation to one another than do the crude values, but this does not hold good for the burghal aggregates. In the latter districts, the weighted average for the schools data is 7 per cent. in excess of the health visitors', the crude figure from this source being only 1 per cent. below of the corresponding average from the health visitor data. In counties, however, correction diminishes the school excess from 15 to 9 per cent., and in burghs and counties together the excess is reduced from 11 to 8 per cent.

If now we deal only with those areas where both sets of information are available, the weighted and unweighted average consumption values are those given in Table 9.

TABLE 9.—SHOWING FOR SCOTLAND, LARGE BURGHS, AND COUNTIES THE WEIGHTED AND UNWEIGHTED AVERAGES FROM HEALTH VISITORS AND SCHOOLS IN AREAS WITH BOTH SERIES OF DATA AVAILABLE.

| | Health Visitors. | | Schools. | |
|---|---|---|---|---|
| | Unweighted. | Weighted. | Unweighted. | Weighted. |
| Burghs . | 0·377 | 0·385 | 0·387 | 0·419 |
| Counties . | 0·561 | 0·508 | 0·519 | 0·502 |
| Scotland . | 0·480 | 0·436 | 0·460 | 0·453 |

The influence of weighting is, briefly, to reduce the average consumption value for the whole of Scotland, whether consumption be judged on the results of the schools or health visitors' inquiries. In the health visitor series, the weighted average in burghs is 2 per cent. in excess of the unweighted, but in extra-burghal areas and in the local authority areas as a whole the former is 9 per cent. lower than the latter. In the school series of figures, weighting increases the burghal average by 8 per cent., but in counties and in all local authority areas together reduces it by 3 and 2 per cent. respectively. Comparison of the values registered from the two sources shows that with the unweighted values the school figure in burghs was 3 per cent. in excess, in counties was 7 per cent. below, and in all local authority areas was 4 per cent. below the corresponding health visitor figure. The weighted results show in burghs an excess of 9 per cent. in the school over the health visitor figure, a defect of only 1 per cent. in counties, and an excess of 4 per cent. for the local authority areas as a whole.

It will be seen, therefore, that the averages are influenced to some extent by non-representation of certain areas in the sample and by undue weight being given to one or several areas. The difference between the figures from the health visitors and schools inquiries when the country as a whole is considered and when allowance is made for the above two factors amounts, however, to only 4 per cent. Such a difference suggests that the factor of selection is not so appreciable as the crude results given before would lead one to suspect; and the closeness of these two averages, together with the high correlation between the geographical variations represented by the two series, suggests that in point of accuracy there is little to choose between the two methods of investigation.

As perhaps furnishing a more reliable indication of the average figure for *per capita* consumption, therefore, the data from these two sources have been pooled and local averages calculated from the two series of observations together. These are given in Table 10 (*a*) and (*b*) for burghs and counties respectively.

TABLE 10.—SHOWING THE AVERAGE MILK CONSUMPTION BASED ON THE COMBINED HEALTH VISITOR AND SCHOOL FIGURES.

(*a*) *Burghs.*

| | | | | | |
|---|---|---|---|---|---|
| Aberdeen | 0·47 | Dunfermline | 0·46 | Rutherglen | 0·4 |
| Arbroath | 0·49 | Kirkcaldy | 0·39 | Edinburgh | 0·4 |
| Dundee | 0·37 | Airdrie | 0·29 | Perth | 0·7 |
| Kilmarnock | 0·38 | Coatbridge | 0·31 | Greenock | 0·3 |
| Clydebank | 0·46 | Glasgow | 0·41 | Paisley | 0·3 |
| Dumbarton | 0·44 | Hamilton | 0·27 | Port-Glasgow | 0·3 |
| Dumfries | 0·46 | Motherwell & Wishaw | 0·31 | Falkirk | 0·5 |
| | | | | Stirling | 0·4 |

(*b*) *Counties.*

| | | | | | |
|---|---|---|---|---|---|
| Aberdeen | 1·03 | Dumfries | 0·57 | Peebles | 0·5 |
| Argyll | 0·65 | East Lothian | 0·44 | Perth | 0·6 |
| Angus | 0·64 | Fife | 0·46 | Renfrew | 0·4 |
| Ayr | 0·50 | Inverness | 0·73 | Ross & Cromarty | 0·7 |
| Banff | 0·62 | Kincardine | 0·72 | Roxburgh | 0·6 |
| Berwick | 0·52 | Kirkcudbright | 0·61 | Selkirk | 0·6 |
| Bute | 0·61 | Lanark | 0·30 | Stirling | 0·4 |
| Caithness | 0·87 | Midlothian | 0·42 | Sutherland | 0·8 |
| Clackmannan | 0·46 | Moray & Nairn | 0·66 | West Lothian | 0·4 |
| Dunbarton | 0·47 | Orkney | 0·79 | Wigtown | 0·7 |
| | | | | Zetland | 0·7 |

If these local averages are weighted by the appropriate Census population, the derived averages for the aggregates are as follows:—

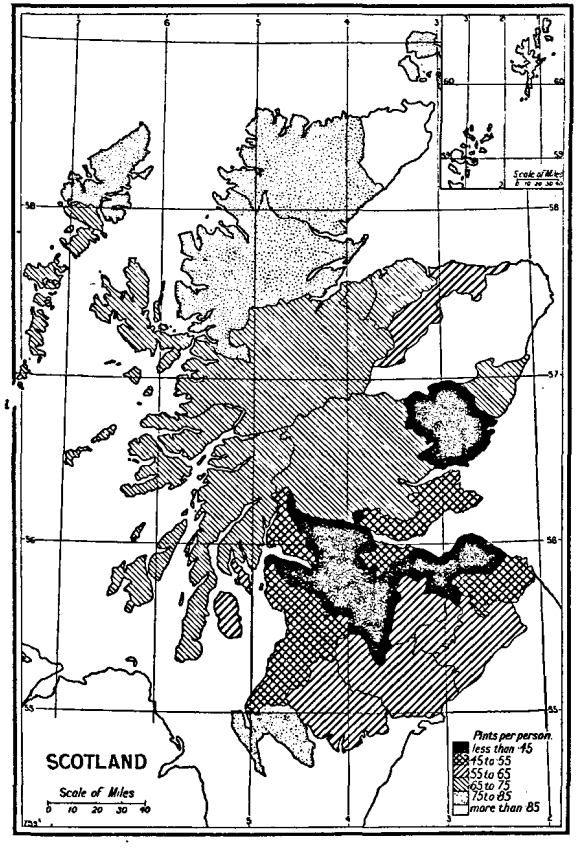
| | |
|---|---|
| Burghs | 0·417 |
| Counties | 0·550 |
| Scotland | 0·479 |

These, we consider, are fairly accurate reflections of the daily *per capita* milk consumption for this country and its two large aggregates.

For purposes of diagrammatic representation of the geographical variation of *per capita* consumption, we have calculated the average values for each of the counties of Scotland (including the appropriate large burgh or burghs) on the figures from these two sources combined, and in the accompanying map these are shown in six groups, the darkest shading indicating areas of lowest consumption, and vice versa. These differences have already been pointed out in the brief discussion of the range of values found in counties and burghs separately; but the diagram shows more clearly how this country roughly divides itself with respect to milk consumption into three broad areas: (1) the industrial belt, including Angus County with the burghs of Arbroath and Dundee, which are mainly industrial; (2) the border counties; and (3) the counties north of the industrial belt. The lowest values pertain to (1) the highest to (3), with the border counties intermediate in value.

TABLE 11.—SHOWING THE AVERAGE *PER CAPITA* MILK CONSUMPTION OF THE THREE AGGREGATES OF COUNTIES.

| | Unweighted. | Weighted. |
|---|---|---|
| North and North-eastern | 0·848 | 0·809 |
| Industrial belt | 0·411 | 0·401 |
| Borders | 0·559 | 0·579 |


SCOTLAND
Scale of Miles
0 10 20 30 40
Pints per person
less than 45
45 to 55
55 to 65
65 to 75
75 to 85
more than 85

For these three aggregates the averages derived (1) from the sample of families actually examined and (2) weighted in accordance with the Census (1931) population are shown in Table 11 above. In the industrial belt the consumption is only half as high as in the northern and north-eastern counties, which are mainly rural in character.

## The Relation between Milk Consumption and Certain Indices of Environmental Conditions.

While it is not possible, in the absence of the requisite information, to account for the variations found within a given geographical unit, there are available from published sources certain recognised criteria which are in some measure indicative of the general conditions obtaining in the several local authority areas themselves. Here we have used three measures, namely, the rate of infant mortality per 1000 births, the number of persons per 100 rooms, and the standardised death-rate from all causes. The infant mortality rates utilised are based on the deaths under one year of age, and the births registered during the triennium 1930–2, that is, centring on the year of investigation. The housing figures are those given in the 1921 Census volume, since the whole series of corresponding data for the more recent (1931) Census was not then available. This figure does not, however, fluctuate widely from Census to Census and the position of the individual areas relative to one another is fairly constant ; so that we should be unlikely to obtain very different results had the more recent data been fully available. In utilising the general death-rate at all ages as a measure of environmental status, the crude rates in the several areas of Scotland are misleading since the diversity of sex and more particularly of age constitution is so great in the different districts studied that standardisation for age and sex alters appreciably the position of these areas in relation to each other. Here again, unfortunately, recourse had to be made to the standardising factors based on the 1921 Census figures of population ; but the same remarks with regard to stability of the geographical peculiarities in these respects apply equally to these as to the data with regard to overcrowding.

In Table 12 are collected the coefficients of correlation between these three indices of social and environmental or health conditions and the average milk consumption figure based on the combined health visitor and school returns previously shown in Table 10. (Coefficients were calculated to show the relation between these social indices and the average milk consumption figures as derived from each of the four sources separately. These have not, however, been reproduced here as, although the arithmetical values fluctuate more widely, the conclusions therefrom differ in no way from those to be drawn from Table 12.)

TABLE 12.—CORRELATION BETWEEN AVERAGE MILK CONSUMPTION AND CERTAIN INDICES OF ENVIRONMENTAL AND HEALTH CONDITIONS, NAMELY, (1) PERSONS PER 100 ROOMS; (2) INFANT MORTALITY RATE PER 1000 BIRTHS; AND (3) STANDARDISED DEATH-RATE.

| | Persons per 100 Rooms. | Infant Mortality. | Standardised Death-rate. |
|---|---|---|---|
| 1. Large Burghs . . . . | $-\cdot66 \pm \cdot08$ | $-\cdot44 \pm \cdot12$ | $-\cdot32 \pm \cdot13$ |
| 2. Counties exclusive of Large Burghs . | $-\cdot57 \pm \cdot08$ | $-\cdot29 \pm \cdot11$ | $-\cdot47 \pm \cdot09$ |
| 3. Counties + Large Burghs (1 + 2) . | $-\cdot55 \pm \cdot08$ | $-\cdot35 \pm \cdot11$ | $-\cdot55 \pm \cdot08$ |
| 4. Counties including Large Burghs . | $-\cdot72 \pm \cdot05$ | $-\cdot55 \pm \cdot07$ | $-\cdot70 \pm \cdot05$ |

With persons per 100 rooms as an index it will be noted that all the coefficients are negative in sign and appreciable in size. The series indicates a progressive diminution in the average consumption of milk per head of population with increase in the degree of housing congestion.

In the series involving infant death rates as our measure of general health conditions, an almost parallel state of affairs is manifest. The numerical values of the coefficients are uniformly lower than those found with the overcrowding figure, but each is negative in sign and, with one exception, namely, for counties exclusive of large burghs, statistically significant. The permissible deductions are therefore similar; the *per capita* consumption of milk is on the average lowest in those areas where the loss of infant life is relatively heaviest and tends to increase as we proceed towards areas better off in this respect.

With the general death-rate standardised for age and sex, we find a series of coefficients uniformly negative in sign and, with one exception, in burghal areas, significant in magnitude, indicating progressive diminution of average milk consumption with increasing force of mortality.

It will be apparent from the results collected in Table 12 that there is a definite relationship between the *per capita* consumption of liquid milk and general environmental conditions. Although no one of the three measures used as an indication of social and environmental status is a true reflex of local conditions in this respect, it will generally be admitted that each is some reflection of the conditions we desire to measure; and the uniformity of the results is sufficient to indicate the truth of the conclusion that liquid milk consumption in the several local authority areas of Scotland tends to be lowest in those in which overcrowding and mortality are heaviest (and vice versa).

**Summary.**

1. The present report deals with the results of an investigation designed to arrive at the average daily *per capita* consumption of fluid milk in Scotland generally, and the variations which occur in this respect throughout its chief administrative subdivisions.

2. The four main sources from which the information required was obtained were (1) co-operative societies, (2) retail dairymen, (3) nurses and health visitors, and (4) schools.

3. The accuracy of results from these four lines of investigation varies. The first two we consider of much less value as a source of this kind of information than inquiries conducted in schools or by health visitors, chiefly because in the former methods there exist (1) overlapping of the source of supply of milk, (2) lack of knowledge of the number of persons per household to which the milk is distributed, and (3) in the case more particularly of co-operative societies, the preponderance of urban communities in the sample of districts examined tending to give a distorted view of the general average consumption of the whole country.

4. The average values for the whole of Scotland obtained in the schools inquiry which covers 66,149 families, comprising 393,726 persons, is 0·540 pint per head per day. The corresponding figure from the inquiries prosecuted by health visitors and nurses, based on 15,187 families of 80,242 persons is 0·488 pint per head per day. Certain corrections discussed in the text were considered necessary; and when these are made the average Scottish milk consumption is calculated as 0·479 pint per head per day.

5. The *per capita* consumption in the aggregate of large burghs is lower than in counties. From the schools inquiry the crude averages are 0·391 and 0·626 pint respectively, and from the nurse-health visitor inquiry 0·393 and 0·546 pint respectively. The corrected figures for large burghs and for counties are 0·417 and 0·550 pint per head per day respectively.

6. The variations of *per capita* milk consumption in the several local authority areas of Scotland show definite relationship with certain indices of the general health and environmental conditions pertaining thereto. The consumption of milk tends to be lower per head of population in areas with the greatest degree of overcrowding, with the heaviest loss of infant life, and with the highest rates of general mortality, and vice versa.

7. A map is given showing the average milk consumption in each county of Scotland. Roughly the country is divided in this respect into three broad groups, the industrial belt, the border counties, and the counties north of the industrial belt. The average milk consumption figures for these three groups of areas are 0·401, 0·579, and 0·809 pint per head per day.

8. The average *per capita* consumption figure for the whole country is more, and in certain local authority areas much more, than was thought to be the case, but could still with advantage to all concerned be appreciably increased.

## APPENDIX I.

## SCOTLAND.

**Total Milk Production in Scotland.**

In order to show how impossible it is to estimate the average consumption of milk merely from the figures of production and population, we obtained the following information from the Department of Agriculture for Scotland :—

"**Milk and Dairy Produce**:—The returns of the production of milk and dairy produce were in many cases imperfect, and while every effort has been made to overcome the difficulties thus placed in the way of framing accurate estimates of the output, the figures are presented with some reserve.

"Milk producers were asked to state the total quantity of milk produced, excluding whole milk fed to calves, the quantities of butter and cheese produced and the quantities of whole milk,[1] cream, butter, and cheese sold.

"The total production of milk is estimated at 171,000,000 gallons, or 430 gallons per cow, as an average for the mean number of cows in milk or in calf at 4th June, 1924, and 4th June, 1925. If heifers in calf be included, the average is reduced to 382 gallons. The figure based on the number of cows in milk or in calf is, however, preferable, as representing the average production during lactation, and it is used throughout this section of the Report. On the assumption that ten per cent. of the total output is used for calf-feeding, the average total production per cow is about 480 gallons."

From the above figures, if we take the population of Scotland at the nearest Census to the date of 1925 and divide the amount of milk produced by that population, it would show that the average amount per head was 0·77 pint per day. The present inquiry, however, has shown that instead of this being the correct figure the average consumption is 0·48 pint.

**Scottish Milk in 1925.**

Figures for the year 1925 show the following :—

| | |
|---|---|
| Total number of cows . . . | 398,000 |
| Total milk produced . . . . | 171,000,000 galls. |
| Used as liquid milk . . . . | 137,000,000 galls. |

The population (1921 Census) was 4,882,497.

[1] A certain proportion of the whole milk sold by farmers would be made into cream, butter, or cheese at creameries and factories, but that operation is excluded from the scope of the Census of Agricultural Production, being dealt with by the Board of Trade in the general Census of Production.

The average consumption per head per day of the total milk was, by this method of reckoning,

·77 pint.

The average per head per day of liquid milk was, by this method of reckoning,

·62 pint.

This inquiry shows that such a method of calculating does not give a true result.

## APPENDIX II

## U.S. OF AMERICA.

**Milk Consumption in U.S.A.**

In reply to an inquiry from us as to whether data were available to give an average consumption for the United States, the following reply, dated 14th January 1931, was received from the Secretary, Department of Agriculture, Washington, with permission to publish it.

> "In regard to the *per capita* consumption of milk in the United States, *we have not sufficient data to provide an absolutely accurate figure for the country as a whole.* Reports from a large number of individual farmers, who act as crop reporters for this Department, indicate an average daily *per capita* consumption of about 1·47 pints of milk and cream (cream in milk equivalent) *on the farms of these reporters.*
>
> "Reports from municipal health officials in 1926 indicated a *per capita* consumption in cities of about 0·96 pints daily. The municipal boards of health report average quantities received daily for consumption as fluid milk or cream. *This figure was derived by dividing the receipts as reported, by the population of the cities reporting.*"

NOTE.—*The italics in this and subsequent appendices are ours.*

From Bulletin 158, "Statistics Relative to the Dairy Industry in New York State, 1922" (published by the Department of Farms and Markets of the State of New York), we quote the following :—

> "Multiplying the estimated number of cows of milking age (1,415,000) by the estimated average production per cow (5,060 pounds) indicates that the total production of milk on the farms of the state during 1922 was about 7,173,000,000 pounds. *If this were all marketed as fresh milk it would give an average of 1¾ pints per person per day for the entire population of the state.*
>
> "The average number of people per farm during 1922 was

perhaps somewhere around 4·3. If this is correct the indicated consumption of fluid milk on the farms with cows was about 93/100 of a pint per person per day.

"The average for the urban and village population of the state in 1918 was about ⅝ pint per person per day."

In Vol. 46, Number 14, of Public Health Reports issued by the United States Public Health Service, is published the Preliminary Report of the Committee on Milk Production and Control, White House Conference on Child Health and Protection. On p. 800 appears the Report of the Sub-Committee on Economic Aspects of Milk, from which we quote the following paragraph :—

"According to the latest figures available, the *per capita* consumption of fluid milk in 1926 in the United States was 55·3 gallons per year, or slightly more than 1 pint per day. In 1926, the most recent year for which figures are available, four European countries exceeded the United States in the *per capita* consumption of milk. These were Finland, with a consumption of 83·9 gallons ; Switzerland, 70·4 gallons ; Sweden, 69·7 gallons ; and Norway, 56·0 gallons."

The following note is quoted from *The Lancet*, Vol. I, 1931, p. 788 :—

**Milk Consumed in New York.**

"In the course of a health survey conducted in New York City last September by nurses of the Department of Health for the purpose of supplying information desired by the White House Conference on Child Health, an inquiry was made as to the amount of milk used in the different families visited. The survey covered about 14,000 families in various parts of the city, evenly distributed among the socio-economic groups. The average consumption of milk per head was found to be 0·98 pint per day compared with 0·55 pint in 1910–14 and 0·80 pint in 1926. The number of children is known, but not the amount of milk they consumed. Assuming, however, as the Health Commissioner thinks reasonable, that the adult members of the families consumed each not over half a pint, the average per child of the lowest economic group works out at 1·07 pints, and in the other groups from below upward 1·48, 1·42, 1·60, and 1·61 pints. A continuance of the educational campaign will, the Commissioner remarks, gradually raise this to the quart per child advocated by all authorities on child health."

## APPENDIX III.

### DENMARK.

**Milk Consumption in Denmark.**

In reply to an inquiry re milk consumption in Denmark, Mr. Harold Faber, the then Agricultural Commissioner to the Danish Government, wrote on 22nd March, 1931, as follows :—

> " As to the question of milk consumption in Denmark *I find that we have no statistics on the subject,* and I am very sorry that for that reason I cannot answer your question properly.
>
> " It is *estimated* that the yearly consumption of whole milk in Copenhagen is about 140 kilogrammes per head.
>
> " Another *estimate* of the consumption of whole milk for the whole country gives this as only 114 kilogrammes, to which I think a considerable consumption of skimmed milk and buttermilk would have to be added.
>
> " Dr. Hindhede has examined the consumption of milk in various classes of the population in various years. As near as I can condense his figures they would work out at 180 kilogrammes."

## APPENDIX IV.

### GREAT BRITAIN.

**Average Milk Consumption for Great Britain.**

The following table is quoted from the Final Report of the " Committee on the Production and Distribution of Milk " (The " Astor " Committee), published in 1919 (page 8, paragraph 21).

> "21. Present-day average consumption:—That enough liquid milk is not consumed is shown by the returns in the following table obtained in January 1918, through the Local Food Control Committees :—

| Food Division Area. | Consumption per head per day. |
|---|---|
| 1. Northern | 0·19 pints liquid milk. |
| 2. North-eastern | 0·22 ,, ,, |
| 3. Home Counties (S.) | 0·29 ,, ,, |
| 4. Home Counties (N.) | 0·27 ,, ,, |
| 5. Eastern | 0·18 ,, ,, |
| 6. North-western | 0·27 ,, ,, |
| 7. London | 0·31 ,, ,, |
| 8. South-western | 0·28 ,, ,, |

| Food Division Area. | Consumption per head per day. |
|---|---|
| 9. South Midlands | 0·27 ,, ,, |
| 10. Midlands | 0·24 ,, ,, |
| 11. North Midlands | 0·23 ,, ,, |
| 12. North Wales | 0·20 ,, ,, |
| 13. South Wales | 0·16 ,, ,, |
| **Scotland.** | |
| Edinburgh | 0·22 ,, ,, |
| Glasgow | 0·25 ,, ,, |
| Inverness | 0·10 ,, ,, |

Average per head per day for Great Britain=0·25 pint."

*Note.*—These figures were obtained in the last year of the Great War. They show that in January 1918 the consumption per head per day varied from one-tenth of a pint in Inverness to one-third of a pint in London. The average for the country was one-quarter pint per head per day.

## APPENDIX V.

## COMPARATIVE WEIGHTS AND MEASURES.

### Imperial Measures of Capacity.

| | | |
|---|---|---|
| 4 gills | = | 1 pint (pt.) |
| 2 pints | = | 1 quart (qt.) |
| 4 quarts | = | 1 gallon (gal.) |
| 2 gallons | = | 1 peck (pk.) |
| 4 pecks | = | 1 bushel (bus.) |
| 8 bushels | = | 1 quarter (qr.) |

These measures are used *up to the gallon for liquids*, and from the *peck upwards for dry goods.*

### Metric Measures of Capacity.

| | | | |
|---|---|---|---|
| 10 millilitres | = 1 centilitre | = | 0·0704 gill. |
| 10 centilitres | = 1 decilitre | = | 0·17598 pint. |
| 10 decilitres | = 1 litre | = | 1·7598 pints. |
| 10 litres | = 1 decalitre | = | 2·1997 gals. |
| 10 decalitres | = 1 hectolitre | = | 2·7497 bushels. |

1 litre = approximately 1¾ pints.

### Comparisons of Liquid Measures.

| | | |
|---|---|---|
| 1 gill | = | ·142 litre. |
| 1 pint | = | ·568 litre. |
| 1 quart | = | 1·136 litres. |
| 1 gallon | = | 4·546 litres. |

**Liquid Measure Equivalent.**

The Litre is the unit.

| | | | | English Pints. |
|---|---|---|---|---|
| 10 centilitres | = | 1 decilitre | = | ·17598 |
| 10 decilitres | = | 1 litre | = | 1·7598 |
| 10 litres | = | 1 decalitre | = | 17·598 |
| 10 decalitres | = | 1 hectolitre | = | 175·98 |

**Weight Measure Equivalents.**

The Gram is the unit.

| | | | English Grains. | | English Drams. |
|---|---|---|---|---|---|
| 10 milligrammes | = 1 centigram | = | ·154 | = | ·0056 |
| 10 centigrammes | = 1 decigram | = | 1·543 | = | ·0564 |
| 10 decigrammes | = 1 gram | = | 15·432 | = | ·5643 |
| 10 grams | = 1 decagram | = | 154·323 | = | 5·6438 |
| 10 decagrams | = 1 hectogram | = | 1543·234 | = | 56·438 |
| 10 hectograms | = 1 kilogram | = | 15432·348 | = | 564·38 |

The unit, the gram, is the weight of a c.c. of water at its greatest density, 4° C. or 39° F.

**Rules for converting scales.**

To convert grams to ounces avoirdupois multiply by 20 and divide by 567.

To convert kilograms to pounds multiply by 1000 and divide by 454.

To convert litres to gallon multiply by 22 and divide by 100.

To convert litre to pints multiply by 88 and divide by 50.

## APPENDIX VI.

**Variations of Milk Consumption within Individual Local Authority Areas.**

The variations of milk consumption in the local authority areas have been shown previously; but from the more detailed returns on which these averages are based, certain interesting differences *within* individual areas have been observed, and it has been considered advisable to relegate these to this appendix rather than incorporate them in the general report.

**1. Glasgow.**

In this area the health visitors' inquiry covered all the 37 wards of the city and, commenting on the results, Dr. Macgregor, Medical Officer of Health, says: "Generally speaking, the quantity of milk obtained per household is larger in the better-class wards than in the poor wards, and in order to obtain a basis for grouping these I have adopted the infant mortality as a standard. The following is an abstract of the group totals:—

| Group. | Infant Mortality Rate, 1921–24. | No. of Persons in Households. | Daily Consumption Liquid Milk. | Average per Head. |
|---|---|---|---|---|
| | | | Pints. | |
| 1. Residential (7 wards) . . | 54 | 1,096 | 508 | 0·46 |
| 2. Residential and Industrial (10 wards) . . . . | 83 | 3,244 | 1,417 | 0·44 |
| 3. Mainly Industrial (10 wards) . | 110 | 6,005 | 2,367 | 0·39 |
| 4. Industrial and Poor (10 wards) | 115 | 4,998 | 1,666 | 0·33 |

The differences are proportionately quite considerable when compared with the average for the city of 0·39 pint per person.

The whole issue is complicated by the quantity of tinned milk purchased by certain families. This may be a question of economy on the part of the household concerned, as sweetened condensed milk is always available in emergency, and prevents the supplies of liquid milk being retained for the dietetic purposes of the older members in the families. If the 1752 tins recorded as being bought weekly are distributed over the week, then roughly 300 tins are purchased per day, and if one tin is equivalent to one pint of milk, then the total supply is equivalent to 6265 pints, which is equal to about 2⅛ pints per household, an equivalent of 0·54 pint per adult, taking two children as equal to one adult." (The full details of this very interesting record of condensed milk, showing the comparison between liquid and condensed milk consumption are shown later.)

The school investigation in this area covered 16 selected schools, 9 of the poorest class, 5 of the medium class, and 2 better class. They cover a population of 30,275 persons (15,782 adults and 14,443 children). These consumed on an average day 13,049 pints of milk, equal to an average consumption of 0·43 pint per head. Information was also obtained showing the consumption of condensed milk in 60 families, and the consumption of fresh and condensed milk in 34 families. Details of all those returns are shown in the following summary. (In Tables 2 and 3 a question mark indicates that condensed milk was referred to without statement of quantity—the size of the tin was not given.)

## THE CORPORATION OF GLASGOW.

**Summary of Information given by Parents of Children regarding Household Milk Supplies.**

TABLE 1.—SUPPLIES OF FRESH MILK.

| School. | Families. | Adults. | Children. | Milk. Pints. |
|---|---|---|---|---|
| GROUP 1.—Poorest Schools. | | | | |
| 1. | 382 | 1,172 | 1,317 | 881 |
| 2. | 352 | 1,094 | 1,145 | 816 |
| 3. | 159 | 486 | 502 | 362¾ |
| 4. | 366 | 1,190 | 1,168 | 845½ |
| 5. | 148 | 478 | 481 | 298½ |
| 6. | 199 | 582 | 657 | 402¾ |
| 7. | 212 | 640 | 629 | 472½ |
| 8. | 370 | 1,255 | 1,240 | 1,039¾ |
| 9. | 136 | 354 | 366 | 216 |
| Totals | 2,324 | 7,251 | 7,505 | 5,334¾ |
| GROUP 2.—Medium Class. | | | | |
| 10. | 168 | 475 | 527 | 431½ |
| 11. | 458 | 1,490 | 1,323 | 1,384½ |
| 12. | 810 | 2,652 | 2,147 | 2,268½ |
| 13. | 299 | 869 | 711 | 755¼ |
| 14. | 479 | 1,450 | 1,257 | 1,254 |
| Totals | 2,214 | 6,936 | 5,965 | 6,093½ |
| GROUP 3.—Better Class Schools. | | | | |
| 15. | 370 | 1,102 | 751 | 1,181¾ |
| 16. | 120 | 493 | 272 | 439 |
| Totals | 490 | 1,595 | 1,023 | 1,620¾ |
| Grand Totals | 5,028 | 15,782 | 14,493 | 13,049 |

TABLE 2.—SUPPLIES OF CONDENSED MILK.

| School. | Families. | Adults. | Children. | Condensed Milk Tins. |
|---|---|---|---|---|
| 1. | 1 | 3 | 1 | 2/7 |
| 2. | 8 | 24 | 25 | 14+ ? |
| 3. | 1 | 2 | 2 | ? |
| 4. | 3 | 11 | 10 | ½+ ? |
| 5. | 32 | 79 | 113 | 10+ ? |
| 6. | 3 | 7 | 12 | 3+ ? |
| 7. | 1 | 4 | 4 | ? |
| 8. | 4 | 9 | 10 | ½+ ? |
| 9. | 1 | 3 | 3 | 1 |
| 10. | 3 | 9 | 11 | 2+ ? |
| 12. | 3 | 10 | 7 | 2½ |
| Totals | 60 | 161 | 198 | 33+ ? |

TABLE 3.—SUPPLIES OF FRESH MILK AND CONDENSED MILK.

| School. | Families. | Adults. | Children. | Milk. Pints. | Condensed Milk Tins. |
|---|---|---|---|---|---|
| 1. | 3 | 12 | 11 | 4½ | 5 |
| 2. | 2 | 8 | 13 | 5 | 1+ ? |
| 3. | 24 | 75 | 80 | 42 | 6+ ? |
| 4. | 3 | 7 | 17 | 2 | 1+ ? |
| 5. | 2 | 5 | 13 | 2 | 1+ ? |
| Totals | 34 | 107 | 134 | 55½ | 14+ ? |

It will be noted that these results for fluid milk consumption substantiate the more general finding for the local authority areas as a whole, wherein the average consumption of milk was shown to be related to differences in the degree of overcrowding and in the rates of infant and of general mortality. From the above table it will be apparent that the average milk consumption is lowest in the poorest and highest in the better-class schools, the figures for poorest, medium and better-class schools being 0·36, 0·47, and 0·62 pint per head per day.

**2. County of Aberdeen.**

In this area the joint results of inquiry by retail dairymen, nurses, and health visitors includes returns from 7 coastal fishing towns and villages, and 21 other towns and villages. The detailed results for this part of the country are given in the following table. The figure for the whole area (1·05 pints per head) is the highest of all, and corresponds very well with the figure for this area derived from

the schools inquiry, wherein the average *per capita* consumption was 1·03 pints.

TABLE 4.—CONSUMPTION OF MILK.

| | Persons. | | | Milk. | |
|---|---|---|---|---|---|
| | Under 15 years of Age. | Over 15 years of Age. | Total. | Pints Consumed. | Average Consumption—Pint per Person |
| 7 coastal (fishing) towns and villages . . | 3,232 | 3,335 | 6,567 | 3,784 | ·58 |
| 28 towns and villages (including 7 above) . | 10,543 | 9,106 | 19,649 | 16,392 | ·8 |
| Rural . . . | 12,263 | 10,197 | 22,460 | 27,770 | 1·2 |
| Whole area . . | 22,806 | 19,303 | 42,109 | 44,162 | 1·05 |

In the school inquiry in this district returns were obtained from 122 schools, showing an average daily consumption figure of 1·03 pints per head. The figures for individual schools range from 0·37 to 2·33 pints per head per day, and the following table shows the number of schools with *per capita* consumption values within the limits indicated :—

| Consumption per Head. | Number of Schools. |
|---|---|
| 0·2 to 0·4 | 1 |
| 0·4 to 0·6 | 5 |
| 0·6 to 0·8 | 4 |
| 0·8 to 1·0 | 29 |
| 1·0 to 1·2 | 33 |
| 1·2 to 1·4 | 27 |
| 1·4 to 1·6 | 10 |
| 1·6 to 1·8 | 7 |
| 1·8 to 2·0 | 5 |
| 2·0 to 2·2 | — |
| 2·2 to 2·4 | 1 |
| | 122 |

Similar wide variations have been observed in the individual schools or different districts of other local authority areas of the country, but it has not been considered necessary to reproduce these here.

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