

## MILK HYGIENE PRACTICE IN EGYPT

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The ancient Egyptians left evidence of their interest in dairying in writings and carvings portraying cattle and dairy practices as early as 3000 B.C. Carvings found in the early tombs reveal the types of cattle kept, milking methods and other interesting facts. In the portrayal of milking, the cow was milked from the side into earthenware containers, a calf was placed in front of the cow during milking, presumably to induce her to let down the milk, and meanwhile the cow shed tears for depriving the calf of her milk. The earthenware vessels shown in such ancient carvings are still in use by the majority of farmers. Although milk sanitarians consider them unhygienic, and advocate the use of properly cleaned and sterilized milking utensils as one of the important factors in the production of milk of low bacterial count, the ancient practices for treatment of these earthenware containers are still in some places being followed today. The porous vessel is washed, a small quantity of milk is rubbed over the inside to fill the pores, and the container is then sterilized by placing it on the embers of the bread oven during baking, where it is left until milking time. After a few such treatments the inside surface becomes glazed and the vessel is used for setting the milk; the cream is churned into butter and a local soft cheese is made from the curd. The sterilization process is carried out daily, with an additional treatment, which is considered by the Egyptian farmer as essential to obtain maximum creaming of the milk.

This treatment, known as "khella", usually consists in burning straw or corn cobs inside the earthenware container, and wiping it with corn stalks or other parts of various plants before heat sterilization. Such practices are giving way to modern methods of milk production, which are being introduced into Egypt. In recent years considerable attention has been given to ways of improving the production and supply of milk to large towns, and the installation of modern pasteurization and processing plants. The task is rather difficult and calls for study of the basic problems of production, collection, transportation, processing, and distribution, estimating the needs of the country and planning a programme to be executed within a certain period.

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## The Milk Industry

There are about two million head of cattle and buffalo in Egypt (United Arab Republic), producing approximately 1.5 million tons of milk valued at £E 50 million.<sup>1</sup> About 60 % of the milk-producing animals are buffaloes.

The milk produced is utilized as follows: 145 000 tons for market milk; 560 000 tons for cheese manufacture; 700 000 tons for butter manufacture; and 95 000 tons for miscellaneous use.

Except for about 400 tons of white cheese sold to neighbouring Arab countries, there is practically no export of milk products. However, Egypt imports cheese, milk powder, condensed milk and butter equivalent to about 45 000 tons of liquid milk valued at \$E 1.5 million.<sup>1</sup> It is estimated that a yearly increase in milk production equivalent to 30 kg per animal could replace the imported milk products, provided that plant facilities were available for their manufacture.

The *per caput* consumption of milk and milk products is very low, amounting to only about 60 kg of milk.

From the nutritional point of view, milk consumption should be increased 300 %; plans are hence being made to increase milk production. Import of dairy cattle is advocated, and the Ministry of Agriculture and other agencies have been empowered to purchase 3000 Friesian cattle, a breed which for the last 20 years has proved able to withstand the climatic conditions in Egypt. Attempts are also being made to increase the level of milk production of buffaloes and local cattle through better feeding, breeding management and disease control.

There are 16 well-equipped milk-processing plants in Egypt handling about 20 000 tons of milk per year or about 1.5 % of the total milk production. The bulk of milk (98.5 %) is either processed on the farms, in small shops, and in dairies with simple installations, or sold directly to the consumers through pedlars. These facts indicate the urgent need for modern dairy plants. Steps are being taken to provide each city and town in Egypt with a well-equipped milk pasteurization and processing plant.

### Milk Production

The two million buffaloes and cows are distributed over six million feddāns<sup>2</sup> of agricultural land which constitute the Nile Valley. About 80 % of the dairy cattle are scattered over one million farms—each farmer owns from one to three animals. These farms are grouped into 4000 villages. The average number of dairy cattle is 500 per village. Milk production of these animals is rather low, being one ton of milk a year per buffalo and half a ton

<sup>1</sup> £E 1 = US\$ 2.25.

<sup>2</sup> 1 feddān = 1.038 acres.

per cow. It is estimated that farm animals in Egypt give work to the farmers represented by £E 45 million and manure valued at £E 10 million. Experiments have shown that when dairy cattle are kept for milk production only, they respond exceedingly well to balanced rations and better management, and usually double their milk production. This indicates the potentialities for increasing milk production without raising the number of cattle.

### *The small farm*

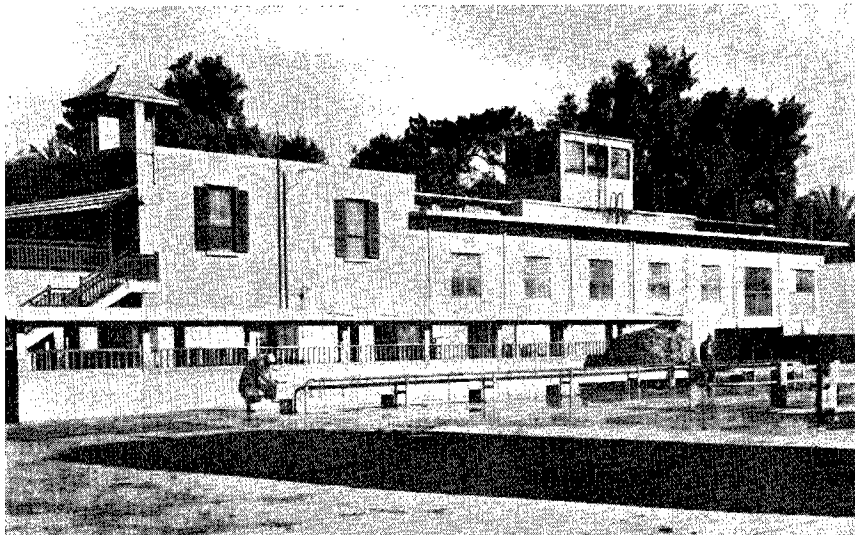
Hygienic conditions of milk production on Egyptian farms are often unsatisfactory. The cattle may be housed in the farm courtyard or in the mud-brick farm-house without adequate ventilation, flooring or drainage or a clean water supply. The hot climate and the presence of flies make good hygiene difficult to achieve, but the farmer's wife tries her best to produce as clean milk as possible by washing the udder (although often clean water may not be available), wiping it with a clean cloth, and milking by hand into an earthenware container previously sterilized in the baking oven for several hours. Milking is done twice a day, at sunrise and sunset, before the cattle are taken out to pasture and after their return. In hot weather the farmer's children take the buffaloes for a dip in the nearby canal to help remove the dirt and dung, and to try to clean them. The milk is not sold fresh except in villages adjacent to towns; it is usually left for "setting" in earthenware vessels covered with a cloth until the creaming of the fat and clotting of the curd is complete. Butter and soft cheese are subsequently made under similar conditions and usually sold on market-day, which is held once a week in each village.

The situation is now improving through the expanded Government scheme to supply clean chlorinated water to the villages, and through the efforts of the Ministry of Agrarian Reform, which is building well-designed new villages for farmers, who are given five acres of land on an easy-payment plan. Community stables are being built in some of these villages; provision is made for a modern milking stable (see Fig. 1), clean water supply, veterinary supervision and extension service for better methods of feeding, management and milking. Milk produced under these conditions was sold in Alexandria during November 1960 at a premium price amounting to 25 % higher than milk produced in the neighbouring locality.

### *The dairy farm*

There are a few dairy farms situated close to large cities in Egypt. They are run by farmers who own from 20 to 300 buffaloes; on these farms, which vary in size from 50 to 200 acres, crop rotation is planned to supply the maximum amount of fodder for the animals; "berseem" or Egyptian clover provides them with enough feed for about six months, and then the herd is usually fed on cottonseed cake, bran, straw, corn stalks and silage or hay. These farms have cattle sheds and some facilities for clean milk production.

FIG. 1  
A MILKING STABLE IN A MODERN VILLAGE



Washing and cleaning facilities for the cattle are provided.

However, cooling of milk is not practised on the farm, which is a great handicap to hygienic milk production. The milk is transported to large dairies immediately so that it reaches its destination within three hours after milking. Practical experience has shown that the acidity of milk does not exceed 7 on the Soxhlet-Henkel scale if milk is received at the pasteurization plants within this period, even during the summer months when the temperature reaches 45°C.

Government dairy farms in Tahreer Province maintain more than 2000 Friesian cattle which are milked daily in very modern stables. In Sakha district the Ministry of Agriculture maintains a herd of 1500 buffalo and Friesian cattle to supply the new milk-drying plant which has been established by UNICEF for the Egyptian Government. The plant is designed to handle 20 tons of milk daily.

The Ministry of Agrarian Reform also maintains large herds at Behtim, 10 km from Cairo, and in other districts to be the nucleus for the "Nasser project" of distributing 10 000 milking buffaloes to landless farmers in order to raise their income. The plan is well on its way, with gratifying results to the farmers. Most of these Government farms have facilities for cooling milk either mechanically or by the use of ice and water, and the milk is produced under hygienic conditions similar to those prevailing in more advanced countries. It is estimated that 10 % of the total number of cattle are maintained on dairy farms.

### *Urban stables*

The urban population in large cities is partly supplied with milk from producers within the municipal area. At present there are about 4000 buffaloes housed in stables within Alexandria city limits, and 2500 in the city of Cairo. The size of herds varies from 10 to 100, and the animals are kept in crowded pens both day and night and milked under the most unhygienic conditions. They are fed a highly concentrated diet. Disposal of manure poses a difficult problem, and tends to cause flies and bad odours.

### **Health of Dairy Animals**

Among the diseases affecting dairy cattle and buffaloes in Egypt are tuberculosis, brucellosis, foot-and-mouth disease and cowpox. Average rates of tuberculosis infection are reported as 5 % in buffaloes, 8 % in cows, 12 % in oxen and 1.5 % in calves from 1 to 2 years. Animals housed in crowded stables in the cities under poor ventilation and hygienic conditions have a higher rate of infection than those on farms leading an open-air life. There is no definite plan for the control and eradication of bovine tuberculosis. Regulations have been in existence since 1951 requiring the condemnation or slaughter of animals that may be a source of infection for any disease, but, because of lack of available funds to compensate the owners, are difficult to enforce.

According to the Veterinary Department, infection rates for brucellosis in Egypt are 4 % for buffaloes, 6 % for cows and 7 % for goats.

Foot-and-mouth disease presents a serious problem for milk producers. Outbreaks occur yearly, causing a marked decrease in milk production and presenting a national health hazard. Regulations demanding that the milk from infected cattle be boiled before sale are difficult to enforce, especially in city barns where the disease is more prevalent. Buffaloes do not respond to cows' vaccine, and a research project is under way to develop a special vaccine for these animals. There is some evidence that various strains of foot-and-mouth disease virus are brought to Egypt twice a year with the migration of birds to and from Europe and South Africa.

Cowpox is not uncommon, but the disease is under control as it is planned to vaccinate all dairy cattle periodically. Eighty-eight veterinary centres for the control of animal diseases have been completed and are in operation; the ultimate goal is to build and equip 329.

### **Health of Milk Handlers**

Milk may be handled by anyone among the village population, and there is no medical examination of milkers for the purpose of preventing the contamination of milk with typhoid and paratyphoid bacilli or other diseases

carried by man. In one village near Cairo a recent medical survey indicated that rates of infection of the population are 2 % for tuberculosis, 5 % for typhoid fever, 12.5 % for typhoid carriers, 75 % for dysentery and an even higher rate for bilharziasis.

However, regulations are strictly enforced for a complete medical control of personnel in pasteurization plants and milk shops and of milk pedlars. A health certificate is issued by Government laboratories to milk handlers within the city limits.

### Quality of Market Milk

#### *Composition*

Milk legislation law No. 132 (28 August 1950) defines milk as the product of healthy buffaloes or cows, free from infection. It prohibits the sale of milk for human consumption unless it is fresh, clean, and free from colostrum, dirt, preservatives and colouring matter. Adulteration, either by watering or by the abstraction of fat, is prohibited. Likewise, it is considered illegal to offer boiled milk for sale except in eating establishments.

The milk regulation dated July 1952 sets the compositional standard for buffalo milk at not less than 5.5 % fat and 8.75 % solids-not-fat, while for cows' milk the limits are 3 % and 8.5 % respectively.

#### *Bacteriological quality*

Several studies have been made to determine the bacteriological quality of raw market milk in Cairo; the Bacteriology Department at the University of Cairo found in 1957 that no difference exists between the bacterial flora of buffaloes' and cows' udders. The average bacterial count was 576 per ml for buffaloes and 2830 per ml for cows, and comprised mainly staphylococci of various types. Pasteurization of aseptically drawn milk resulted in complete sterilization of the milk, showing that the organisms present in the normal udder are unable to survive pasteurization, and that the udder is not the source of thermoduric bacteria.

On the other hand, plate counts and presumptive coliform tests of regular market milk samples revealed gross contamination by streptococci, micrococci, corynebacteria and alcaligenes in addition to the coliform group. The total plate count varied between 194 000 and 29 million, with an average of 9 million, bacteria per ml. Similar studies at Ain Shams University revealed heavier contamination of 100 milk samples taken from pedlars: bacterial counts ranged between 143 000 and 400 million, with an average of 44 million, per ml. Boiled milk samples contained an average of 13.8 million bacteria per ml. The number of coliform organisms showed an apparent correlation with the plate count in raw milk samples but not in boiled milk samples. These facts explain the prevalence of diarrhoea among children, especially during the summer months.

### Quality of Pasteurized Milk

Properly pasteurized milk has been available in Egypt since 1952. At present there are two modern plants supplying the cities of Cairo and Alexandria and distributing about 18 million bottles of standardized pasteurized milk per year. Samples of milk taken daily by municipal health departments and by the Ministry of Health indicate that all samples conform to legal standards as regards composition, phosphatase test, and methylene blue tests. The method of pasteurization used in both plants is the high-temperature, short-time (HTST) process, heating milk to 85°C for 15 seconds and cooling to below 5°C in up-to-date equipment provided with flow diversion valves and temperature-recording charts. The regulations for pasteurized milk passed in 1954 are strictly enforced on pasteurization plants, and require that temperature-recording charts be kept for one month for examination by health inspectors. Dating of pasteurized milk is also required, and a numerical system has been adopted from 1 to 7 for the days of the week, starting with Sunday. Milk fat is standardized to 3% in order to produce pasteurized butter for the local market, since Egypt formerly imported 1000 tons yearly.

The high pasteurization temperature of 85°C has been selected in order to improve the keeping quality of milk. Studies have shown that vitamin C present in buffalo milk is not affected by heat treatment under commercial conditions. The pasteurized milk contains 25 mg of ascorbic acid. Furthermore, the higher temperature ensures adequate destruction of *Coxiella burnetii*, the infectious agent of Q-fever. The taste of milk is greatly improved by the process of preclarification of the milk before pasteurization. There is no noticeable heated flavour in pasteurized milk, especially to a population accustomed to boiled milk.

Raw milk is collected in clean milk cans by trucks owned by the pasteurization plants from milk farms, co-operatives, and private dealers collecting milk from small farmers. Strict control is maintained to ensure transport of milk within three hours of milking. Milk with acidity higher than 7 on the Soxhlet-Henkel scale is rejected at the platform. Payment is made on the basis of compositional quality, a premium being given for a percentage of fat higher than 7% and the price being reduced when the fat of buffalo milk is less than 6.5%. Studies have shown that such raw milk is grossly contaminated with thermoduric bacteria. Laboratory pasteurization on individual samples at 63°C for 30 minutes indicated that the efficiency of pasteurization varied between 32% and 90% depending on the degree of contamination with the thermoduric bacteria (such as *Streptococcus bovis*, *Str. thermophilus*, aerobic spore-forming rods and thermoduric actinomyces). However, commercial pasteurization using the HTST process gives a higher efficiency of pasteurization (98%). Official bacterial counts on commercial pasteurized milk sold in Alexandria during 1953-54 have shown that the

FIG. 2  
MILK COLLECTION CENTRE IN A COLLECTIVE UNIT

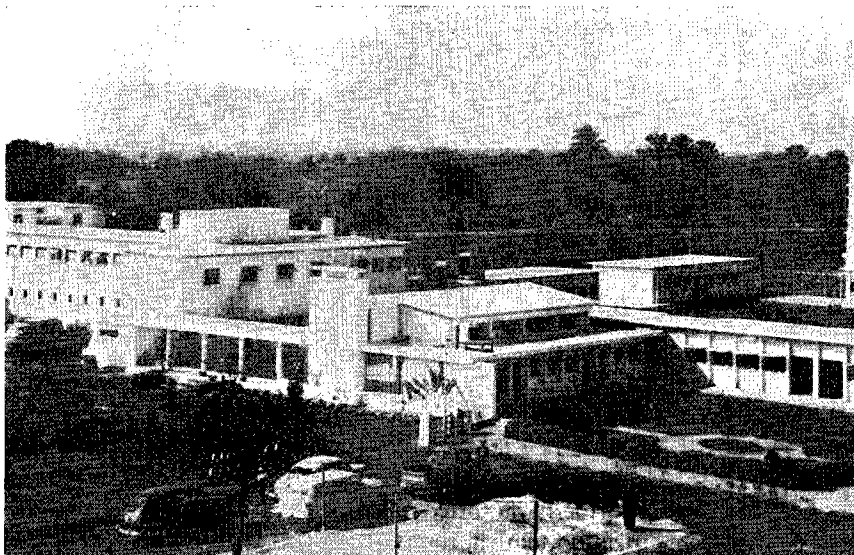
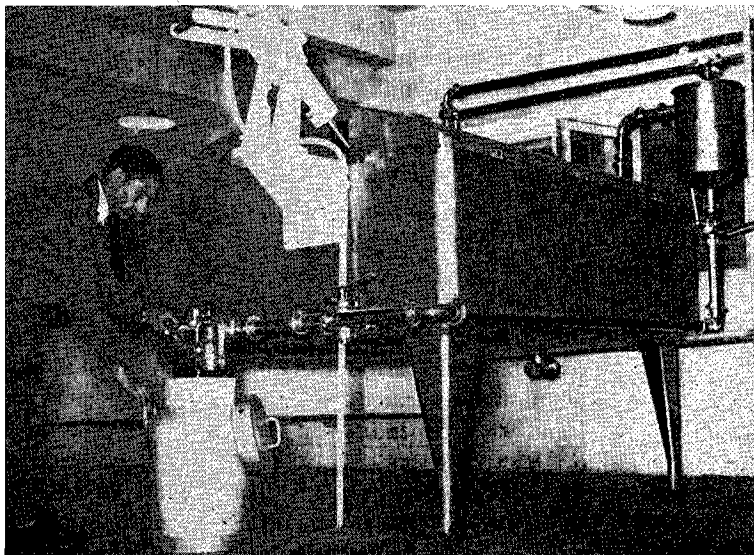


FIG. 3  
FILLING OF CANS AT A MILK COLLECTION CENTRE



The cans are to be shipped to a pasteurization plant in Cairo.

total number of bacteria varies between 10 000 and 140 000 per ml, with an average of 35 000 per ml. However, the fact that raw milk is heavily contaminated with spore-forming rods and other thermophilic bacteria makes the setting-up of plate-count standards of questionable value for the control of pasteurization processes under Egyptian conditions. The phosphatase test and the methylene blue test are required by the pasteurized milk regulations. The alkaline phosphatase in buffalo milk is lower than in local cows' milk or milk from foreign cows; phosphatase activity has been shown to be 28, 82 and 120 units per 100 ml of these milks respectively. However, experiments have shown that the enzymes present in the milk of the cow and the buffalo are identical; thus the phosphatase test can be safely adopted for testing the efficiency of pasteurization of buffalo milk (sensitive as it is to the presence of 0.25 % of raw milk).

Preliminary bacteriological study made in one pasteurized plant indicated that the quality of uncooled raw milk received during hot weather (above 25°C) was indicated by plate counts varying between 1.5 and 10 million, with an average of 4 million. The count was reduced to 3000 after pasteurization, revealing the efficiency of pasteurization to be over 99 %. The total count increased to 14 000 after bottling. The quality of pasteurized milk was not impaired when stored at low temperature. After 7 days' storage at 5°C, samples of bottled milk from the experimental batch showed practically no increase in acidity. The bacterial count after one week's storage at 5°C was 33 000 per ml.

### *Collection centres*

In 1953 the Government established the Permanent Council for Public Welfare Services to examine the general policy of reform and draw the broad lines of the new projects on reconstruction, production, social and health services and education. To distribute the services equally among the population the Council has decided to amalgamate all its services—health, educational and social—in a single unit to serve an area of 15 000 inhabitants. Egypt has been divided into suitably sized areas for this purpose, and each unit has been sited as centrally as possible within its area. Two hundred and fifty of these units have so far been completed. The Council has started to provide drinking-water to the rural areas, and has allocated £E 5.5 million to supply three million people as the first step towards establishing a complete clean-water system throughout the country. Within each unit there will be a milk collection and cooling centre to serve four or five villages, each village to produce one ton of milk daily in addition to that allocated for local consumption. Twelve of the milk collection centres have been completed, of which three started to deliver milk to the Cairo pasteurizing plant during November 1960, while that in Tahreer province is delivering six tons of milk daily to the Alexandria dairy (see Fig. 2, 3). Each centre is provided with facilities for testing, weighing and straining the milk,

FIG. 4  
CAIRO PASTEURIZATION PLANT: RECEPTION PLATFORM

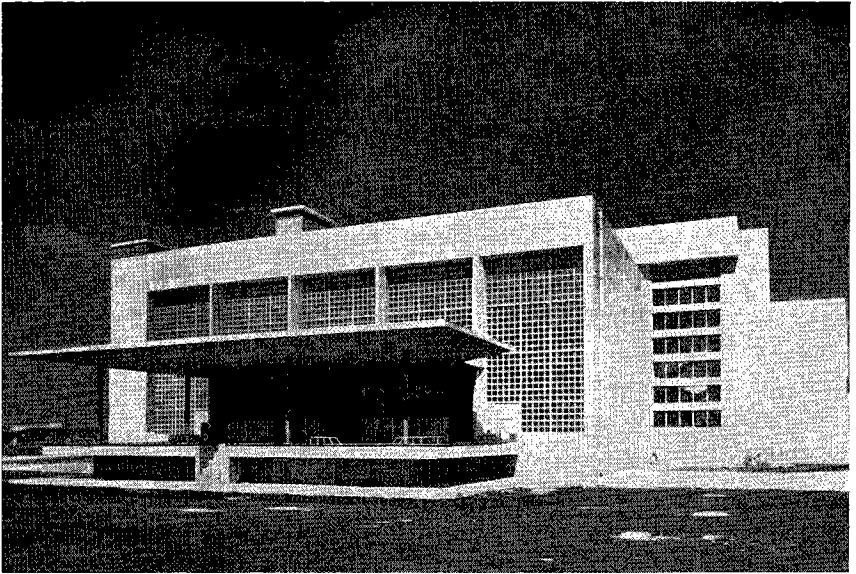


FIG. 5  
CAIRO PASTEURIZATION PLANT: RECEPTION DEPARTMENT

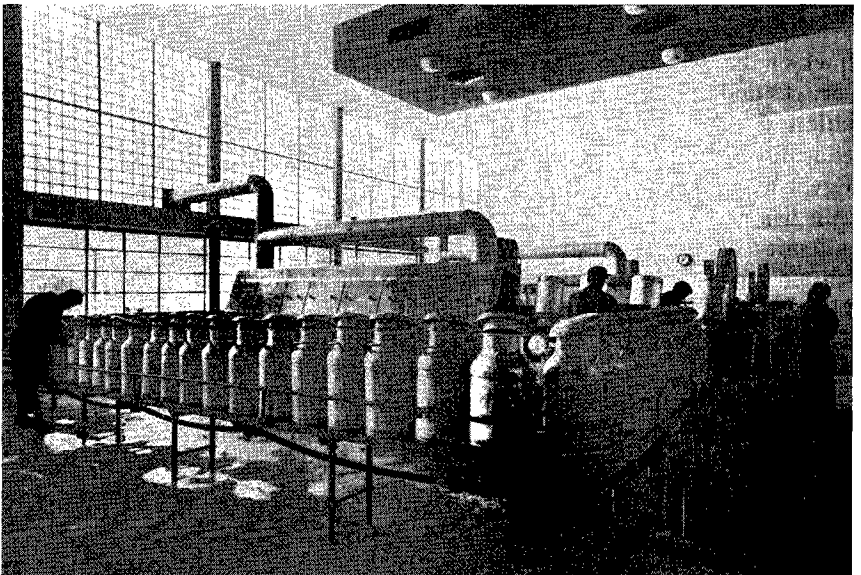


FIG. 6  
CAIRO PASTEURIZATION PLANT: PROCESSING HALL

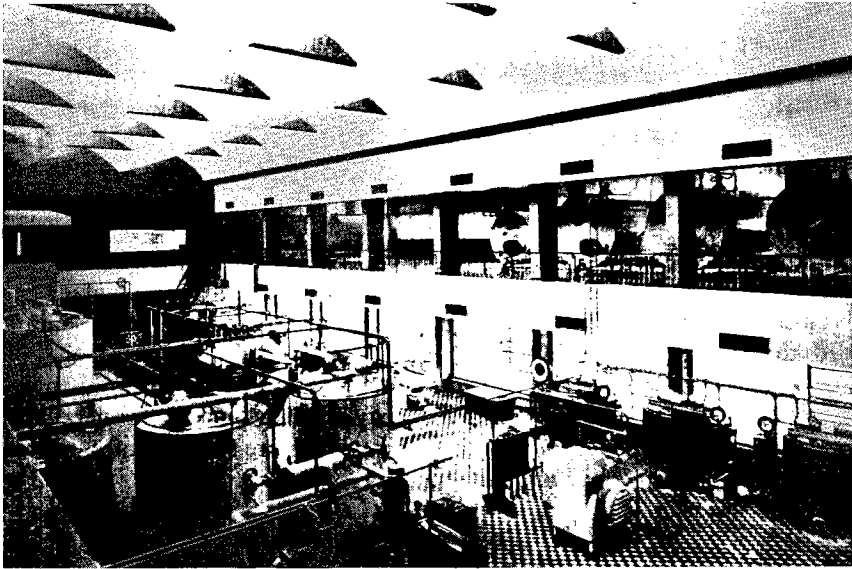
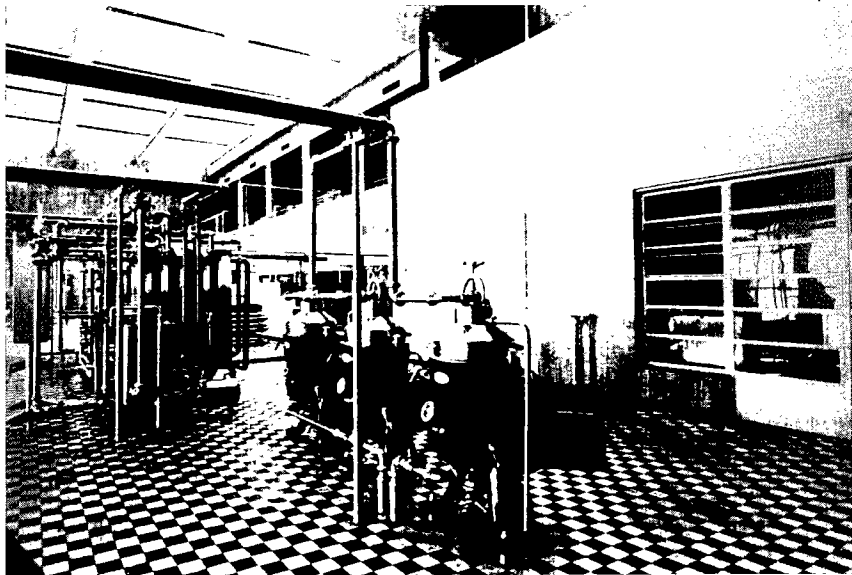


FIG. 7  
CAIRO PASTEURIZATION PLANT: CLARIFIERS AND PASTEURIZATION UNIT



and cooling it at the rate of 1.5 tons of milk per hour to about 2°C. A boiler-house, mechanical refrigeration and a storage tank for three tons of milk are available in each unit. Provision is made to transport the milk to the centres within two hours of milking. The centres are run by co-operatives under the technical supervision of officials appointed by the Council and of university professors. The farmer is paid a higher price for his milk—up to 40 milleems<sup>1</sup> per kg instead of the 20-30 milleems which he used to get from pedlars or from the manufacture of butter and cheese. Milk collection centres aim at improving milk production and providing pure milk to the pasteurization plants.

Another type of milk collection and cooling centre has been established around the milk-drying plant at Sakha. The equipment for this plant has been supplied by UNICEF; the project has been carried out in collaboration with the Ministry of Agriculture.

With the aim of reducing risks of contamination of milk from utensils, clean aluminium milk cans of 5-litre capacity are distributed to farmers, who milk directly into these wide-mouthed cans, which are subsequently washed and steamed in the collection centres.

#### *Central pasteurization plants*

To supply each town and city with hygienic milk and milk products, three pasteurization plants are being constructed for the cities of Tantah, Mansourah and Ismallia, in addition to the existing plants (see Fig. 4-7) in Cairo and Alexandria. Each plant is equipped to process 25 tons of pasteurized milk, yogurt, cheese and crude milk sugar. The milk will be supplied from collecting centres established within a radius of 50 km from each plant.

Sterilized milk has been suggested as a substitute for pasteurized milk in Egypt. The authorities have requested a comparative study to be made at Cairo dairy, and a pilot sterilizing unit will be installed for this purpose. While the advantages of sterilized milk are well known, consideration will be given to the acceptability to consumers of such milk in localities where fresh pasteurized milk is kept under refrigeration in most grocery stores all day. The cost of production, changes in flavour, colour, and nutritive value and the heat stability of buffalo milk are among the points to be studied. The survival of spores may present a problem in the production of sterilized milk under Egyptian conditions.

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<sup>1</sup> 350 milleems = US\$ 1.00