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WESTERN AUSTRALIA.

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REPORT AND RECOMMENDATIONS

OF THE

ROYAL COMMISSION

ON THE

METROPOLITAN MILK SUPPLY.

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*Presented to both Houses of Parliament by His Excellency's Command.*

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[SECOND SESSION OF THE TWELFTH PARLIAMENT.]

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## REPORT AND RECOMMENDATIONS OF THE ROYAL COMMISSION ON THE METROPOLITAN MILK SUPPLY.

*To His Excellency Colonel Sir William Robert Campion, Knight Commander of the Most Distinguished Order of St. Michael and St. George, D.S.O., Governor in and over the State of Western Australia and its Dependencies, in the Commonwealth of Australia.*

*May it please Your Excellency,*

The Order in Council appointing the Commission was published in the *Government Gazette* dated 16th January, 1925.

The terms on which the appointment was made were:—

- (a.) To inquire into the milk supply of the metropolitan area, having regard to its production, quantity and quality, and its transport, handling, and distribution.
- (b.) To consider whether the methods of production, transport, handling, and distribution can be improved, and, if so, to make recommendations accordingly.
- (c.) And generally to make such other recommendations as you may consider would lead to improvement in the milk supply.

From these terms it will be seen that a comprehensive charter was bestowed on the Commission.

At the request of the Commission returns were furnished by all local health authorities of the milk producers and vendors registered with them; by all producers of their herds and the amount and destination of the milk produced; by the depot keepers of their dealings, and by the vendors of the amount and source of their supplies.

The majority of the dairies supplying milk to the metropolitan area were inspected, and other centres from which milk could be obtained were visited.

Depots and other distributing establishments were inspected.

Sixty individual witnesses were examined, and deputations representing the producers' and the retailers' associations waited on the Commission and submitted interesting and helpful statements.

Included in the witnesses were:—

- Dr. Everitt Atkinson, Commissioner of Public Health.
- Dr. Douglas Kerr, Chairman, Health Committee, Fremantle Municipal Council.
- F. Murray-Jones, B.V.Sc., Chief Veterinary Officer.
- A. E. Weston, B.V.Sc., Veterinary Surgeon, formerly Lecturer in Veterinary Science, W.A. University.
- P. G. Hampshire, State Dairy Expert.
- L. R. MacGregor, Director of the Council of Agriculture, Queensland.

- G. A. Greenhill, Chief Health Inspector, Department of Public Health.
- F. Higgs, Chief Health Inspector, Perth City Council.
- W. Dow, President of the Health Inspectors' Association.
- R. G. Lapsley, B.Sc., Analyst, and Member of the Health Inspectors' Association.
- R. Adam, Food Inspector, Perth City Council, and Member of the Health Inspectors' Association.
- E. G. Paddison, Railway Inspector, representing the Commissioner of Railways.
- R. C. Kerr, Manager Dairy Farm, Hospital for Insane.
- J. C. Armstrong, Agricultural Adviser to the Department of Agriculture.
- Mrs. Bell, President of the Housewives' League.
- W. R. Clarke, representing the Westralian Farmers, Ltd.
- Wm. Traylen.
- R. S. Sampson, M.L.A.

In addition to the above there were examined seven depot keepers, twelve producers, and twenty-four distributors, some of whom were also producers.

It will be readily understood that among such a wide range of witnesses much diversity of opinion would exist. There was, however, unanimity among the witnesses regarding the present unsatisfactory condition of the industry.

The successive sections of this report deal with the existing conditions of the milk supply under the following headings:—

Legislation, Control, Quality, Quantity, Production, Transport, Handling, Distribution and Economics.

Thereafter follows a summary of conclusions and the outline of a scheme for the organisation of the industry.

Finally are presented the recommendations of the Commission, arrived at as a result of careful consideration of the evidence submitted, the knowledge gained by personal inspection, and the investigations carried out under its direction.

### LEGISLATION AND CONTROL.

Existing legislation is contained within "The Health Act, 1911-19," and the by-laws made thereunder. The Stock Diseases Act is of little value in connection with the milk supply, and the Stock De-

partment is dependent on the health legislation for its powers in relation thereto.

The Health Act and by-laws are administered by the Department of Public Health in localities outside the boundaries of a local health authority, and by the local health authorities within their own boundaries.

The powers conferred by the Health Act are extensive and, except for one or two minor matters, ample for the purpose of providing for such matters as registration, cleanliness, conformity to standard, inspection, etc.

The legislation, however, fails to be effective—a failure due to a break-down in its application.

The Department of Health, in theory, exercises supervision over the work of local authorities, but in practice such supervision is very irregular.

The department has not in the past been able to exercise efficient supervision over the dairy premises under its own jurisdiction, much less pay adequate attention to the position elsewhere. In fact, the control of dairies by both the department and local authorities consists of the annual registration of the premises concerned plus occasional and more or less perfunctory inspections. Some dairymen have described the inspections as a "look round," and there has been little real enthusiasm displayed, neither have the visits been of much educative value. It is true that in some districts supervision may not be so ineffective as in others, but there is conclusive evidence that, judged by the standards of real cleanliness, satisfactory methods, proper water supply, etc., the level attained is nowhere a high one.

So far as the department is concerned it appears that sufficient staff is not available to permit of this work being carried out thoroughly. The staff is small and has very varied duties to perform over most of the State.

The officer of the local authority in many cases is allotted such a multiplicity of duties that little time is available for supervision of dairies. It must be remembered also that a local authority has no jurisdiction outside its own boundaries, and is therefore only in a position to exercise partial control. Thus, though a local authority may be dissatisfied with the cleanliness of the milk sent into and distributed within its district, it can deal only with the question of the chemical quality. It has no control over the dairies outside its boundaries, and could not take effective steps to deal with any defects existing thereat.

It is clear that there is no authority or officer whose particular duty it is to exercise control over the milk supply. Everyone has something else to do, and the work has been neglected.

An inspector dealing with the milk supply must have special knowledge and qualifications and be free to apply these. There is no doubt that many, indeed most, dairymen are in need of advice as to how best to conduct their business, but the capacity to instruct demands extensive knowledge and enthusiasm.

#### *Standard for chemical composition.*

The existing standard in this State for fresh milk is contained in the Food and Drug Regulations.

These regulations have been made on the advice of the Food Standards Advisory Committee, appointed under the Health Act. The regulations setting up the standard read as follows:—

#### 28.—*Milk.*

"1. Milk is the lacteal secretion of the cow. It shall be clean and fresh, and shall be obtained by completely emptying the udder of the healthy cow, properly fed and kept, excluding that got during fifteen days immediately before, and ten days immediately following on, parturition. It shall contain not less than eight and five-tenths parts per centum of milk solids not fat, and not less than three and two-tenths parts per centum of milk-fat and not less than eleven and seven-tenths parts per centum of total solids."

This standard was arrived at after a State-wide survey, extending over a period of twelve months, carried out in 1911-1912, and, so far as can be discovered, there has been no reasonable demand for any variation, nor does it appear that any alteration in respect of the standard itself is desirable.

The Commission considers, however, that a valuable addition to the existing methods of examination can be made by the introduction of what is known as the "freezing test," which has been used for many years by the Government Analyst of Queensland. It seems that the test is of great value in ascertaining whether water has been added to the milk. It is based on the fact that the addition of water to milk raises the freezing point, and shows whether a poor sample is natural milk of poor quality or milk of good quality to which water has been added.

The test would, therefore, assist in certain cases in deciding whether a prosecution should be undertaken or not. If it were found that the milk had been adulterated the offender would be prosecuted. If, however, the test showed that the sample was natural milk of poor quality, steps could be taken to improve the supply, which could be excluded, if necessary, until the improvements were effected. Under existing circumstances, a prosecution on account of poor quality carries an implication of fraudulent dealing on the part of a person who may be perfectly innocent thereof, and this may tend to keep conscientious persons out of an industry in which conscientiousness is so desirable.

During the twelve months ending 31st December, 1924, a total of 1,733 official samples were obtained by local authorities within the metropolitan area and examined by chemical analysis. The control exercised by some local authorities in this regard has certainly been very efficient. The results of the analyses of these samples showed that the milk supplied to consumers was generally well above the standard, particularly in respect of the butter-fat content. Nevertheless, of the samples taken a considerable number were below the standard, and this lack of conformity, having regard to the reasonableness of the standard, must in the main be regarded as the result of deliberate adulteration.

In this connection the leniency of magistrates towards offenders against both the law and the public good is a matter for comment. Too often the bench has lamentably failed to realise the serious nature of the offence. No doubt there are many cases in which the circumstances are such as to justify leniency, but when such circumstances are absent, the infliction of the minimum penalty emphatically does not meet the case.

## THE QUALITY OF THE MILK SUPPLY.

The quality of milk must be considered from several different points of view, including those of its food value, its safety as regards infection, its cleanliness, and its stability or keeping qualities.

### *Food Value.*

The food value of milk depends on its make-up, that is, on the amount and proportion of its constituents. These can be ascertained partly by chemical analysis, but this method is useless for the estimation of its content of vitamins, those imponderable constituents or properties of foods in the absence of which the ordinary gross constituents of a diet are useless to the consuming animal.

Judged by the standard of chemical analysis, the metropolitan milk supply is of very good quality. The analyses carried out for the various health authorities show that the average milk is well above the standard and compares very favourably with milk supplies in other parts of the world. This is a matter of great importance. The food value of genuine milk, estimated in terms of its "calories" or energy-producing value, varies within such wide limits that, if the value of one sample be 3s. a gallon, the value of another may be as much as 3s. 10d. The variations occur, as stated, chiefly in the fat content of the milk, and there is clearly much to be said in favour of the purchase of milk on the basis of its fat content.

The estimation of the "biological value" or vitamin content of milk is a matter of great difficulty, involving very prolonged and tiresome experiments in the feeding of animals. Apparently no such experiments have yet been carried out with milk anywhere in Australia, and the quality of the local milk in this regard is not known.

It is, however, generally agreed that milk is an extremely valuable foodstuff, especially for the young, and milk is often stated to be one of the "protective" foodstuffs, because by its "positive qualities" it protects a population from the "negative qualities" or deficiencies of its ordinary diet. Among these positive qualities are the vitamins which have been repeatedly proved to be present in the milk of well-fed cows. But it has also been proved that the vitamin content is dependent on the food of the cow. No animal can manufacture vitamins, and if cow's milk is to contain them they must be supplied in her food. It is impossible here to discuss the question fully; it suffices to say that the local milk may be deficient, especially during certain seasons of the year, in the vitamins known as "A" and "C." Even so, it would be a very valuable food, but not so valuable as it might be. The Government Bacteriologist has, at the request of the Commission, initiated some experiments designed to throw light on the question; and it is very desirable that the whole matter should be fully investigated.

### *Safety.*

The safety of a milk supply implies the absence therefrom of micro-organisms capable of causing illness in man. The germs may get into the milk from the cow (germs of bovine tuberculosis, actinomycosis, and streptococci capable of causing sore throat), from the water used in washing utensils

(germs of the enteric group), from the person handling the milk from hands or sputum (germs of the enteric fever group and of the respiratory group, such as scarlet fever and diphtheria), and from flies (germs of the enteric group).

The danger may obviously be reduced by eliminating these sources of infection as far as possible, and existing legislation regarding the health of the cows and of persons handling milk, cleanliness of premises, water supply, is designed to effect this. If infection has occurred, the milk may be made safe by heating under certain conditions, as in pasteurisation, boiling, or sterilisation.

There is very little evidence that infection of the metropolitan milk has been a cause of disease, although one small outbreak of typhoid fever was traced to an infected milk some twelve years ago.

Human tuberculosis of bovine origin manifests itself chiefly in young children. The extent to which it may exist in this State is not known, and is apparently not discoverable under present conditions. It seems to be more prevalent in Great Britain than in Australia, and in parts of Scotland than elsewhere in Great Britain. Variation in prevalence depends probably on a number of factors, which include the extent to which the dairy cattle are affected and the degree of resistance offered by the children to the attack of the tubercle bacilli, a resistance which seems to be adversely affected by bad social and hygienic conditions, such as improper feeding, lack of fresh air, and sunlight. Western Australia, and indeed the whole continent, is fortunately situated in respect of both these factors. The conditions of life both for the cattle and for the children may be regarded as more favourable in Australia than in many parts of Great Britain. Ricketts in human beings is a disease believed to be due to much the same factors as are responsible for lack of resistance to tuberculosis, and ricketts is certainly far less prevalent in Australia than in Great Britain. Tuberculosis of bovine origin does, nevertheless, occur among children in Australia, as is proved by the recognition of nine strains of bovine origin among 52 cultures of tubercle bacilli recovered from post-mortem examinations of children in Melbourne (see "M.J.A. Supplement," 19th July, 1924). Some cases probably have occurred and do exist in Western Australia, but the extent of the disease in this State has not been sufficient to call urgently for investigation as to the presence of tubercle bacilli in the milk and the prevalence of tuberculosis among the dairy cattle.

At the request of the Commission a number of samples of milk were examined in the laboratory of the Health Department, and one infected specimen was discovered. Ample evidence does exist that infection is present among dairy cattle. Grossly infected dairy cows are not infrequently discovered and destroyed at the abattoirs, and infected animals are found from time to time in the herds during inspections by the veterinary officers of the Agricultural Department.

The extent to which tuberculosis exists among dairy herds may be decided with a fair degree of accuracy by the application of the tuberculin test. This has not been carried out on any large scale, but tests of individual herds have shown varying proportions up

to 30 or 40 per cent. of infected animals. The chief veterinary officer estimates that the proportion among the herds generally would be 5 to 10 per cent. It is clear, therefore, that the metropolitan milk supply is infected in some degree with tubercle bacilli.

In various American cities, where infection among the herds is possibly greater than is the case here, and where cases of bovine infection among children were certainly more evident, it has been enacted that all milk that does not come from certified tubercle-free herds must be pasteurised. This is equivalent to a suggestion recently made by Dr. Penfold, Director of the Commonwealth Serum Laboratories, that the tuberculous cow should be officially recognised, and that the dairy farmer should be compelled either to free his herd from tuberculosis or to bear the expense of pasteurisation of his milk.

In the absence of more information as to the prevalence of bovine tuberculosis both in the herds and among children, it is doubtful if the adoption of this recommendation is urgently called for at the moment. More knowledge of local conditions is required, and in the meantime parents who are alarmed at the possibility of infection of their children may be advised to bring the milk to the boil. On one point a definite recommendation is necessary—namely, that the practice of keeping one or two cows for home supply, or in connection with an institution, especially where there are children, should only be permitted when the cow or cows are certified to be tubercle-free. The reasons for this are, on the one hand, that the tuberculous cattle are, as was stated in evidence, specially liable to get into the hands of private householders, and, secondly, that the milk of an infected cow is, owing to the relative concentration of the germs therein, believed to be more dangerous than the mixed milk of a large herd, a few members only of which may be giving infected milk.

#### *Cleanliness.*

The word cleanliness suggests dirt—foreign matter. This is commonly present in milk in two forms, visible or gross, and invisible or microscopic.

The gross dirt consists of particles derived from the feed and manure, of hairs, and of dust of various kinds. A small amount of this gross dirt will find its way into milk even under the best conditions. It can be removed by careful straining.

The invisible dirt includes many micro-organisms. It is practically impossible to obtain milk that is free from them, though it is probable that the milk in the udder is usually almost germ-free. Under actual conditions the number of living germs that can be demonstrated in one cubic centimetre (18 drops) of freshly drawn milk varies from a few hundreds under the best conditions to a few millions under the worst.

#### *Significance of ordinary bacteria in milk.*

These germs must not be confused with the "specific" or special germs of the infectious diseases, also called pathogenic organisms, which have been mentioned above in dealing with the safety of the milk. These ordinary germs belong to that vast world of invisible life which the microscope has shown to exist everywhere in conjunction with the visible forms—the ordinary animals and plants.

These germs play, of course, a great part in the scheme of nature, a part that is not yet fully understood, but it is now known that they are the principal agents of decomposition—in other words, their work is to break up the dead bodies and products of the visible animals and plants and "return them to the dust"—a very necessary function. Most of our foodstuffs are dead organic matter, and they all sooner or later tend to decompose. The public is beginning to realise that the "keeping good" of foodstuffs is a question of keeping germs off foods (protection) or of preventing their growth (refrigeration, preservatives), or of killing them (pasteurisation, boiling, cooking, sterilisation), and that "going bad" and the degree of "badness" indicate the growth of micro-organisms in food and the extent to which decomposition has taken place.

So with milk, it is dead organic matter intended by nature for immediate consumption. Germs gain access to it from the same sources as, and to a great extent together with, the gross dirt mentioned above.

The durability of fresh milk depends upon the number of germs that have gained access to it and the conditions under which it is kept. Milk that is procured under the best conditions of cleanliness and is kept cold will "keep good" for days and weeks; sterilised milk and dried milk will keep for months; pasteurisation will give dirty milk a new lease of "life," whereas milk that is procured under dirty conditions and is not properly cooled and kept so will "turn" or "go bad" within twelve hours.

The counting of germs in milk is, therefore, a matter of importance. Gross dirt can be removed by straining; germs cannot. The bacterial count of a fresh milk gives a good indication of the cleanliness or lack thereof, under which it was produced, and it gives an idea of its probable keeping qualities, though the keeping will depend, of course, upon the conditions under which it be kept. The bacterial count of milk that is not fresh gives an idea of its history, a high count indicating either that it was obtained under dirty conditions or that it has not been protected and kept cold, or both.

A high count of any milk indicates the fact that it is to a certain extent damaged or spoiled, and these terms have been freely and rightly used in this connection.

There is, however, no clear evidence that milk with a high bacterial count is in any way injurious to health or that its food value is necessarily or appreciably diminished.

As the ordinary germs grow in milk and their numbers increase to millions per c.c., its acidity usually increases, and when there are many millions it becomes sour and clots. On the other hand, according to the species of the predominant germs, it may become putrid and stink, or it may become viscid or ropy, or it may develop colour.

Some people like sour milk, some intentionally add cultures of germs thereto in order to prolong their lives, or remove joint pains or improve their complexions. Some races, whose virility is largely to be ascribed to the part which milk plays in their diet, habitually allow it to clot naturally, after the development of very many millions of organisms per

c.c. Moreover, some foods are consumed in an advanced state of decomposition.

On the other hand many medical men have stated that in their opinion milk with a high count, which is, therefore, well on the way to obvious souring, is unsuitable for young infants, and members of the laity generally have assumed that the bodies alive or dead of millions of organisms cannot do them any good.

In any event it is undesirable that milk on delivery to the consumers should contain large numbers of germs. Such milk will not keep as well as milk with a relatively low count, and is suggestive of dirty conditions at the dairy and of improper handling.

As soon as the Commission was appointed a survey of the bacteriological condition of the milk supply was instituted. The results are set out in the special report (see addendum). They show that much of the milk does contain a large number of germs at the time of delivery. The figures averaging, though they do, many hundreds of thousands, compare quite favourably with similar figures obtained in other populous centres in Australia and Great Britain. The actual figures are not of great significance since there is no agreed standard method of counting, and different methods give rather different results, and it must be remembered that a milk giving a count of half a million might give, after two hours' keeping under certain conditions, a count of eight millions. Of greater significance are the facts disclosed in the survey that some of the milk is much better than the average, and that by careful and inexpensive methods it is possible to produce and deliver milk with a low count and consequent good keeping quality. The Commission believes that it would be possible, with the adequate education and supervision which it recommends, to ensure that the whole supply would be of similar good quality.

The survey mentioned should be continued in order to determine the possible influence of seasonal changes, and thereafter a constant bacteriological control should be maintained. Should it prove eventually to be impracticable to ensure by simple inexpensive means that the whole supply be satisfactory in this respect, it may be necessary to resort to pasteurisation of the unsatisfactory milk.

Pasteurisation as mentioned above kills the greater number of the organisms and gives the milk a new lease of life, and in this connection it must be noted that proper pasteurisation also destroys all disease-producing organisms, and that should the further investigation of the tuberculosis problem, which is recommended, indicate its desirability, the method may have to be introduced on that account. Many communities now pasteurise the greater portion of their supply with the double object of making it safe and of reducing the number of organisms.

#### QUANTITY OF MILK CONSUMED.

From figures supplied by the State Statistician the population of the metropolitan area is estimated to be 176,467 persons. On the basis of a daily consumption of 8,000 gallons it will be seen that the amount consumed equals 0.36 pints per head.

An average consumption of slightly over 7ozs. of fresh milk per person per day certainly cannot be

regarded as sufficient, and indicates that there is urgent need of intelligent propaganda regarding the virtues of milk as an article of food. Propaganda along these lines, however, should be preceded by certain reforms in the method of production and distribution, in order that the public may be assured that the article is clean and of good chemical composition. Elimination of wasteful methods in production and distribution should bring about a reduction in price, and this should certainly have the effect of encouraging greater consumption.

Extreme difficulty was experienced in estimating the number of occupied tenements in the metropolitan area, but from the figures supplied by local authorities the figure 41,626 was arrived at.

This gives the average number of occupants per tenement as 4.2, and the average quantity of milk consumed per household is therefore 1.5 pints.

The quantity of milk consumed varied considerably in different districts, ranging from an average of 2.5 pints in West Perth to 1.25 pints per household in North Fremantle.

It is probable that the quantity of milk from "house" cows, which has not been estimated, would increase the consumption figures slightly.

It is believed that the resources of production could ensure a constant supply greatly in excess of the present quantity of 8,000 gallons per day.

The area of coastal lands between Perth and Bunbury or Busselton is capable of and is now producing large quantities of milk, much of which is separated for the butter trade. It is evidently intended that milk production should be a chief activity of the settlers on the Peel Estate, which is within a short distance of the metropolis, and in the Harvey district there are at present some 50 dairy farmers chiefly engaged in butter-fat production.

The possibility of establishing depots in country centres, where milk could be brine-cooled before despatch to the metropolis, will have to be considered.

In no district supplying milk at present, however, is the quantity sufficient to warrant the expenditure involved.

#### PRODUCTION.

##### *Source of Supply.*

The milk is drawn from 313 dairies, situated as follows:—

- (1) Within the boundaries of the following health districts (249):—

Fremantle, Fremantle Road District, East Fremantle, Melville Road District, North Fremantle, Cottesloe Beach, Cottesloe, Claremont, Claremont Road District, Subiaco, Perth, Osborne Park, Maylands, Bayswater Road District, Bassen-dean Road District, Guildford, Midland Junction, Belmont Road District, Canning Road District, Gosnells Road District, Armadale-Kelmscott Road District.

The above health districts are within the metropolitan area, and dairies within these districts are under the supervision of the respective local health authority.

(2) Outside the boundaries of the above districts but adjacent thereto, and under the supervision of the Department of Public Health (34).

(3) Along the South-West Railway system, situated at the following centres (30):—

Mundijong, Mardella, Serpentine, North Dandalup, Pinjarra, Waroona, Yalup Brook, Wagerup, Hamel;

also under the supervision of the Health Department.

The total average number of cows in milk at the above dairies is 5,404, distributed thus:—

At dairies within the health districts specified above—3,965.

At dairies adjacent to the metropolitan area and under the supervision of the Health Department—900.

At dairies along the South-West Railway—539.

From returns furnished by local authorities and from other data at the disposal of the Commission, it is estimated that the quantity of milk consumed in the metropolitan area is about 8,000 gallons per day. It will thus be seen that the average daily yield per cow in milk is 1.47 gallons. Taking 292 days as a reasonable period of lactation, the total number of cows necessary to maintain a daily supply of 8,000 gallons amounts to 6,755, of which 1,351 are dry.

The average daily yield per cow throughout the year, therefore, amounts to 1.18 gallons, not a very satisfactory figure.

Generally, operations in connection with the production of milk are based on family effort, that is to say, the dairyman, his wife and family, perform all the necessary duties; but there are, however, a considerable number of dairies, practically all within the metropolitan area, at which some outside labour is employed.

The work is hard, continuous and, under existing conditions, unprofitable, to say nothing of the uncertainty as to the disposal of the product.

#### *Dairy Premises.*

Many dairy farms were visited by the Commission, and reports were submitted by the secretary regarding others.

From these visits and reports it is clear that the buildings are in the main structurally satisfactory, having regard to the relative importance of the part played by same in the production of clean milk, but scarcely any were found which did not require some attention.

The milking sheds generally were found to be sound, but in many cases the floors were not properly cleansed, nor was adequate provision made for drainage. The superstructures were fairly satisfactory, but many were festooned with cobwebs and dust.

The milk rooms rarely complied with the regulations, inasmuch as few were found to be fly-proof, and in many the walls and ceilings were not clean.

Yards, with few exceptions, were littered with manure which, when dry, doubtless contributes to the bacterial content of the milk.

Stables usually provided accumulations of manure, in which flies breed in vast numbers. Proper manure bins are seldom provided.

Sanitary conveniences were not sanitary. Structurally they were defective, not fly-proof, not clean, and usually no deodorant was provided.

The water supply, an extremely important matter, was in many cases such as to warrant it being regarded with suspicion, and, in some cases was disgusting, if not dangerous. A number of shallow wells, not covered nor properly lined, were found, in which the water was covered with a film of dust and manure. In a number of cases the well was close to the milking shed and yards, and consequently must be highly polluted. In one case the water supply consisted of a large soakage pool, situated just below the milking shed and other buildings. The pool was devoid of covering. A sample of this water was examined and found to contain *bacillus coli* in uncountable numbers, conclusive proof of extensive pollution from the cowshed and yards. This case was certainly not typical, but has significance when considered in conjunction with the conclusions arrived at regarding inspection and control.

Where the premises are not structurally sound they may be made so without much expense, and there is no necessity for sweeping condemnation and demolition. In a few isolated cases it may be necessary to amend the buildings almost to the point of reconstruction, but this could be done gradually.

#### *Cleanliness of Premises.*

In only a few instances real cleanliness was observed. Certain portions of a dairy may be found to be clean, but there were usually places to which the practice did not penetrate. The floors of the milking shed and milk room may be washed but the yards allowed to remain littered with manure and the privy left without proper attention. Indeed it was evident that the average dairyman did not consider anything further than the washing of the floors necessary, and, judging from the condition of many of the floors, and the fact that in a number of cases water was not laid on to the milking shed, it is doubtful if the floors are really properly cleansed.

Drainage of premises, and particularly that of the milking shed, was not satisfactory, the liquid wastes merely discharging on the surface of the ground just outside the building.

Generally, the management of the dairies left much to be desired, but this is due to the absence of intelligent and instructive supervision and to lack of knowledge, more than to deliberate neglect, on the part of the farmer.

#### *Herds.*

The animals are generally in good condition and of a mixed, and in some cases nondescript, breed. There are, of course, variations in the degree of purity of breed, but in no case is there a pure-bred herd engaged in the production of milk for the city.

Several cross-bred herds exist, and where care has been taken in the selection of the bulls, the result is a more valuable herd of greater productivity. Some two years ago an Act was passed making the regis-

tration of bulls compulsory, but the effect of the legislation, excellent as it eventually should be, is, of course, not yet evident.

Apart from this special Act, little if any official action has been taken with the object of improving the class of stock, although it is clear that many dairymen are anxious to be advised as to the best lines to follow in building up and improving their herds. In fact many of them feel that they have been neglected in this respect. Advisers have been made available for assisting dairymen producing butter-fat, but so far as the dairymen producing milk for domestic consumption are concerned little has been done.

Further, milk producers require educating as to the best methods of caring for their herds. They are faced with difficult problems as to methods of feeding, culling their herds, testing individual animals, selecting new cows, etc.

It will perhaps be said that information regarding these matters is available in the form of books and pamphlets. That may be so, but it must be remembered that dairymen, from the very nature of their business, generally have not the time for reading these publications, while some of them have not the inclination to do so. Instruction by means of the spoken word and demonstration is called for.

#### *Methods of Milking and Handling.*

In the majority of cases the practice of hand milking is followed, but there are a fair number of milking machines in use.

Where the first method is adopted the cows are milked into open pails and the milk is then transferred to the milk room, where it is poured into a receptacle and allowed to run over a cooler into a drum beneath. It is then either taken to a depot or delivered retail to the consumers.

The methods adopted generally are far from satisfactory in many respects. In many dairies the washing of the cow's udder is done in a casual manner, usually by dabbing it with a damp rag. Proper ablutionary appliances, clean water, soap and towel, are in the main absent, and the milker's hands, if clean when operations are commenced, cannot and do not remain so for long. These methods are not universal, but unfortunately they obtain at the majority of dairies.

The precautions taken at the dairy to prevent contamination are inadequate (see under "Dairy Premises"). From the section dealing with the production of clean milk based on the investigations and experiments of the Commission, it will be seen that the methods necessary are simple and inexpensive.

When milking machines are used the matter of cleanliness is not so simple. Even when extreme care is taken the initial bacterial content is greater than when clean hand-milking is followed. There is evidently great difficulty in keeping the machine clean, and unless it is kept so the production of clean milk by this method is impossible. There is no doubt that rigid supervision is required where machines are used.

#### TRANSPORT.

Milk is transported from the place of production to the metropolitan area by means of motor lorries, carts, and the railway system, the latter being re-

sponsible for the carriage of about 2,500 gallons daily. On certain trains a special van is attached for this purpose, but on others no such provision is made. In the latter case the regulations of the Railway Department require milk to be placed in one end of the van and to be kept separate from all other merchandise. This regulation is, however, frequently departed from, despite instructions that it must be strictly obeyed.

There are no specially constructed vans or refrigerated trucks provided. The quantity of milk carried on several trains from stations between Mundijong and Wagerup inclusive amounts to about 800 gallons per day, and this amount is not sufficient to warrant the construction of special vehicles. Some of this milk is carried a distance of seventy-four miles and takes some seven hours to reach Perth.

Ultimately the production of milk along the South-West railway for consumption in the metropolitan area is likely to assume greater proportions, and the question of the methods by which this is transported should receive attention from time to time.

From stations Byford to Queen's Park inclusive approximately 1,700 gallons of milk are picked up daily, but the journey is short and the provision of a refrigerated van would, therefore, not be justified.

Under the railway regulations consignors of milk, if it be contained in ten-gallon drums, are required to assist in loading the drums into the van or be charged full parcel rates for freight. Provided that the train runs to its scheduled time this regulation is reasonable, but instances have occurred in which the dairyman has been compelled to wait a considerable time because the train was late. This regulation should be modified so as to provide that if the train be more than half an hour late the loading shall be done by the servants of the Commissioner of Railways without extra cost in freight to the consignor.

On arrival at its destination the milk is picked up without undue delay and taken to be dealt with according to the requirements of the consignee.

The containers in which milk is handled during transport consist of ten-gallon drums. This is a suitable size capable of being conveniently handled. They are subjected to rough usage, and should be of the seamless kind fitted with a flanged lid and provided with some means of locking, or should be sealed.

This latter provision is recommended, for the reason that the containers are sometimes ullaged on the railways. If the lid be removed from a drum and a quantity of milk taken out during transit, a considerable proportion of the cream may be removed and the milk may fail to comply with the standard for butter-fat content—a very serious matter for the consignee or retailer, in view of the fact that he is liable to prosecution if the milk is found to be below the standard.

#### HANDLING.

There is some variation in the methods by which the milk is handled, according to the nature of the business of the consignee.

If the milk is received by a depot keeper, it is at once brine-cooled and returned to the drums. If not immediately disposed of to retailers it is stored in a cool chamber.

Where a producer retails the product himself, it is in a few cases taken to a depot and brine-cooled before delivery, but as a rule the milk is only water-cooled in the usual manner.

In three cases a retailer has a brine-cooling plant of his own, and approximately 300 gallons daily are dealt with by such in this manner, while in a few instances a retailer takes the milk to a depot for cooling as soon as he receives it.

Of the quantity of milk consumed daily in the metropolitan area more than half is brine-cooled. The balance is water-cooled.

The rapid reduction of the temperature of milk is important. Several tests were made during February and March, and it was found that by means of the usual water-cooling appliances it was impossible to reduce the temperature of the milk to less than 75deg. F. The question of effecting improvement in cooling methods should receive attention.

#### Depots.

There are in the area nine depots where milk is bought from producers, cooled and sold to retailers.

These depots, with a few exceptions, are unsuitable structurally and inadequately equipped. As a matter of fact, in some cases their condition is a reflection on both the proprietor and the local health authority. This applies to such a degree as to warrant the use of the unsuitable depots being discontinued for this purpose.

None of the milk sold in the metropolitan area is pasteurised.

#### DISTRIBUTION.

The distribution of milk to consumers is carried on by 157 vendors with vehicles, and 217 shops licensed with the appropriate health authority for this purpose.

The licensed vendors utilise 222 carts and six motor lorries, these vehicles being apportioned as follows:—

Vendors.	Total Carts.	Motors.
With 1 cart ... ..	113	...
" 2 carts ... ..	24	...
" 3 " ... ..	10	...
" 1 cart and motor ...	2	2
" 4 carts ... ..	2	8
" 2 " and motor ...	2	4
" 5 carts ... ..	2	10
" 3 " and motor ...	1	3
" 4 " " " ... ..	1	4
	157	222
		6

It will be seen that about 72 per cent. of vendors work single-handed, and it is assumed that these employ little or no labour, although sometimes a boy is engaged to assist. The remainder of the vendors employ what labour is necessary in addition to their own effort. There is nothing in the way of any extensive operations by one man, nor is there any company operating.

The quantity of milk distributed by a motor lorry is about equal to the output of two carts, and on this basis the average quantity delivered per cart, after making an allowance for milk delivered by hand and that distributed in bulk, is 29 gallons approximately.

Differences ranging from 10 to 58 gallons exist in the actual quantity delivered by a cart.

As a rule the milk is carried in 10-gallon drums, one or two of which are provided with taps. The distributor utilises a hand can with a more or less tight-fitting lid in which to carry the milk into premises, and the milk is dipped from the hand can by a measure and transferred to the customer's receptacle. There is no system of delivery in sealed containers such as bottles.

The existing practice is open to the objection that it conduces to contamination by dust and dirt, but this can be minimised if proper precautionary measures are taken. The delivery of milk in sealed bottles is desirable and must be considered in the future.

During the summer, for a period of four or five months, there are usually two deliveries per day, but this is not by any means universal; while during the remainder of the year there is only one delivery daily.

The vendor usually commences his round at about 2 a.m. and finishes the morning delivery by about 8 a.m. Much of the work is carried out in the dark, and this is one of the drawbacks of the occupation. There seems no good reason why delivery should not be carried out in daylight during the winter months, and even during summer much of it could be so accomplished. In the hot weather, however, it is probably more pleasant to commence this work shortly after midnight rather than to be so engaged during the daytime. In the wet months it would certainly be an advantage, from the retailer's point of view, to commence at, say, 5 or 6 a.m. The keeping qualities of the milk would not be impaired and the consumer should not be inconvenienced.

There is need for education of some consumers regarding the treatment milk should receive in the home, as it must be admitted that the condition of the receptacle put out for the milk is often not all that can be desired.

Under existing haphazard conditions, the time taken to deliver the milk on an average round is excessive. The vendors are willing to travel great distances to serve new customers, and in consequence they travel many miles serving a few customers in each street

and delivering a few gallons only per mile. Details are given in the following table:—

Vendor.	Gallons of milk delivered.	No. of streets.	No. of customers.	No. of customers per street.	Average quantity per customer.	Locality.	Distance travelled
					pints.		miles.
No. 1 (4 rounds)— Total of three rounds	115	248	565	2.14	1.6	Perth, North Perth, Leederville, Subiaco, West Perth, Mt. Hawthorn, Maylands	...
Fourth round ...	35	100	181	1.8	1.54	Perth, North Perth, West Perth, Leederville, Subiaco	18
No. 2 (2 rounds)— First round ... Second round ...	24 19	36 43	108 90	3.0 2.9	1.7 1.68	North Perth and Perth ... Leederville and Subiaco ...	...
No. 3 (2 rounds)— Total ...	60	91	307	3.3	1.5	North Perth, Perth, Mt. Lawley, East Perth, Leederville	...
No. 4 (2 rounds)— Total ...	38	30	219	7.3	1.4	Perth, East Perth ...	...
No. 5 (2 rounds)— No. 6 (5 rounds)— Total of four rounds	38 136	90 55	185 440	2.0 8.0	1.6 2.47	Leederville and Subiaco ... Perth, West Perth, Leederville	...
One round ...	31	25	130	5.5	1.9	Subiaco ...	...
No. 7 ...	23	31	102	3.3	1.8	Perth, Leederville, Subiaco	...
No. 8 ...	33	26	137	5.2	1.9	Claremont ...	9
No. 9— First round ... Second round ...	10 30	... ...	60 190	... ...	1.33 1.26	Cottesloe Beach, North and East Fremantle In nearly every street in North Fremantle	10 not measured.
No. 10 ...	27	...	150	...	1.4	Leederville, Perth, West Perth, Subiaco	21½
No. 11 ...	40	...	245	...	1.3	Beaconsfield, South Fremantle, Fremantle, East Fremantle	17
No. 12 ... No. 13 (2 rounds)— Total ...	58 90	48 186	285 435	5.9 2.9	1.6 1.4	Leederville, Perth, Subiaco North Perth, Leederville, Subiaco, West Perth, Perth, East Perth, Mt. Lawley	... ...
No. 14 ...	45	...	160	...	2.25	South Perth ...	...

With regard to Nos. 9, 10, 11, the number of streets was not obtained. The distances were measured by the secretary by means of a speedometer on a car, and he was accompanied either by the vendor or one of his employees, who indicated the route.

It has been pointed out under another heading that the average consumption per household is 1.5 pints per day: thus one gallon of milk supplies 5.3 houses. The average number of customers per street of 21 rounds is 3.1.

The five rounds measured averaged 15 miles per round, the number of customers being 10, and the number of gallons two per mile.

#### ECONOMICS.

In this section an attempt is made to summarise the evidence as to the cost of production, handling, and distribution under local conditions.

In addition to the evidence there was available a considerable amount of information as to the costs in other places, such as that given in the report upon milk of the New South Wales Board of Trade, 1923.

#### Production.

The cost of production of milk varies chiefly with the cost of feed, the quality of the cows as milk producers, and the skill of the farmer. The two latter

factors can be slowly influenced by education. The main expense is the cost of feeding the cows, which has been estimated, in the case of the entirely hand-fed animal, to be 68.7 per cent. of the total cost (Cornell University Bulletin, No. 364, page 115), a figure which may be regarded as approximately correct for this State.

Variations in cost of feeding depend very largely on the extent to which the cows can be pasture-fed, and to which fodder can be produced on the farm. The cost of pasture-feeding and of food production on the farm varies with the locality: the value of land, other things being equal, being greater near the metropolis; but this variation is offset by difference in freight costs.

Most producers for the metropolitan market are compelled to hand-feed all through the year, although during several months the value of what the cows can "eat for themselves" is a considerable factor.

In hand-feeding in this State bran is a principal item, and the cost of this has, during the last few years, shown a variation of at least 50 per cent., representing in some cases a difference of 2d. per gallon in the cost of production.

Reliable evidence of the actual cost of production was very difficult to obtain. In the absence of a proper system of book-keeping, the statements made by

producers regarding their costs could only be regarded as approximate.

From information which, although not submitted as evidence, was obtained from sources regarded as reliable, some details of cost in regard to two cases were available.

In the case of a cow entirely hand-fed, which averaged two gallons per day for 292 days and was hand-fed for the dry period of 73 days, the cost of feed was approximately 1s. 2d. per gallon over the year, giving, if the cost of feed be taken as 65 per cent. of the total, a total cost of 1s. 9d. per gallon. In the other case, a dairy of 50 cows, which were turned into the bush every day, the cost of feed actually purchased over the year amounted to 11.7d. per gallon of milk produced. This represents a probable total cost of about 1s. 5d.

Of the producers who were examined by the Commission, one submitted figures covering the whole year which showed the cost of feed and labour only was 1s. 5d. per gallon. Another calculated that the cost per gallon over the year, exclusive of wages for himself, interest and depreciation, was 1s. 2d., or a total cost, less depreciation, of 1s. 6d. A third witness gave the cost of production per gallon over the year as 1s. 4½d., exclusive of wages for himself and interest and depreciation.

These figures are considered, however, to be unreliable and to rather over-estimate the cost. A number of producers stated that a net return of 1s. 5d. per gallon all the year round would be satisfactory.

A number of balance sheets were received showing that, without any allowance for interest on capital and depreciation, the amount received provided only the barest wages for the farmer himself. The Commission found the families of a number of dairymen living under conditions that were strong presumptive evidence of insufficient income. Furthermore, it was stated in evidence that health inspectors of the Central Department refrained from urging the carrying out of desirable improvements on dairy farms because they were satisfied the farmers could not afford the expense involved.

At present the Retailers' Association is the dominating factor in determining the price received by the producers. Owing to the nature of the industry and the vast area over which dairy farmers are scattered they have little chance to organise for their protection, and they are therefore at the mercy of the organised distributing interest and must accept the terms and conditions decided on by these or lose the sale of their product.

It was stated by some witnesses that the producers determined the price. However, on closely investigating these assertions, in no instance was it shown that the producer was successful in deciding the price he should receive for his product, although attempts had been made along these lines.

It has been insistently urged in certain quarters that the main factor in determining the price the producer should be paid for milk is the amount he would receive for butter-fat.

The requirements of the milk trade are, however, far more exacting than those of the cream trade. The

departure of the trains from the nearest railway station decides the hour for milking in the country districts; in fact, the circumstances peculiar to the milk trade as a whole necessitate milking being carried out at most inconvenient hours. This is a drawback that is not experienced by those engaged in producing milk for butter-fat.

Further, the supplier of milk must despatch his product to the market without delay, and is always faced with the possibility of some, if not the whole, of his milk being rejected, whereas it is only necessary to forward cream two or three times a week to the factory without the fear of any being rejected through excessive supply.

The milk producer under contract must maintain a constant supply, whilst the butter-fat producer can turn his cows out when natural pasture is not available, thus avoiding the expense of purchasing feed.

The cream supplier has also the advantages of reduced labour cost, lower freight bill, and lesser cost of plant, and, in addition, his work can be performed during more convenient hours.

Unless a fair margin over butter-fat parity is allowed to the dairy farmer supplying milk, there is no inducement for him to continue in a branch of the trade that is abundant with difficulties.

The amount the dairyman has actually received for his milk at the depot or retailer's store varies from 1s. 8½d. downwards. This was the figure fixed by the Prices Regulation Commission, 1921, and by an independent arbitrator in 1924. This price has also been paid over a number of years to a few producers. The vast majority, however, receive considerably less.

The price paid at the principal depot, which may be said to govern the price of milk, has varied during recent months from 1s. 2d. to 1s. 5½d., and is now 1s. 5½d. Some dealers have paid 1s., and sometimes even less during the flush season.

The average price received at the farm by producers during the last twelve months is probably below 1s. 3d. per gallon.

The Commission believes that 1s. 7d. at the depot all the year round would give a reasonable return to producers in the metropolitan area, and that a lower price would attract a considerable quantity of milk from the relatively favourable areas of the South-West.

#### *Distribution.*

The present price of milk to the retailer at the depot is 1s. 7½d. per gallon, and the bulk of this is sold at 3s. per gallon. A considerable amount, chiefly in the suburbs, is retailed at 2s. 8d., and a small quantity at 2s. 4d. An average based on ten rounds was found to be 2s. 10d.

The cost of delivery is unnecessarily great. The long distances covered entail much wear and tear of horse-flesh, carts and appliances generally, and involve much waste of time.

Various statements of the cost of distribution under existing conditions were presented, showing the cost per cart, inclusive of wages, to vary from £6 10s. to £8 per week. The Commission considers the figure £7 10s. to represent a fair average.

Accurate details of 27 rounds are recorded in the section dealing with distribution. In these the amount distributed per cart varies from 10 to 58 gallons, the average being 31.5 gallons. Taking the average cost of running a cart as £7 10s., which includes a sum of £4 10s. for wages, the average cost of distribution on the 27 rounds amounts to 8.2d. per gallon, with a maximum of 25.7d. for the 10-gallon round and a minimum of 4.4d. for the 58-gallon round, whilst the cost of distribution on the amount of milk, 29 gallons, which is calculated as an average round for the whole metropolitan area, is 8.9d. per gallon.

At the present price of milk to the retailer, viz., 1s. 7½d., and at a sale price of 2s. 10d., the average profit, after allowing for wages and all other costs, on the 27 rounds is 6.3d. per gallon, equal to £5 15s. 9d. per round per week, and on a similar basis the profits on the average 29-gallon round of the metropolitan area amount to 5.6d. per gallon and £4 14s. 9d. per week.

### CONCLUSIONS.

#### *Existing Legislation and Control.*

The provisions of the Health Act and by-laws are sufficient to safeguard the quality of the milk supply, but these are not enforced in practice.

Responsibility is shared by too many authorities.

Veterinary inspection has been irregular and incomplete.

#### *Standards.*

The present legal standard of chemical quality is satisfactory, but methods of examination of samples are inadequate in that no means exist of distinguishing between natural milk of poor quality and adulterated milk.

The penalties imposed by the courts upon persons convicted of selling milk below the standard have frequently been insufficient.

No bacteriological standard exists.

#### *Quality.*

The chemical quality of the milk is good; the biological quality (vitamins) is unknown.

With regard to safety, there is little definite evidence that harm has arisen from contamination with pathogenic organisms. Germs of tuberculosis are present to an extent which is unknown, but is probably less than in Great Britain. There exists here, as elsewhere, the possibility of infection with other pathogenic organisms. In order to eliminate this danger pasteurisation may be found necessary, but further information is needed before a definite opinion can be formed.

The keeping qualities of the milk compare favourably with that of other cities, but considerable improvement is possible, especially in regard to milk produced by machines. It may be necessary to adopt pasteurisation on account of bacterial growth, but not until better methods of production and handling have been tried and have failed.

#### *Quantity.*

The daily average consumption of milk per head is slightly over 7 ozs., and this is regarded as too low.

In some parts of the metropolitan area the quantity is considerably below even this figure.

The quantity supplied is adequate to the demand, and could be increased without difficulty.

#### *Production.*

The milk is produced chiefly within or adjacent to the metropolitan area, but some is supplied from country districts. Most dairy farms are run on a family basis.

Premises and methods generally are capable of considerable improvement.

The milk producer suffers from lack of skilled advice.

#### *Handling.*

Slightly more than half the milk is adequately cooled.

The depots include two or three which are specially constructed and run on good lines, but the remainder are in the main unsatisfactory.

#### *Distribution.*

There is much economic waste entailed owing to overlapping of rounds and excessive distances traversed. The methods of handling milk during delivery can be improved.

#### *Economics.*

Accurate information as to costs of production is not available.

There is necessity for hand-feeding to some extent all the year round, whilst from January to August the cows are almost entirely hand-fed.

Bran is a principal item in hand-feeding, and some form of price control over this commodity should be exercised.

The producer is unable to influence the price of his product and must accept whatever is offered by distributors. There is ample evidence that most producers have not in the past received fair treatment in the matter of price.

The average cost of distribution can be more accurately determined.

The cost, including wages, of running a retail cart at present is approximately £7 10s. per week, and the average profit over and above that amount, if the average sale price be taken as 2s. 10d. only, is equal to £4 14s. 9d. per week.

When the price to the producers has been reduced by the retailers there has been no reduction in the price paid by consumers.

Some equitable system of adjusting prices from producer to consumer is desirable.

### A BASIS OF ORGANISATION.

Our findings show that the milk supply is in a disorganised and unsatisfactory condition.

Milk is an essential article of human diet, especially for infants; it is highly perishable and easily contaminated. It should, therefore, be produced and distributed under strict hygienic conditions, and should be made available to the consumer at the lowest possible price consistent with a fair return to

those engaged in its production and distribution. To-day the consumer is paying a high price, whilst the return to the producer is so low that he is scarcely able to carry on. The hygienic and economic conditions under which the industry is carried on demand drastic improvement.

Milk supply can be regarded as a public utility comparable to water supply, and in order to endeavour to organise the industry on a basis as such it is necessary that some form of control, more effective than that hitherto prevailing, should be instituted. This is not to be regarded as a reflection on those in responsible positions in the departments concerned, for the multifarious duties of the officers render it difficult for them to give to the milk supply that attention which its importance demands. Direct governmental control is not likely to be a satisfactory solution of the problem, even if a special department or branch were set up to deal with it. Municipal control is not recommended, principally because such a large number of local authorities are concerned and because each local authority has no jurisdiction outside its own boundaries. Any attempt to confer on one local authority the right to exercise its powers in the district of another would present great difficulty. It is necessary that the controlling authority should have complete control and should not be subjected to interference.

It is considered that the situation can best be met by the creation under special Act of Parliament of a board or trust to be appointed by the Government and to be constituted as follows:—

One representative of the consumers, who shall be chairman.

One representative of the producers.

One representative of the vendors.

A medical officer of health designated by the Commissioner of Public Health.

The chief veterinary officer for the State.

The board should have powers which would enable it—

- (1) to safeguard the quality of the milk supply;
- (2) to encourage the consumption of milk;
- (3) to reduce waste;
- (4) to adjust prices so that each interest shall receive equitable treatment.

#### *Suggested Powers and Functions of the Board.*

The board should be the only authority controlling the metropolitan milk supply, and should have control over all premises concerned wherever situated.

The powers of the board should include the following:—

- (1.) To appoint inspectors and other necessary officers.
- (2) To license milk producers, under conditions to be determined, and prohibit the sale of milk unless produced under license.
- (3.) To buy, sell, and deal in milk and milk products.
- (4.) To establish and conduct such premises as may be required.
- (5) To license persons to distribute milk, either wholesale or retail, under conditions to be determined, and prohibit the sale of milk except under license.

- (6.) To inaugurate a block system of milk distribution, determine the boundaries of such blocks, vary or alter such boundaries from time to time when deemed necessary; allocate blocks to distributors in such manner as may be determined.
- (7.) To determine the minimum price the producer shall receive for his product; the charges to be made for handling and treatment, and the maximum price to be paid by consumers, and vary such prices from time to time.
- (8.) To make regulations for the efficient control of the industry and impose penalties for breaches of the regulations.

#### *Finance.*

In order to provide the necessary revenue to enable the board to carry out its functions and to provide a sinking fund for the redemption of loans and payment of interest thereon, it should have power to levy a sum of money on each gallon of milk sold within the metropolitan area and to charge and collect license fees.

It is difficult to estimate the exact amount of the suggested levy. One half-penny per gallon on the quantity of milk at present sold would give an approximate return of £5,800 per annum. This sum should be sufficient to meet all the ordinary expenses of the board. Adjustments could be made from time to time until the amount levied plus revenue from other sources would return the exact amount required.

For the purpose of providing premises, plant, etc., the board should have power to borrow money on terms and conditions approved by the Governor in Council.

Certain existing depots might be found suitable, but even if this were so, a considerable amount of capital would be required. The business of depot keeping should be distinct from the other functions of the board, and revenue should be obtained from the charges for handling milk. These should be sufficient to provide interest and sinking fund on money borrowed for the purpose.

The introduction of a block system of distribution would not, it is thought, be one of the first steps which the board would take. But as the system were introduced it would naturally follow that the existing milk-vendors' rounds in any area concerned would cease to exist. Some of the vendors thus displaced would presumably become distributors in the blocks under the conditions laid down by the board, whilst a considerable number, at least one-third, would have to seek other means of livelihood. Thus some of the existing vendors would have lost their rounds, and if those who continued to distribute milk in the various blocks had no proprietary interest therein, all the existing vendors would have lost their rounds. Since a milk-round has come to be regarded as personal property, and since they have been bought and sold in some instances for considerable sums, the question of compensation arises and must be considered.

Is the displaced vendor entitled to compensation, and, if so, in what manner are the amounts to be assessed and provided? In this connection the following facts must not be lost sight of:—

Distribution is the phase of milk supply in which the most obvious waste is occurring. It is safe to say that under a properly regulated scheme two men could do the work of three and one horse the work of two now engaged therein, whereas it would be impossible even to suggest such a thing in connection with production. The distributors are the section of the trade which has been and is able to make a good thing out of it. In the favourable situation of middlemen, it has been possible for them to combine effectively, and so to fix in practice both the price which they shall pay to the relatively unorganised and struggling producers and the price at which they shall sell to the unorganised consumers.

Various attempts have been made by the producers to obtain a fairer share of the returns of the industry, as witness the recent producers' strike, and the recent entry of some producers into the business of distribution. Owing, however, to lack of organisation, the former attempt has achieved no success and the latter no stability. Similarly, a section of consumers under the aegis of the Housewives' League has been impelled to try to organise the distribution of milk on more favourable terms, but this attempt also has proved of small account.

The amount received by the retailers has certainly been out of all proportion to that received by the producers in view of the relative service rendered by each section and the amount of capital required by each.

On the basis of a price to the consumer of 3s. per gallon, which has obtained in the greater part of the metropolitan area over a number of years, the retailer has been paid for his services a sum varying from 1s. 1½d. to 1s. 7½d. per gallon, according to the price of milk at the depot.

The cost of distribution under existing circumstances has been shown to be approximately £7 10s. per cart per week, including wages on a scale of £4 10s., and this represents 8.9d. per gallon on the average round.

Under these circumstances it is not to be wondered at that the number of persons engaged in the retailing of milk is large, that milk rounds extend over many miles wherever the retailer can secure a few customers, and that well-established rounds, particularly in well-to-do districts, are eagerly sought after and command a ready sale at as much as £10 per gallon.

Despite the relatively good returns secured by the milk vendor it cannot be maintained that the service has, on the whole, been very satisfactorily carried out. A few vendors have carried on their business without any cause at all for complaint, except in regard to price. They have taken pains to secure and deliver milk of a high quality and cleanliness and to oblige their customers in every way. But generally it must be admitted that it is only by unremitting activity on the part of its officials that the public has been able to check the practice of adulteration and secure the quality of its milk supply.

The question of compensation, therefore, requires very careful consideration. It is possible to argue that the vendors have been fortunate in the past in

occupying a position of vantage which enabled them to combine to secure what has been shown to be an unusually good living, despite the somewhat trying and continuous labour involved, and that they are not morally entitled to any compensation whatsoever. It is possible to say in effect: "These are they who have been getting the cream of the business for years; why give them butter now?" There occurs also the reflection that the bucking mule does not stay to compensate the displaced rider, except perhaps with a well-placed kick; also, that he who makes hay while the sun shines is already compensated when it rains. The average man who may be deprived of his means of livelihood in the maelstrom of commercial life receives as a rule no compensation.

On the other hand, it would be absurd to maintain that the average retailer has played the part of the conscious villain in the piece. Either he has entered into the business by the purchase of an existing round, or he has built up his round gradually, a process which made demands on his time and labour equivalent to an outlay of capital. And in his round he possesses an asset which has as definite a value and is as readily convertible into pounds, shillings and pence as any other asset he may possess.

The value of rounds has varied considerably, some being readily saleable at £10 per gallon, or even more, and others at so many shillings. The more valuable rounds have been, of course, those which were compact and those in well-to-do districts where the quantity of milk delivered to each house was large. But even in these cases the value of the round did not depend solely on the proximity and relative affluence of the customers. The vendor was exposed to keen competition, except perhaps in the matter of price (an important exception, competition therein having only recently been instituted), and the value of the round depended very largely therefore upon the care, patience, and skill of the vendor, and, to some extent, no doubt, upon his reputation. Thus, though the consumers themselves have created the value of rounds in general, that is, of all rounds, yet the owner of the good rounds has himself been responsible for the fact that a relatively large slice of the general value has come to him.

The position is a very difficult one. The Commission is loth to recommend the confiscation of what has been actually and legally purchased by many vendors, and is a means of livelihood to all, and are prepared to agree to recommend that the principle of compensation should be recognised. In view of what has been said above, to the effect that the more careful and conscientious vendors are likely to have the better rounds, and consequently the more secure means of livelihood, it would be more equitable that compensation should be paid in proportion to the existing values of the rounds, provided that the proposed board were able to assess them fairly. If that were impossible, payment at a flat rate would be the alternative.

In considering the total amount of compensation, however, the interests of the long-suffering consumers, who must also pay this bill, are paramount. It is in Australia a recognised right of the community to legally "fix" the prices of essential commodities, with due regard to all interests concerned, whenever this may be necessary.

The Commission regards one of the most important functions of the proposed board of control to be the fixing and periodic adjustment of the price paid for milk by the consumer and those paid during the stages of its journey to him; it believes that the present price of milk is too high and should be reduced considerably, and that a substantial reduction in the amount received by the distributor would be made even if the block system of delivery were not instituted. It is recommended, therefore, that the amount of compensation to vendors should be assessed, not on the present value of the rounds, but on what their value would be when the board had adjusted the various prices.

The average value of existing rounds at present prices is estimated as a result of general inquiries and information concerning actual sales effected to be approximately £5 per gallon. Under the proposed new conditions, and after the inevitable adjustment of prices, it is estimated that the sale value of the rounds would be reduced considerably, and that the average sale value of rounds would not exceed £2 10s. per gallon, exclusive of the plant.

The block system would probably be introduced in areas, that is, the Perth-Maylands-Subiaco district would be dealt with at one time, and subsequently other districts would be blocked. In Perth, Subiaco,

and Maylands there are approximately 5,000 gallons of milk distributed at present, and compensation for that area would amount to; perhaps, £15,000.

Compensation might be paid in a lump sum to vendors who go out of the business, while those who acquire rounds on the block system could have the amount of compensation due to them placed to their credit with the board, payments to be extended over a number of years. In the event of a vendor operating on the block system desiring to go out of business, then the balance due to him would be paid.

It is considered that a levy of one half-penny per gallon on the milk distributed in the area which had been blocked would produce sufficient revenue to make provision for all compensation claims to be paid within a few years.

The Commission is satisfied that a great reduction of the waste now occurring in distribution would be effected by its organisation on a block system. It is estimated that a vendor would deliver at least 45 gallons on a block.

A statement of the estimated weekly receipts and expenditure of a distributor handling on this system 45 gallons bought at 1s. 10d. and sold at 2s. 6d. a gallon is shown hereunder:—

RECEIPTS.		EXPENDITURE.	
	£ s. d.		£ s. d.
To sale of 315 gals. of milk at 2/6d. ... ..	39 7 6	Purchase of 325 gals. of milk at 1/10d. ... ..	29 15 10
		Feed and Shoeing one Horse ... ..	1 0 0
		Depreciation on Plant valued at £100—5 years ... ..	0 8 0
		Repairs to Plant ... ..	0 5 0
		Stationery ... ..	0 1 6
		Lamps and Kerosene, brushes ... ..	0 2 0
		Cost of washing Cans ... ..	0 4 0
		Bad Debts ... ..	0 5 0
		Contingencies and Holidays ... ..	0 12 3
		Balance ... ..	6 13 11
	£39 7 6		£39 7 6

On a 50-gallon round the balance would be £7 17s. 3d. per week.

The statement shows that on a 45-gallon round on the block system the return, after meeting all expenses, would amount to £6 13s. 11d., and on a 50-gallon round to £7 17s. 3d. per week.

It has been contended that a return of £7 17s. 3d. per week is insufficient to attract men of a suitable type.

It must be remembered that the labour required is of the unskilled class and the capital involved amounts, at the most, to £100. It is pointed out also that included in the expenditure is an amount of 12s. 3d. per week for contingencies. This is considered sufficient to provide for holidays and relief in the case of illness of the vendor. The annual return of the vendor amounts to £408 17s., after allowing £31 17s. for holidays, etc., or a total income, above all expenses of running his business, of £440 14s.

The Commission believes that the amount provides for a very good living.

#### General.

A board constituted on the lines indicated would be able to exercise complete and effective control from the producer to the consumer. Representing all the interests concerned, and having only the one duty to perform, it should certainly be in a position to organise the industry in a satisfactory manner.

The appointment of special dairy inspectors and of veterinary officers should have the effect of achieving uniformity of methods. The duties of these officers would be chiefly educative and advisory, and to see that the regulations were carried out.

To ensure the success of the block system of delivery it would be necessary that the milk should be all of one—the best—quality, and for this reason all milk must pass through depots conducted by the board. Such control would lessen the temptation to extract portion of the cream content. Uniformity of quality cannot be obtained whilst a number of depots exist, each conducted independently and by different methods.

When the depots are brought under the direction of the board, annual contracts should be arranged between the board and the producers for the supply of milk sufficient to meet the normal requirements of the community. Any surplus above that specified in the contract should be pooled and disposed of to the best advantage. Such surplus milk might be sold to schools or institutions, or separated for table cream or for butter making.

Delivery on the block system would eliminate the waste of existing methods. The Retailers' Association was in complete accord with the proposal, and its introduction was ably advocated by the president and secretary of that body. The proposal received also the commendation of a majority of the retailers examined.

Under the block system it is estimated that a round would be not less than 45, probably 50 to 60, gallons daily, and that at least 70 carts would be no further required. Under this heading alone the saving to be effected is considerable.

Other features of the proposed system are the saving of time and energy, the better condition of the milk as a result of being quickly delivered and not subjected to the agitation occasioned by its rapid conveyance over long distances, and the minimising of the annoyance caused to householders by the rattle of carts and the clanging of milk cans during practically the whole of the early hours of the morning.

The allocation of blocks under the proposed scheme should be carried out with the utmost care. Persons whom the board might consider unsuitable should be excluded from the industry. A rigid system of control should be enforced and exemplary punishment meted out to those who commit breaches of the regulations, serious offences being punishable by the cancellation of the license.

Milk shops, for trading over the counter only, should also be licensed.

The fixing of prices would be an important function of the board. Many witnesses testified to the equity of the control exercised by the Prices Regulation Commission and urged that a similar system should be again introduced.

The adjustment of prices would take some time, and should be subject to continued investigation by the board. It is suggested, however, that the producer should receive 1s. 7d. per gallon, less freight, all the year round; that the depot should receive 1½d. per gallon for ordinary trading purposes, plus ½d. per gallon, until the loan for its establishment be redeemed. The board should receive ½d. per gallon for administrative purposes, and one half-penny for redemption of loans for compensation. Eightpence per gallon should be the amount received by the distributor on the block system.

The result would then be as follows:—		s.	d.
Producer	.. .. .	1	7
Depot, ordinary rate	.. .. .	0	1½
Depot, special rate	.. .. .	0	0½
Board, general rate	.. .. .	0	0½
Board, compensation rate	.. .. .	0	0½
Distributor	.. .. .	0	8
<hr/>			
Price paid by consumer	.. .. .	2	6
<hr/>			

It is very doubtful if the adjustment suggested would give justice to the producer as compared to the retailer.

As stated in the section dealing with economics it has been impossible to arrive at a satisfactory estimate of the cost of production. Supposing, however, that an estimated cost of 1s. 2d. per gallon for feed and labour only be taken as approximately correct, it is possible to draw up rough comparative balance sheets of the operations of a retailer vending fifty gallons a day and a farmer producing forty-five gallons a day.

These show for the vendor a profit of £3 7s. 3d. after allowing for expenses, holidays, and wages at current award rates, and for the producer a profit of £2 12s. 6d. without any allowance for contingencies and holidays.

Bearing in mind the greater capital required by the latter, the greater risks, and the greater skill required, and the longer hours worked, such a discrepancy is obviously unfair. This is a matter that should occupy the attention of the proposed board, with a view to a more accurate estimate of producers' costs and a re-adjustment of prices.

The figures suggested above, however, represent an immediate increase to the producers and a reduction to the majority of consumers, and further reductions are possible with the system in complete working order. The conditions of distribution would be considerably improved. The improvement of herds and the more scientific methods resulting from the better education of the dairy farmer should have the effect of lowering the cost of production. When this time arrives the cost to the consumer would be reduced.

#### RECOMMENDATIONS.

1. That a Board or Trust constituted as outlined in the preceding section be appointed to control the metropolitan milk supply, and that the board be given power:—
  - (a.) to appoint inspectors and other necessary officers;
  - (b.) to license milk producers, under conditions to be determined, and prohibit the sale of milk unless produced under license;
  - (c.) to buy, sell, and deal in milk and milk products;
  - (d.) to establish and conduct such premises as may be required;
  - (e.) to license persons to distribute milk, either wholesale or retail, under conditions to be determined and prohibit the sale of milk except under license;
  - (f.) to inaugurate a block system of milk distribution, determine the boundaries of such blocks, vary or alter such boundaries from time to time when deemed necessary; allocate blocks to distributors in such manner as may be determined;
  - (g.) to determine the minimum price the producer shall receive for his product: the charges to be made for handling and treatment, and the maximum price to be paid by consumers, and vary such prices from time to time:

- (h.) to license the keeping of one or more cows for the supply of milk to private households or institutions, and to prohibit the keeping of such cow or cows unless the animals be certified as tubercle-free;
- (i.) to institute a bacteriological control of the milk supply;
- (j.) to conduct a system of propaganda for the purpose of increasing the consumption and improving the methods of treatment of milk in the home;
- (k.) to make regulations for the efficient control of the industry and impose penalties for breaches of the regulations.
2. That the "freezing test" be included in the methods of examination of milk samples.
3. That the attention of Magistrates and Justices be drawn to the serious nature of the offence of milk adulteration with a view to the imposition of more adequate penalties.
4. That steps be taken to further investigate the quality of the milk supply in respect of its biological properties, and the possible presence of pathogenic organisms.

We have the honour to be,

Sir,

Your most obedient servants,

J. W. BURGESS,

Chairman.

JOHN DALE,

\*F. J. ROBERTS,

Commissioners.

D. G. STEWART,

Secretary.

22nd June, 1925.

\* Signed subject to the following reservations:—

I am in complete agreement with my colleagues on all matters dealt with in the report so far as the following are concerned:

Legislation, control, quality, quantity, production, transport, handling, distribution, economics, and conclusions.

I agree also with the recommendations, with the exception of Clauses (c) and (d) of recommendation No. 1.

I do not concur in regard to that portion of the report dealing with "A basis of organisation" in respect of—

- (a) the suggested power of the board to buy, sell, and deal in milk, etc.;
- (b) a suggested ownership by the board of depots and of rounds;
- (c) the suggestion that all milk should pass through depots;
- (d) suggested method of compensation;
- and I differ also with certain conclusions given in the addendum.

(a) 1. In regard to depots, I consider that the interests of all concerned can be best served by allowing this phase of the industry to remain in the hands of private enterprise.

It is admitted that a few of the existing depots are structurally satisfactory and well conducted. One such depot has been erected at a cost of about £3,000, and is capable of handling approximately 4,000 gallons per day. This indicates that private enterprise is able and willing to render satisfactory service. Under the board's supervision all depots could be made satisfactory. By leaving the handling of milk in private hands the necessity of raising money by the board for the purpose of establishing such premises and paying compensation is obviated.

2. In regard to Clause (f) of recommendation No. 1 I consider that when blocks are being allocated there should be no restriction as to the number of blocks which may be operated by one distributor.

The cart delivery of milk is work suitable for young men only, and therefore supervision is necessary.

There are many men now engaged in distribution who have been in the business for upwards of twenty years and are no longer able to personally deliver milk on a big round. It should be possible for these men to remain in the business and supervise the rounds as they are doing at present. If a number of blocks were allocated to one man it would enable him to keep an emergency man and horse or to act in an emergency himself.

It should also be possible so to allot the rounds that consumers continue to receive milk as far as is practicable from the dairymen now supplying them.

(b) I differ also with the view that all milk must pass through a depot.

A great deal of the milk is delivered to consumers immediately after milking, and the treatment which it would receive at a depot would not, in my opinion, compensate for the additional expense and the loss of freshness resulting from the delay involved. Since milk is intended by nature for immediate consumption, any interference with quick delivery should be avoided. The handling of this milk could be supervised by the inspectors of the board without its being compelled to pass through the depot.

If brine-cooling be considered necessary, a retailer or producer-retailer should be permitted to instal the necessary plant himself, provided that the work is done in a manner satisfactory to the board. Several retailers have already done this and subject all milk handled to this treatment.

(c) I consider that the question of compensation can be best dealt with in the following manner:—

Those vendors who are forced out of the business through the introduction of the block system of delivery should be compensated by those vendors who continue to operate under the new system. This would obviate the necessity of raising a loan by the board for this purpose. The vendors still operating would have a substantial stake in the industry, and this would tend to improve the service rendered to consumers, as more responsible men would remain in the business. I consider also that compensation should be paid on the existing values of the rounds, plus 25 per cent.

It seems to me that to merely compensate for the value of the business lost is unjust, inasmuch that it leaves the unfortunate vendor who has been stood down faced with the necessity of securing other means of livelihood and also leaves him with certain

equipment on his hands. For this equipment there would be little or no market, as so large a number of turn-outs would cease to operate.

The amount involved in compensating all the vendors would be, if the principle of ownership by the board be admitted, not less than £60,000 at existing values. There is at present a ready sale for rounds at from £6 to £10 per gallon. In many cases these rounds have been bought on terms and have yet to be paid for.

Those vendors who continue would willingly pay a good price for the additional business—as witness the ready sale at good prices of protected newspaper rounds—and the consumers, represented by the board, would bear none of the expense of compensation.

With regard to the preliminary survey of the bacteriological condition of the milk as described in the addendum, I consider that the conclusion relating to milking machines is misleading. The number of examinations made was small, and the results do not

tally with experience. The whole of the witnesses, including the Chief Dairy Expert, were in favour of the use of machines, and it is possible to select seven samples from one of the machines tested which gave an average count of 27,000, one count being as low as 12,000, a very satisfactory figure. I consider, therefore, that further careful investigations should be made before any sweeping conclusions are drawn.

I cannot agree also that the count of the milk as delivered under existing conditions to consumers should be called high, since it is easy to show that, in comparison with figures for other British cities, and even with standards suggested elsewhere, it is relatively low. Defects in the present milk supply as dealt with in the report should undoubtedly be remedied, but their over-emphasis may reduce the consumption to a figure even lower than that prevailing, namely, 1.5 pints per house; whereas it is most desirable for the health of the community that this amount should be increased.

F. J. ROBERTS.

## ADDENDUM.

### A PRELIMINARY SURVEY OF THE BACTERIAL CONDITION OF THE METROPOLITAN MILK SUPPLY AND SOME EXPERIMENTS IN CLEAN MILK PRODUCTION.

#### SUMMARY.

Examinations were made of samples taken at various points between the cow and the consumer and investigations were carried out in order to compare the results of hand-milking with those of machine-milking and to determine the influence and importance of various factors involved in the production of clean milk.

Counts were made of total colonies on plain agar and on McConkey-bile-salt-lactose-agar plates after three days' incubation at 37deg. C.

The averages of the counts recorded are as follows:—

1. Of milk as delivered to the consumers under existing conditions: total, 580,000; coli, 1,000 approx.
2. Of country milks on arrival at Perth station: total, 72,800; coli, 387.
3. Of milk as produced at hand-milking dairies under existing conditions: total, 52,100; coli, 135.
4. Of milk produced at a hand-milking dairy of 20 cows under good conditions: total, 2,278; coli, less than 1.  
As delivered to consumers (average of four samples): total, 3,900; coli, 40.
5. Of milk produced by hand milking of single cows, by careful owners, under ordinary conditions: total, 900; coli, nil.
6. Of milk as produced at machine-milking dairies under existing conditions: total, 694,504; coli, 1,000 approx.
7. Of milk as produced at machine-milking dairies under specially clean conditions: total, 60,000; coli, 197.

All samples were taken by one of two persons, both carefully trained in the necessary technique. Unless delivered within an hour to the laboratory the samples were placed in an ice-box or in a refrigerating chamber.

The investigation was made between 1st February and 14th May, 1925. The temperature during the period was slightly below the average for the last 23 years—the mean maxima and minima being as shown below:—

Month.	Mean Max.	Highest.	Mean Min.	Lowest.
February ... (Average, 23 years)	82.1 84.6	98.0 ...	60.5 63.3	51.1
March ... (Average) ...	80.1 81.1	94.1 ...	62.4 60.7	54.0
April ... (Average) ...	75.2 75.8	87.9 ...	56.6 57.0	44.0
May (1st—15th) (Average) ...	70.6 68.6	81.2 ...	53.2 52.3	44.1

#### Methods.

The samples of milk were examined in the Government Laboratory by Dr. McGillivray in order to determine the total number of organisms and the number of organisms of probable faecal origin (*b. coli* group). At the first the counts were made both by the so-called direct method and by the plate-culture method. The former method, though possessing the possible advantage that all organisms present are countable, including any that may be dead and any such as anaerobes which though alive may not develop in the ordinary plate culture, was nevertheless found unsatisfactory, owing principally to the fact that, on account of the dilution employed, each organism recognised has to be multiplied by several thousands in arriving at the final result. Recognition of organisms is not always certain, and moreover since clean samples contain only a few hundreds or thousands of bacteria the method is not applicable to them.

The plate-culture method may be accepted as giving a very good idea of the total number of organisms which would have continued to grow in the milk under the ordinary conditions of handling, despite the facts that some kinds of bacteria may not grow, and that organisms which are linked together in groups or clumps give rise to one visible colony only and are counted therefore as one.

For the total count two agar plates were poured containing 0.5 c.c. of dilutions of 1 in 10 and 1 in 100 respectively. The agar was cooled before the plates were poured to 40deg. C., and the counts were made after three days' incubation at 37deg. C.

The *bacillus coli* group count (germs of probable excretal origin) was not made in the usual fluid cultures containing 1.0, 0.1, etc., c.c. of milk, but by pouring 0.5 c.c. of undiluted milk in a plate of McConkey-bile-salt-lactose-agar medium and counting the colonies thereon. This method was found very satisfactory; a large majority of the relatively few colonies which appear on such plates have the naked eye characters of *bacillus coli* and many were confirmed by further investigation; and in view of the nature of the medium and the circumstances of the case all the colonies developing thereon may fairly be presumed to be of faecal origin and of specially undesirable character.

Examinations were made:—

- A.—Of milks at point of distribution to the consumer.
- B.—Of milks on arrival at Perth station from country suppliers.
- C.—Of milk produced in dairies in the metropolitan area by hand-milking, taken at time of milking.
- D.—Of milks produced in dairies in the metropolitan area by machine-milking, taken at time of milking.
- E.—Of milks dealt with in the course of experiments in clean milk production.

A.—Milk at point of distribution to consumer.

Samples were taken from the hand-cans of vendors, the milk being poured from the measure into a sterile bottle. The samples were delivered to the laboratory within two to four hours and were plated at once or after a short sojourn in the ice-chest.

The results are shown in Table I.

TABLE I.  
Bacterial Counts of Milk taken at the points of delivery to Consumer.

Date.	No. of sample.	Organisms per c.c.	B. Coli. per c.c.
11-2-25	1	112,000	680
23-3-25	2	771,200	several thousands
Do.	3	710,800	do.
27-3-25	4	2,275,200	do.
Do.	5	86,400	216
Do.	6	over 2,000,000	several thousand
Do.	7	over 2,000,000	do.
Do.	8	over 2,000,000	do.
Do.	9	561,600	84
3-4-25	10	16,200	128
Do.	11	387,200	1,700
Do.	12	347,200	several thousands
Do.	13	250,000	do.
Do.	14	104,800	1,000
20-4-25	15	158,400	256
Do.	16	132,800	several thousands
1-5-25	17	37,960	24
Do.	18	76,800	160
Do.	19	71,120	10
Do.	20	55,504	40
8-5-25	21	252,000	5,072
Do.	22	918,400	several thousands
Do.	23	13,600	256

Excluding the five worst samples which had a count of over 2 millions, the average total count of 19 samples is 266,525.

It will be seen that on the whole a high total count is accompanied by a high coli count. Thirteen samples in which satisfactory counts of both total organisms and coli were made give averages of 148,700 total and 740 coli—a proportion of 200 to 1.

B.—Country milks on arrival at Perth station.

Samples were taken from the drums on arrival at the station in ordinary closed luggage van.

The milks all came from hand-milking dairies and had been passed over ordinary coolers or cooled by standing containers in a running brook. In many cases the drum was surrounded by jackets of sacking which was still damp—a precaution probably of considerable value. The contents of the drum were thoroughly stirred, the temperature ascertained, and the samples taken by dipping a sterile container and pouring into a sterile bottle. The majority were taken during the day time, and were delivered to the laboratory immediately and plated at once, and the remainder, Nos. 11, 12, 13, and 14, were taken at 8 p.m. and kept until the following morning in the ice-chest.

The results are shown in Table II., on which are recorded also the temperature of each sample and the number of hours that had elapsed since milking.

Twenty-eight samples were examined, and these came from eighteen producers. More than one

sample was taken from each of eight producers, whose samples are therefore bracketed together in the table.

TABLE II.

Bacterial account of Country Milk on arrival at Perth.

Date.	No. of sample	Temp. at time of sampling.	Organisms per c.c.	B. Coli.	Approximate hours since milking.
15-2-25	A. 1	68°F.	5,800	40	8 hours.
4-3-25	A. 19	68°	5,530	96	8 "
9-3-25	A. 24	70°	25,000	90	8 "
15-2-25	B. 2	68°	28,000	120	9 "
4-3-25	B. 21	69°	15,500	280	9 "
15-2-25	C. 3	68°	Uncountable on account of spreaders	620	9 "
2-3-25	C. 18	78°	331,200	several thousands	9 "
15-2-25	D. 4	68°	7,540	320	9 "
4-3-25	D. 20	68°	2,400	Nil.	9 "
9-3-25	D. 23	69°	9,500	76	9 "
18-2-25	E. 5	72°	185,920	240	9 "
2-3-25	E. 15	78°	212,800	1,936	9 "
18-2-25	F. 6	72°	13,480	Nil.	9 "
2-3-25	F. 17	77°	53,600	176	9 "
18-2-25	G. 7	72°	11,120	40	9 "
2-3-25	G. 16	80°	143,200	1,232	9 "
20-2-25	H. 10	68°	3,400	Nil.	9 "
4-3-25	H. 22	69°	160,000	344	9 "
20-2-25	8	68°	49,920	60	6 "
20-2-25	9	68°	13,520	20	8 "
23-2-25	11	82°	286,400	2,272	4 "
Do.	12	78°	7,680	6	4 "
Do.	13	83°	199,200	14	3 "
Do.	14	79°	153,600	1,936	3 "
16-3-25	25	68°	50,560	38	9 "
Do.	26	70°	82,400	568	9 "
Do.	27	67°	5,960	8	9 "
Do.	28	70°	160,800	160	6 "

In connection with twenty-six of these samples satisfactory counts were made of both total organisms and coli, the averages being 72,801 and 387 respectively, a ratio of 190 to 1.

Reference to the temperatures shows that twenty samples were within a range of 67deg. to 72deg. F., the other eight of 77deg. to 83deg. F. The relatively cool samples give average counts of 44,000 and 131 with a ratio of 334 to 1, whilst the warmer samples give averages of 173,460 and 1,081 with a ratio calculated on seven of the samples only of 140 to 1.

It seems, as is to be expected, that a higher temperature of the milk during transit results in a relative increase in both counts and that it favours the development of the coli group as compared with the other organisms.

Many of the counts are surprisingly low considering that no special care had been urged on the dairy-men concerned, who were quite unaware that the tests were being made. Eight of the best samples were sent to the Analyst to be examined for preservatives, no trace of which was discovered.

C.—Samples produced by hand-milking—taken at time of milking.

Nine samples from different dairies are dealt with under this heading. Milking was carried out by the dairyman's usual method. Samples were taken from

the receiving drum beneath the cooler and kept on ice until plated.

The results are shown in Table III.

TABLE III.  
*Bacterial Counts of Milk from Dairies where Hand Milking is followed. Ordinary conditions.*

Date.	No. of Sample.	Organisms per c.c.	B. Coli per c.c.
1925.			
February 6 ...	1	30,000	} Not counted.
February 6 ...	2	70,000	
February 6 ...	3	48,000	
February 13 ...	4	28,000	
February 13 ...	5	13,600	
February 26 ...	6	12,040	14
March 2 ...	7	122,400	50
March 30 ...	8	161,600	392
April 1 ...	9	13,640	86

The average total count is 52,120 and average coli count of four of the samples is 135. The ratio of total count to coli calculated on four samples is 570 to 1.

D.—*Samples produced by machine-milking—taken at time of milking.*

Ten samples from different dairies were examined. In view of the results, it is hardly necessary to say that the milking was conducted by the usual methods without any special notice or advice. Samples were taken from the receiving drum under the cooler and kept on ice until plated.

The results are shown in Table IV.

TABLE IV.  
*Bacterial Count of Milk from Dairies in Metropolitan Area at which a Milking Machine is in use (Ordinary Conditions).*

Date.	No.	Organisms per c.c.	B. Coli per c.c.
1925.			
February 26 ...	1	227,200	Thousands
March 5 ...	2	567,000	176
March 5 ...	3	768,000	472
March 6 ...	4	352,000	726
March 11 ...	5	1,596,800	Thousands
March 17 ...	6	1,264,000	Thousands
March 17 ...	7	947,000	Thousands
March 24 ...	8	248,640	446
March 27 ...	9	350,400	Thousands
March 27 ...	10	624,000	1888

No. 9 was milk as it was delivered to a large public institution.

No. 10 was from a dairy where a new machine had been installed ten days previously.

The average total count is 694,504. The dilution employed in plating the samples for coli estimation was too low in five instances to allow of a satisfactory count. The average coli count of the other five samples was 743, and the ratio of total count to coli was 688 to 1.

E.—*Samples taken under experimental conditions.*

The work undertaken under this heading included the sampling of milk from one-cow dairies, several experiments at hand-milking dairies, and two more

prolonged investigations into the possibilities of clean-milk production at a hand-milking and a machine-milking dairy respectively.

E1.—*Single cow dairies.*—Two members of the staff of the department who milked their own cows submitted samples for examination. In the case of cow A the udder and teats were wiped with wet and dry cloths, and the flank was wiped with a damp cloth. Vaseline was used on the hands. No other special precautions were taken. In the case of cow B the teats were wiped with a damp cloth. In each case the first jets were rejected and the pail was rinsed with boiling water before use. Samples were taken from the pail and brought direct to the laboratory.

Results are as follows:—

*Bacterial Counts of Milk from Private Cows.*

Date.	No.	Organisms per c.c.	B. Coli.
11 Feb. 1925	1 Cow A.	170	Nil.
2 March 1925	2 Cow B.	2130	Nil.
12 March 1925	3 Cow A.	400	Nil.

Sample No. 3 stood in the laboratory at room temperature from 10 a.m. to 4 p.m. before being plated.

The average count of the three samples was 900; coli, nil.

E2.—*Single experiments at hand-milking dairies.*

Four dairies were visited with the object of ascertaining what immediate improvement could be effected at dairies where hand milking was practised.

One sample was taken from a drum as produced by the dairyman's method.

Three cows were then selected and the flank of each cow was rubbed down with a damp cloth. The udders were well washed and dried, and the first jets of milk were rejected.

The milker's hands and forearms were then thoroughly washed in clean water with soap and nail brush, then dried on a clean towel. He then donned a clean overall and the three cows were milked into a partly covered bucket which had previously been rinsed in boiling water. A sample was taken from the bucket. The samples marked "A" represent the milk as produced by the dairyman's method, and those marked "B" the milk as produced under the conditions described.

Having regard to the results obtained at the dairy, where extensive tests were made as described later, it is highly probable that the results were not materially influenced by the fact that the bucket was covered or by the use of the clean overalls.

The results are shown in Table 6:—

Table 6.

Dairy No.	Date.	Organisms per c.c.	B. Coli per c.c.
1	13 Feb. 1925	A. 28,000	thousands
		B. 1,300	40
2	13 Feb. 1925	A. 13,000	thousands
		B. 6,500	110
3	2 March 1925	A. 122,400	50
		B. 11,840	Nil.
4	1 April 1925	A. 13,640	86
		B. 1,390	Nil.

In considering these results it must be remembered that the "A" samples had been passed over the cooler, whilst the "B" samples were taken direct from the milk pail, and were therefore not exposed to contamination from and on the cooler.

The average total counts of the "A" samples is 44,160, and of the "B" samples 3,112. In two of the "B" samples the coli group was absent in 0.5 c.c.

*E3.—Investigations at dairy using the hand method of milking.*

The dairy was of the usual kind in respect of the buildings. The milking shed was of the lean-to pattern, completely open at one side, had a sound floor and reasonable drainage. A few square yards outside the shed were paved with sleepers. The yards consisted of deep loose sand, from which the manure was removed regularly as far as this was practicable. The food shed and stable for one horse were unpaved, and adjoined the milking shed. No proper manure bin was provided, but the stable was kept free from accumulations. The herd consisted of 17 cows in good condition, entirely hand fed, quiet and well handled. The water supply was obtained from the main. The milk room was well constructed, not quite fly-proof, the door self-closing, and the room and utensils were clean. The method of milking was superior to that usually adopted. The owner of the dairy did this himself. He followed the dry method and was very clean. The udders of the cows were well washed with clean water and dried. The milk was transferred to the milk room after each pair of cows was milked, this being done by the dairyman's wife. The milk room was about thirty yards distant from the milking shed.

Effective cooling of the milk was not practicable owing to the high temperature of the water from the main, which ranged from 76° to 80° F. No special facilities for washing the hands were provided in the milking shed.

The dairyman retailed his own milk on a round, examination of the milk up to the time of delivery to the consumer being thereby facilitated. The results of all examinations are collected in Table V. and are described individually hereunder.

The first samples were taken under the usual conditions of the dairy.

Sample No. 1 was obtained at the evening milking (as were all others except where specified) from the mixed milk after cooling.

No. 1—Organisms, 49,600; Coli, nil.

Sample No. 2 was obtained next morning during delivery, the milk having been kept at the dairy all night at ordinary temperature, and was 15 hours old when plated.

No. 2—Organisms, 504,000; Coli, 1,300.

Certain alterations in the methods were then instituted. A partly covered bucket was used for milking and its use continued for some time; the animal's tail was secured; the udders were washed as before and dried with a separate clean cloth; the flanks of the animal were brushed with a damp brush, and these precautions were carried out during the whole period.

Sample No. 3 represents the mixed milk as obtained under the altered conditions.

No. 3—Organisms, 5,800; Coli, nil.

Clean overalls were worn by the dairyman, and the use of these was continued for some time. The hands were washed and dried before milking each cow, and for this purpose a basin of clean water, soap, nail brush, and towel were provided. The practice was continued throughout the duration of the experiment.

Sample No. 4 is a sample of the morning's milk obtained at the dairy at 4 a.m. and delivered to the laboratory at 9 a.m.

No. 4—Organisms, 20,400; Coli, nil.

Sample No. 5 is a duplicate of No. 4 and was, in fact, taken from the same drum.

No. 5—Organisms, 9,180; Coli, 4.

The next point investigated was the effect of passing the milk over the cooler.

Sample No. 6 taken from the bucket before the milk was passed over the cooler.

No. 6—Organisms, 3,120; Coli, 2.

Sample No. 7 is the same milk as No. 6, but the sample was taken after the milk had passed over the cooler.

No. 7—Organisms, 132,000; Coli, 2.

Sample No. 8 represents the mixed milk of five cows before passing over the cooler.

No. 8—Organisms, 1,800; Coli, nil.

Sample No. 9 is the same milk after passage over cooler.

No. 9—Organisms, 8,000; Coli, 2.

Samples Nos. 10 and 11 were obtained under similar conditions as Samples No. 8 and 9, being taken before and after passing over the cooler.

No. 10—Organisms, 7,110; Coli, nil.

No. 11—Organisms, 105,000; Coli, 2.

The milk pail was then sterilised immediately before use.

Sample No. 12 represents the mixed milk of each of six cows before cooling.

No. 12—Organisms, 1,790; Coli, 2.

Sample No. 13 is the same milk after cooling.

No. 13—Organisms, 41,000; Coli, 20.

The effect of sterilising all the utensils immediately before use was then investigated.

Sample No. 14 represents the mixed milk of six cows before cooling.

No. 14—Organisms, 950; Coli, nil.

Sample No. 15 represents the remainder of the milk after having been put over the cooler.

The cooler, receptacle over same, and the drum into which the milk was passed had just previously been treated with boiling water.

No. 15—Organisms, 1,430; Coli, 8.

Sample No. 16 represents milk before cooling. The sample was obtained at 7.30 p.m. but was not plated until 4.30 p.m. next day after standing at ordinary room temperature from 10 a.m.

No. 16—Organisms, 3,180; Coli, 4.

Sample No. 17 represents the milk after being put over the cooler.

No. 17—Organisms, 3,500; Coli, nil.

These results were considered very satisfactory. In order to discover if certain of the precautions were unnecessary it was decided to revert to some of the original methods. The special bucket and overalls were discarded, the dairyman's clothing being as usual clean, and the ordinary open pail was used for milking. The udders were dried with the same cloth which was used for washing, it being merely wrung out. Throughout the remainder of the experiment all utensils used were dipped into a copper of boiling water just before milking was started.

It was then decided to test the evening's milk during delivery on the round next morning, in order to ascertain the effect of conditions of storage in the milk room.

Sample No. 18 is from the bulk milk of the herd after the milk had been put over the cooler.

No. 18—Organisms, 1,280; Coli nil.

Sample 19 is a sample of the same milk as No. 18, but taken on delivery next morning after having been kept at the dairy overnight. The cooling which it received at the dairy reduced the temperature to 82deg. F.—the sample received no other cooling treatment.

No. 19—Organisms, 33,760; Coli 3,152.

Samples Nos. 20 and 21 are a repetition of Nos. 18 and 19.

No. 20—Organisms, 2,920; Coli 2.

No. 21—Organisms, 123,000; Coli 3,680.

Since the effect of standing overnight was clearly deleterious, treatment by means of ice tubes was instituted.

Sample No. 22 is bulk milk immediately after passing over cooler.

No. 22—Organisms 1,540; Coli nil.

Sample No. 23 is from same bulk milk as No. 22. It had been put over the cooler at the dairy which reduced the temperature to 80 deg. F. It was then further cooled by means of an ice tube to a temperature of 56deg. F. in 45 minutes. The milk was kept at the dairy all night and the sample taken during delivery next morning. It was kept at ordinary room temperature until plated some five hours after the sample was taken. Temperature at the time of sampling 50deg. F.

No. 23—Organisms 6,000; Coli 144.

Sample No. 24 is a sample of the morning milking taken at delivery. It was plated seven hours after milking and was never ice-cooled.

No. 24—Organisms 3,420; Coli 10.

Sample No. 25 represents bulk milk immediately after passing over cooler.

No. 25—Organisms 1,360; Coli nil.

Sample No. 26 is a sample of the same milk as No. 25 taken during delivery next morning, not having been ice-cooled. Temperature after passing over the cooler 78deg. F.

No. 26—Organisms 5,440; Coli 14.

Sample No. 27 is the same milk as Nos. 25 and 26, but after passing over the cooler in the dairy it was further cooled by means of ice tube which reduced the temperature to 56deg. in 40 minutes.

No. 27—Organisms 1,280; Coli nil.

Nos. 26 and 27 remained at room temperature until plated five hours after the samples were obtained. No. 26 had therefore endured 15 hours standing without ice-cooling.

Nos. 30, 31, and 32 are samples taken under the same conditions as Nos. 25, 26, and 27, No. 31 having been additionally cooled by means of an ice tube.

No. 30—Organisms 910; Coli nil.

No. 31—Organisms 4,800; Coli 2.

No. 32—Organisms 11,200; Coli 12.

The striking result of this investigation is the effect of sterilisation of all utensils immediately before milking.

Seven samples taken after passing over the cooler into a drum, after mere "cleaning" of reservoir cooler and drum gave the following counts:—

Total 45,000; Coli 4.

Eight samples taken after passing over the same utensils after they have just previously been dipped in boiling water gave the following:—

Total 2,045; Coli 2.

The effect of ice-cooling of the evening milk during storage overnight in the milkroom was naturally considerable. Four samples of the evening's milk stood overnight without ice-cooling, and gave on delivery next morning the following averages:—

Total 43,300; Coli 1,714.

Whereas three similar samples of evening's milk after standing overnight with ice tubes in the drums gave on delivery next morning the following averages:—

Total 4,026; Coli 48.

With these simple precautions—namely, reasonable cleanliness on the part of the milker, washing of the udders, rejection of first jets, scalding of all utensils, and the use of ice tubes in milk which had to be stored overnight—it was possible for this dairyman to deliver milk to consumers which as sampled from the hand-can on delivery gave an average count on four samples:—

Total 3,900; Coli 40.

The dairyman was pleased to observe the precautions suggested which entailed practically no additional expense and very little extra trouble. The principal and most valuable change in his methods was the bringing of his copper to the boil immediately before instead of after milking. The milk he delivered was undoubtedly of very high quality and most of the samples kept good for some days at room temperature.

TABLE V.

*Bacterial Counts of samples of Milk from Hand Milking Dairy.*

Date.	No.	Organisms per c.c.	B. Coli per c.c.
10-2-25	1	49,600	Nil.
10-2-25	2	504,000	1,300
14-2-25	3	5,800	Nil.
28-2-25	4	20,400	Nil.
28-2-25	5	9,180	4
4-3-25	6	3,120	2
4-3-25	7	132,000	2
11-3-25	8	1,800	Nil.
11-3-25	9	8,000	2
13-3-25	10	7,110	Nil.
13-3-25	11	105,000	2
20-3-25	12	1,790	2
20-3-25	13	41,000	20
24-3-25	14	950	Nil.
24-3-25	15	1,430	8
30-3-25	16	3,180	4
30-3-25	17	3,500	Nil.
5-4-25	18	1,280	Nil.
6-4-25	19	33,760	3,152
14-4-25	20	2,920	2
15-4-25	21	123,000	3,680
23-4-25	22	1,540	Nil.
24-4-25	23	6,000	144
24-4-25	24	3,420	10
27-4-25	25	1,360	Nil.
28-4-25	26	5,440	14
28-4-25	27	1,280	Nil.
9-5-25	30	910	Nil.
10-5-25	31	4,800	2
10-5-25	32	11,200	12

#### E4.—Investigations at dairies using machines.

The two dairies concerned in these investigations were both of considerable size, employing well-paid labour under the control of an intelligent manager who was undoubtedly anxious to produce milk of as high a standard of cleanliness as possible.

In the following account are detailed the methods followed in cleaning the machines. It was not possible to be certain that the methods were scrupulously followed in each instance, but there is very good reason to believe that they were.

The collected results are shown in Table VI., details being given below:—

TABLE VI.

*Bacterial Counts of Milk from Dairies where milking machine was in use and special measures were taken.*

Date.	No.	Organisms per c.c.	B. Coli per c.c.
Dairy "R"—			
February 9, 1925	1	16,600	Nil.
February 25, 1925	2	33,600	192
March 10, 1925 ...	3	19,000	2
March 20, 1925 ...	4	12,680	448
March 20, 1925 ...	5	51,800	128
March 30, 1925 ...	6	395,200	1,792
March 30, 1925 ...	7	124,800	28
March 31, 1925 ...	8	27,200	84
March 31, 1925 ...	9	30,960	176
Dairy "W"—			
April 2, 1925 ...	10	36,800	24
April 2, 1925 ...	11	44,000	74
April 2, 1925 ...	12	129,600	208
April 14, 1925 ...	13	10,740	Nil.
April 15, 1925 ...	14	38,960	224
April 22, 1925 ...	15	16,400	56
April 22, 1925 ...	16	38,400	60
April 29, 1925 ...	17	55,240	36
April 29, 1925 ...	18	59,200	26
April 29, 1925 ...	19	27,200	
April 29, 1925 ...	20	75,200	
April 29, 1925 ...	21	36,000	

#### Conditions at the Dairy "R."

The milking shed was open at one side; the floor was sound and clean. The yards were sandy but were kept free from manure. The milk room was well-kept and utensils were clean, the business generally being well conducted. The cows' udders were well washed and dried before the machine was applied.

The machine in use was a "Simplex," releaser type.

The method of cleaning the machine was as follows:—

After each milking, cold water, followed by hot water and soda, followed by hot water, was drawn through the appliance. The movable parts were then placed in the milk room until next morning. The long tube through which the milk passes to the cooler was scrubbed by a brush during the passage of the hot water and soda.

Two or three times a week the cups were completely dismantled and cleansed with hot water and brushes.

Sample No. 1.—Taken from drum after the milk had been passed over the cooler.

No. 1—Organisms 16,000; Coli nil.

Sample No. 2.—The first jets of milk were rejected before the machine cups were applied. The cups had been taken apart two days previously.

No. 2—Organisms 33,600; Coli 192.

Sample No. 3.—No alteration in methods.

No. 3—Organisms 19,600; Coli 2.

Sample No. 4 represents mixed milk of the first eight cows milked. New cups were used on the machine.

No. 4—Organisms 12,080; Coli 448.

Sample No. 5 is the mixed milk of the second eight cows, received into another drum which had just previously been rinsed by the dairyman with boiling water and then with cold water.

No. 5—Organisms 51,800; Coli 128.

Sample No. 6.—Mixed milk of first eight cows.

No. 6—Organisms 395,200; Coli 1,792.

Sample No. 7.—From the second eight cows. The receiving drum had been rinsed with boiling water and then allowed to cool.

No. 7—Organisms 124,800; Coli 28.

The machine was not working well on this day.

Sample No. 8.—Mixed milk of the first eight cows. The machine, reservoir, cooler and drums were treated with boiling water just before milking. The movable parts of the machine had been kept in a solution of stabilised chloride of lime (20 per cent. Cl. approx.), 1½ozs. to one gallon of water, since the previous milking. Some of the cups fell off during operations and could only be rinsed with cold water. The sample was taken when the drum was quarter-full.

No. 8—Organisms 27,200; Coli 84.

Sample No. 9.—Taken from the same drum as No. 8, but when the drum was three-quarters full.

No. 9—Organisms 30,960; Coli 176.

All the above samples were placed on ice and plated within two hours of the time they were taken. This dairy then went out of production. The tests were continued at another dairy, "W."

#### Conditions at the dairy "W."

The premises were similar to and quite as good as those at dairy "R." The machine used was of the same make but of the bucket type.

The method of cleansing the machine was as follows:—After one milking cold and then boiling water was pumped through and the parts placed in the milk room. After the next milking, cold and then boiling water was pumped through and the machines were then completely dismantled, washed with brushes, hot water and soda, and then immersed in ordinary cold water until assembling for next milking. The washing process was very thoroughly done.

Sample No. 10 was taken from a bucket to which the strippings had not been added.

No. 10—Organisms 36,800; Coli 24.

Sample No. 11 of the same milk, but including strippings (hand milked), after being passed over the cooler.

No. 11—Organisms 44,000; Coli 74.

Sample No. 12 is the same milk as No. 10, but taken after passing over the cooler.

No. 12—Organisms 129,600; Coli 208.

All the following samples were taken from the buckets before cooling. The afternoon's milk was kept on ice overnight and the morning's milk was not cooled at all. The afternoon's milk was about 18 hours old when plated and the morning's milk about 4 to 5 hours old.

Sample No. 13.—Afternoon's milk.

No. 13—Organisms 10,740; Coli nil.

Sample No. 14.—Morning's milk.

No. 14—Organisms 38,960; Coli 224.

The following methods of cleaning the machine were then adopted:—

After each milking the buckets and all pails were scrubbed first with cold then with hot water and soda and scalded with boiling water. After the morning milking the cups and tubes had first cold water pumped through, followed by hot water and soda. They were then placed in the dairy. Just prior to the commencement of the afternoon's milking boiling water was pumped through and the buckets scalded. When the afternoon milking had been completed cold water was pumped through the cups, tubes, etc., and the parts were then taken adrift and cleansed with hot water and soda by the use of brushes. They were then rinsed in boiling water, dried, and assembled for use next morning.

Sample No. 15.—Morning's milk.

No. 15—Organisms 16,400; Coli 56.

Sample No. 16.—Afternoon's milk.

No. 16—Organisms 38,400; Coli 60.

The following alterations in the instructions for cleansing the machine were then given:—

After the morning's milking, the machine to have cold water drawn through and then to be taken apart and allowed to soak in soda water. Cleaning by the brush to be done just before the afternoon milking, the machines to have boiling water drawn through each after assembling and before being put on the cows.

After the afternoon's milking, the usual drawing through of cold water, warm soda water, and finally boiling water to be carried out immediately, and the machines placed in the dairy.

Sample No. 17.—Afternoon's milk.

No. 17—Organisms 55,240; Coli 36.

Sample No. 18.—Morning's milk.

No. 18—Organisms 59,200; Coli 26.

Sample No. 19.—Morning's milk, but the vessels had been washed with hot water and "Clenzol" instead of hot water and soda.

No. 19—Organisms 27,200.

Sample No. 20.—Afternoon's milk.

No. 20—Organisms 75,200.

Sample No. 21.—Afternoon's milk. The vessels had been washed with "Clenzol."

No. 21—Organisms 36,000.

It will be observed that the suggestions offered to these dairymen did not result in any improvement in the counts. Nine samples from dairy "R" give average counts of 79,000 and 316. Excluding the sample taken on the day when the machine was not working properly, the remaining seven samples give averages of 27,000 and 150.

Twelve samples from dairy "W" give average counts of 47,000 and 78.

The average of all samples is—  
60,000 and 197.

The ratio of total count to Coli is 304 to 1.

The average is in startling contrast with that obtained from ordinary machine-milking dairies as described in Section D, namely—

Total 694,504; Coli 743,

but compares by no means well with results that were obtained at a hand-milking dairy where similar care was taken, and from which milk with counts of 3,900 and 40 was delivered to the consumer.

The difficulty of obtaining milk of low count by means of a milking machine is further illustrated by an experiment made at a one-man dairy where a Ridd machine was in use. The dairyman was especially interested and was more than ordinarily careful in his methods. A random sample taken from the bucket of his machine gave the following count: total, 947,000; Coli, thousands. The cups of his machine had not been dismantled for many days. The dairy was revisited, the machine was dismantled and the parts treated, just prior to milking, in the following way: The parts were scrubbed by brushes in water at 170° F., the parts remaining in this water for several minutes. The buckets were well washed with water of a temperature of 200° F. and allowed to cool. Two samples taken from the milking which followed immediately, gave the following figures:—

	Total.	Coli.
No. 1 .. .. .	270,400	238
No. 2 .. .. .	150,080	904

Had it been possible to further assist this dairyman with regard to the cleaning and maintenance of his machine better results could, no doubt, have been obtained, but the experience illustrates the difficulty involved.

#### Conclusions.

It must be remembered that the investigations on which the following conclusions are based were carried out during the latter part of the summer. Seasonal changes may exercise considerable influence, and it is desirable that further examinations be made in order to determine the extent thereof.

1. Milk as delivered to consumers under existing conditions shows a high bacterial count.

2. Country milk on arrival at Perth station and milk produced at hand-milking dairies in the metropolitan area under existing conditions gives a relatively low count.

3. By the use of simple inexpensive methods it was possible at a hand-milking dairy to produce milk of an extremely satisfactory degree of cleanliness, and to deliver it to the consumer in the same condition.

4. The most important factor in the production of clean milk under the usual conditions is the sterilisation of all utensils. This can be well accomplished by the dipping of all utensils in boiling water immediately before use. This necessitates the bringing of the water to the boil before instead of after milking, and makes it desirable that, instead of the usual round copper, a rectangular boiler, capable of taking a 10-gallon milk drum laid on its side, should be installed.

5. The use of milking machines under existing conditions give very unsatisfactory results.

6. The results obtained by the use of milking machines under very good conditions are no better than those obtained by hand milking under ordinary conditions, and do not approximate to those obtained by hand milking under the best conditions.

7. The counts of the *bacillus coli* group show that these undesirable organisms are practically absent from the milk as produced under the best conditions

of hand milking; that they are more numerous absolutely in any samples with a high total count than in those with a low count, and that they are more numerous relatively in milk that has been kept for a number of hours at ordinary temperature than in the same milks at the time of production.

J. W. B.

J. D.

F. J. R.