ANIMAL DISEASES

W. D. POUNDEI, SECTION EDITOR


A method of determining adaptability of quarter milk samples for the growth of S. agalactiae was developed. Quarter samples were drawn aseptically and duplicate Hotis tests set up for 24 hr. at 37°C. One of the tests was inoculated with a fresh culture of S. agalactiae before incubation. The incubated inoculated tubes were titrated with N/10 NaOH to match the color of the duplicate tube for each quarter. The amount of NaOH required was taken as an index of the suitability of the milk to S. agalactiae growth. Two groups of 8 cows each were tested at weekly intervals. One group was fed good quality alfalfa hay and meadow crop silage with little grain. The other group received poor quality grass hay and heavy grain feed. After 8 wk., in which little group difference occurred, the high grain-fed group exhibited persistently higher milk susceptibility to mastitis than the others. There were also 7 cases of detectable mastitis in the former group and only 2 in the latter during the 17-wk. observation period. The possibility is suggested that abundant good quality roughage may improve the health and disease resistance of the cows.

E. W. Swanson


Weekly collected milk samples from 2 groups of 8 cows each were inoculated with S. agalactiae, and after 24 hr. incubation the acid produced was estimated by titrating with 0.1N sodium hydroxide. Beginning with the test conducted in the 9th week and continuing for the 7 remaining weeks of the experiment, samples from one group which received poor quality timothy hay and relatively large quantities of grain required on the average approximately one-third more sodium hydroxide to neutralize the acid formed than those from the group that were fed alfalfa hay, meadow crop silage, and less grain. The procedure was considered as possibly offering a measure of the resistance of milk to the activity of S. agalactiae and possibly of cows to mastitis caused by this infection. Evidence of mastitis was manifested by 7 quarters on 5 cows in the group fed the less desirable ration and by 2 quarters on 2 cows in the other group.

W. D. Pounden


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W. D. Pounden

106. Comparative tests of the protective value of Huddleson’s Mucoid and Strain 19 vaccines in cattle. II. B. H. EDGINGTON, N. B. KING, and Norma Frank, Ohio Agr. Expt. Sta.,

In order to determine the effect of sexual development upon resistance or susceptibility to brucellosis, 2 groups of 4 calves each were injected with gonad stimulating hormones and estrogen at about 1 mo. of age. After about 2 mo. treatment these and a group of untreated calves of the same age were inoculated with virulent Br. abortus organisms. All of the sexually stimulated calves developed high blood agglutinin titers which receded after 6 mo., but no reaction occurred in the controls. This indicated that sexual development reduced the resistance to Br. abortus. The calves then were bred, and after pregnancy was established they were exposed twice at weekly intervals to Br. abortus per the conjunctiva. High blood titers were produced this time in only 2 of the control heifers and 1 of the estrogen treated heifers. Abortions and positive detection of Br. abortus occurred in all groups, with the control group having the largest proportion of positive animals. The prepubertal infection in the sexually stimulated calves may have caused some reduction in the abortion rate. E. W. Swanson


Since Q fever (C. burnetii infection) had been found primarily in the udders of cattle, the mode of transmission was presumed to be via the teat. Experiments had shown that massive inoculations of C. burnetii into the mammary gland resulted in an established infection. Further experiments were conducted with 5 cows to determine whether bathing the teats in infected milk before and after the milking process could induce infection. In no case could C. burnetii be isolated from aseptically collected milk from these cows treated over an 8-mo. period. Two of the 5 cows then were exposed to a mixture of C. burnetii and S. agalactiae in the same manner. In each case the latter established an infection, with no evidence of the former. Since these cows remained refractive to infection with Q fever rickettsias but were easily infected with streptococci via the teat, it was concluded that this means of transmission is not the natural one among cattle.

E. W. Swanson


An investigation was made in a herd that was free of Streptococcus agalactiae but still had mastitis and micrococcus infection, to determine the most important sources of the latter infection. Samples were taken with sterile swabs from the following: skin of teats, hair of flank, vulva, floor of barn, teat cups before milking, teat cups after milking before and after rinsing in chloroform, hands of milkers, and chloroform solution used for rinsing teat cups. The pathogenic micrococci were detected by testing for hemolysis, mannitol fermentation, and coagulase activity. Very few of the micrococci met all of these tests. The most important sources of infection were milk from the udder, the skin of the teats, and the teat cups after milking. Rinsing in chloroform solution did not reduce the percentage recovery of pathogenic micrococci from teat cups, and several successful collections were made directly from the disinfecting solution. Samples of straw used for bedding were inoculated with coagulase; positive micrococci and viable organisms were recovered as long as 49 d. later, indicating the possibility of spread of infection by contaminated bedding.

E. W. Swanson


This investigation was designed to detect whether or not a poorly functioning corpus luteum could be responsible for resorption or abortion of the fetus. Corpora lutea were surgically removed from ovaries of cows after positive pregnancy determination at about 60 d. All of the 5 cows not given supplemental progesterone aborted. The quantity of intramuscular progesterone in oil required to support pregnancy was found to exceed 75 mg. daily. Seven of 8 cows given 100 mg. daily carried their calves to term. Progesterone injections were discontinued in cows at 102, 137, 162, 180, 188, 192, 203, 225, 233, and 237 d. with only the 102 and 137-d. pregnancies resulting in abortion. Apparently pregnancy can be maintained without supplemental progesterone after 6 mo. of pregnancy when the corpus luteum has been removed earlier, but removal of the corpus luteum in a normal 183-
day pregnancy, resulted in prompt abortion. Seven of the 8 cows carrying their calves to full term had retained placentas requiring manual removal, indicating a possible hormone basis for this condition. Two of the pregnant cows commenced lactation after progesterone injections were stopped. Lactation also commenced in 2 of the cows which aborted following progesterone withdrawal at 102 and 137-d.

E. W. Swanson

BUFFET

H. A. Hollender, Section Editor


A study of the formation of diacetyl in cultures and cream is presented. From this study it was deduced that ripened cream should be churned while there is still citric acid left in the cream to be decomposed during churning. Careful selection of a starter that will have a sufficient number of aroma-producing bacteria present to form an appreciable amount of diacetyl in a short time is also important. The author felt that citric acid was the source of the diacetyl and a compound X was formed chat reacts like diacetyl but is not volatile with steam and is not decomposed in the starter to diacetyl. It was concluded also that pyruvic acid was an intermediate in the formation of diacetyl.

W. W. Overcast


Cream is strained by allowing it to flow through an endless fine mesh filter screen, which runs continuously between a set of 4 rollers. The portion between the bottom 2 rollers is used for filtering, while the portion between the top 2 rollers is passed through a cleaning zone.

R. Whitaker


Two antioxidants, tetramethylthiuramdisulfide (T.M.T.D.) and tetraethylthiuramdisulfide (T.E.T.D.), were added to sour cream prior to making butter to study the influence on cold storage defects. Both showed favorable influence on cold storage defects. Both showed favorable influences upon the keeping quality at very low concentration. Further tests on the toxicity are in progress.

W. W. Overcast

CHEESE

A. C. Dahlberg, Section Editor


The use of silage as a feed for dairy cows is increasing in popularity in Sweden. Concurrent with this has been a greater percentage of defective textured "Emmental" cheese, primarily the Herrgård variety. This was attributed to an abnormal fermentation and was thought to be related to the feeding of silage to the cows. In the experiments conducted no abnormalities in the cheese made were encountered apart from those caused by the butyric acid bacterial spores that were present in the silage and gained access to the milk. Several types of silage were fed to the cows. The silage from 14 farms had average spore counts from 3,000-6,000,000/g. The average counts in manure ranged from 2,000-400,000,000/g., and the average butyric acid bacteria spore count in 10 ml. milk ranged from 1-500. The frequency of the butyric acid fermentation in the cheese was influenced by the number of spores in the milk. The addition of 20 g. sodium nitrate (saltpetre) per 100 l. milk was fairly effective in controlling an undesirable swelling and abnormal eye formation. It was recommended that for the manufacture of "Emmental" textured cheese, a requirement should be that the producers supply milk that is either free, or almost free, from butyric acid bacteria spores. This can be accomplished by either preparing silage with a low spore count or producing the milk under such sanitary conditions that no spores are added to the milk.

G. H. Wilster


Trace quantities of copper, lactic acid fermentations, and propionic acid fermentations were investigated as factors in lysis of the bovine tubercle bacillus in cheese. Copper, lactates, and cultures of lactic acid bacteria were found to have no noticeable effect. The presence of propionic acid bacteria arrested the development of tubercle bacilli. This action did not result from acid formation or the inhibiting effect of propionate ion.

S. Patton


Seven samples each, collected over a 2-yr. period (1950-1952), of Bleu d'Auvergne made from cow's milk and Roquefort made from sheep's milk were analyzed. Mean values for
moisture, dry matter, calcium, and phosphorus in g./100 g. of cheese were respectively as follows: Bleu—33.20, 60.80, 0.459, 0.284; Roquefort—40.00, 60.00, 0.704, 0.537. These results are discussed in relation to those previously obtained on other types of cheese.

S. Patton


Skimmilk at a temp. between 2 and 16° C. is acidified to a pH between 4.4 and 4.8 and then heated to 65-75° C. to facilitate separation of the whey from the curd.

R. Whitaker


A cheese hoop so designed to produce round flat cheeses with beveled edges.

R. Whitaker


A curd agitating machine operating on a rail mounted over the longitudinal axis of the cheese vat.

R. Whitaker


A spread for bread having a flavor and texture similar to butter and consisting of an edible fat, such as butterfat, into which there is emulsified an aqueous discontinuous phase made up of fresh soft curd, nonfat milk solids, water, and suitable stabilizer.

R. Whitaker


A cheese bandage of the previous non-woven type.

R. Whitaker


A hand operated slicer for cheese consisting of a cutting wire guided by a roller.

R. Whitaker

CONDENSED AND DRIED MILKS; BY-PRODUCTS

F. J. Doan, SECTION EDITOR


Some dairy plants are considering the preparation of a low heat 3-1 concentrated milk product for (a) freezing and shipping in the frozen state to other areas, (b) freezing and storing in the plant as a supplement to the milk supply in periods of shortage, and (c) shipping in place of milk to other areas. Experiments using forewarming temperatures of 135, 145, and 155° F., concentrating 3-1 at temperatures below 125° F., pasteurizing the concentrate at 143° F. for 30 min. and cooling in glass showed that there was no relationship between the forewarming temperature and the flavor or keeping quality after storage for 10 d. at 34 to 44° F. The milk possessed excellent flavor when fresh and acceptable flavor throughout the storage period. Bacterial counts (mesophilic and psychrophilic) were generally satisfactory for a 10-d. period, although psychrophilic counts increased markedly after 7 d.

Factors affecting flavor and casein stability of frozen concentrated milk and problems of marketing are discussed. Concentrated milk normally has a flat flavor, and an oxidized flavor often develops during prolonged frozen storage. Oxidized flavor can be retarded or controlled by heating the milk to at least 155° F. for 30 min. or 167° F. flash, or by addition of antioxidants. Gradual loss of stability by the casein during frozen storage is probably caused by dehydration and a "salting out" effect by the high concentration of soluble salts in the small amount of unfrozen water. Destabilization during frozen storage is favored by increasing concentration of milk solids, by increasing time interval between concentrating and freezing the milk, and by raising storage temperature below 125° F., pasteurizing the concentrate at 143° F. for 30 min. and cooling in glass showed that there was no relationship between the forewarming temperature and the flavor or keeping quality after storage for 10 d. at 34 to 44° F. The milk possessed excellent flavor when fresh and acceptable flavor throughout the storage period. Bacterial counts (mesophilic and psychrophilic) were generally satisfactory for a 10-d. period, although psychrophilic counts increased markedly after 7 d.

Post-pasteurization contamination was detrimental to keeping quality, and thorough sanitizing of all surface contacted following pasteurization is essential. A low temperature of storage also was an important factor in storage life of the concentrated milk. Pasteurization after concentration, rather than before, resulted in better keeping quality. Reconstituted concentrated milk exhibited poor keeping quality, probably due to psychrophilic bacteria in the water used. Preheating to 135° F. did not inactivate phosphatase enzyme but preheating to 145° F., or above, resulted in a negative test. Concentrated milk frozen and stored at about —10° F. held up well for more than 3 mo. Flakiness was encountered in most samples on melting and reconstituting, but never to an objectionable degree. Higher forewarming temperatures seemed to retard flakiness. Curd tension was not appreciably affected by concentrating and reconstituting.

C. J. Babcock


Factors affecting flavor and casein stability of frozen concentrated milk and problems of marketing are discussed. Concentrated milk normally has a flat flavor, and an oxidized flavor often develops during prolonged frozen storage. Oxidized flavor can be retarded or controlled by heating the milk to at least 155° F. for 30 min. or 167° F. flash, or by addition of antioxidants. Gradual loss of stability by the casein during frozen storage is probably caused by dehydration and a "salting out" effect by the high concentration of soluble salts in the small amount of unfrozen water. Destabilization during frozen storage is favored by increasing concentration of milk solids, by increasing time interval between concentrating and freezing the milk, and by raising storage temperature below 125° F., pasteurizing the concentrate at 143° F. for 30 min. and cooling in glass showed that there was no relationship between the forewarming temperature and the flavor or keeping quality after storage for 10 d. at 34 to 44° F. The milk possessed excellent flavor when fresh and acceptable flavor throughout the storage period. Bacterial counts (mesophilic and psychrophilic) were generally satisfactory for a 10-d. period, although psychrophilic counts increased markedly after 7 d. Post-pasteurization contamination was detrimental to keeping quality, and thorough sanitizing of all surface contacted following pasteurization is essential. A low temperature of storage also was an important factor in storage life of the concentrated milk. Pasteurization after concentration, rather than before, resulted in better keeping quality. Reconstituted concentrated milk exhibited poor keeping quality, probably due to psychrophilic bacteria in the water used. Preheating to 135° F. did not inactivate phosphatase enzyme but preheating to 145° F., or above, resulted in a negative test. Concentrated milk frozen and stored at about —10° F. held up well for more than 3 mo. Flakiness was encountered in most samples on melting and reconstituting, but never to an objectionable degree. Higher forewarming temperatures seemed to retard flakiness. Curd tension was not appreciably affected by concentrating and reconstituting.

C. J. Babcock
temperatures. Frozen concentrated milk should be stored at \(-10^\circ F\), or below, if to be held more than 3 wk. Reducing the soluble calcium content of the milk before freezing by ion-exchange treatment or by other methods is a possible way of increasing casein stability during frozen storage. Frozen concentrated milk probably cannot be sold at a lower equivalent price than bottled milk in domestic markets. The reduction in bulk compared with fluid milk and a storage life, when properly processed and held, of about 3 mo. make frozen concentrated milk well fitted to the role of utilizing surpluses in areas where milk is over produced for shipment to areas deficient in fresh milk.

E. R. Garrison

DAIRY BACTERIOLOGY

P. R. Elliker, Section Editor


A mixture of 10-70 parts of honey solids to 90-30 parts whole or skim milk, buttermilk, or whey solids. Dryness is obtained through crystallization of the lactose and dextrose hydrates, at a temp. of 50-110° F.

R. Whitaker


About 50% of the total amount of penicillin injected into the udders appeared in the milk and as little as 0.05 unit/ml was found to cause failure in the manufacturing of various dairy products. Cultures resistant to 1 unit/ml of penicillin were developed but the associate organisms disappeared with a penicillin concentration of 0.25 unit/ml. Hydroxylamine was found to be very active in the inactivation of penicillin but its toxicity prevents its use commercially. Penicillinase was found to be very effective and had no influence on the flavor of the milk or milk product. However, some preparations of penicillinase were found to be far too expensive for a commercial operation.

W. W. Overcast


High plate counts on commercially pasteurized milk were caused by microbacteria, thermoduric streptococci, and non-heat-resistant achromobacteria. The non-heat-resistant achromobacteria presumably were due to post-pasteurization contamination and multiplication at cold storage temperatures. High counts of microbacteria in the pasteurized milk were correlated with high counts in the raw milk evidently due to improper sterilization of the milk cans. The occurrence of high counts due to thermoduric streptococci was explained on the basis of multiplication during the processing within the plant.

W. W. Overcast


A study of the thermoduric bacteria in raw milk of the western part of the Netherlands revealed that the microbacteria were more prevalent in the summer months and thermoduric streptococci during the winter season. The data indicated that microbacteria and thermoduric micrococci originate from dirty utensils. The initial contamination and the temperature of the milk were important in the number of thermoduric streptococci. Other groups of thermoduric microorganisms sometimes encountered included the aerobic bacilli, achromobacteria, sarcinae, and actinomyces.

W. W. Overcast


Based on experiments using Serratia marcescens and "Roccal" (alkyl dimethyl benzyl ammonium chloride), it was shown that the resistance to higher concentrations of the quaternary can be obtained through successive transfers. Like bactericidal activity, the adaptation is dependent on pH. The authors are led to the hypothesis that any factor which changes the affinity of a bactericidal compound for bacteria will influence the bactericidal activity in the same direction.

R. Whitaker


The influence of ration, age, breed, stage of lactation, and milk production level upon the resistance of aseptically drawn milk to Streptococcus agalactiae was studied in a herd of 17 Holstein-Friesians and 5 Guernsey-Jerseys. These were divided into 2 groups receiving, respectively, alfalfa and timothy hay plus grain. During most of the periods no appreciable difference due to rations could be detected. But milk from the cows fed alfalfa hay occasionally was the more resistant. Heifers in their first lactation gave milk at first definitely more resistant to S. agalactiae than the milk of older cows, but this resistance was nearly equalized in the last half of their lactations. Nearly all cows lost resistance gradually as the lactation advanced; and in the terminal stages their milk was very low in resistance factors.
The 5 Guernsey-Jerseys had greater resistance in their milk than the Holsteins. Clinical symptoms of mastitis occurred in 12 of the cows. All of these, except one cow infected with hemolytic staphylococci, gave milk of low resistance to S. agalactiae during and after the attacks. Since most of these attacks of mastitis were associated with micrococci, coliform, and streptococci other than S. agalactiae, it is probable that the milk was low in resistance factors for these organisms also.

E. W. Swanson


The lactic acid bacteria were found to be sensitive to aureomycin and terramycin. Presence of 0.01 µg aureomycin per ml of milk was able to slightly inhibit growth of the lactic acid streptococci; 1.0 µg aureomycin or 2.0 µg terramycin per ml of milk inhibited growth of the bacteria completely. To attain the corresponding inhibitions the milk must contain respectively 0.01 µg and 10.0 µg streptomycin or 0.20 µg and 10.0 µg chloromycetin. The activity of the four antibiotics was not affected by pasteurization of the milk at 80° C.

After intramammary treatment with the four antibiotics the milk from the first milking contained such amounts of aureomycin that the addition of 2% of this milk to normal milk was enough to inhibit acid production completely. The same effect was obtained with addition of 5% of the milk from streptomycin-treated cows, 10% from penicillin- or terramycin-treated cows, and not less than 40% of the milk from chloromycetin-treated cows.

The amounts of the four antibiotics in the milk decreased at the following milkings. At this time there are no methods available for inactivation of the above four antibiotics in the milk, in contrast to inactivation of penicillin. The author suggested that the milk from cows treated with antibiotics should not be supplied to the dairy plants the first 2 days after the treatment with chloromycetin, 3 days after treatment with streptomycin and terramycin, and 4 days after the treatment with aureomycin.

G. H. Wilster  

DAIRY CHEMISTRY  

H. H. SOMMER, SECTION EDITOR


These three articles are from a symposium presented to the sub-committee on meat and animal products of the Canadian committee on food preservation. They discuss casein, nature of the phosphorous linkage, action of rennin, whey proteins, the denaturation of whey proteins, proteolytic enzymes in the dairy industry, action of rennin on milk, and cheese ripening.

H. Pyenson


Holding the milk samples at high temperatures following the addition of Folin-Cieau reagent and prior to placing the tubes in boiling water, as suggested in Standard Methods, may give high readings for the Gilcreas-Davis modification of the Kay-Graham phosphatase test. High temperature alone may not be an important source of error, providing the interval between taking the samples from the incubator and immersing them in boiling water is held less than 30 min. If the samples are held longer than 5 min. above normal, an increase in the phosphatase reading may result. This can be overcome by placing the tubes in a water bath at 70° F. after adding Folin-Cieau reagent. Placing the tubes in the refrigerator after removing from the incubator will give comparable results.

H. H. Weiser


It is suggested that a milk pipette having 10.77 ml capacity be used instead of an 11 ml pipette. By so doing the fat content by the Gerber method more nearly correlates with the Röse-Gottlieb method.

W. W. Overcast


The phosphorus of casein is bound to both serine and threonine.

R. Whitaker


A description is given of an apparatus to read Gerber tubes accurately without removing them from the water bath.

W. W. Overcast

DAIRY ENGINEERING  

C. W. HALL, SECTION EDITOR


A positive action sanitary milk pump having 2 overlapping vertical cylindrical chambers. A rotor in each is driven by a set of gears from a shaft below the pump housing.

R. Whitaker

A rack for holding milk cans, milking pails, strainers, lids, etc., for attaching to the wall of farm milk houses.

R. Whitaker


A device for freezing mix to a slush in a household refrigerator.

R. Whitaker


An arrangement whereby any plate of a plate heat exchanger can be removed singly from the frame.

R. Whitaker


A small weigh vat is described consisting of a tank, mounted on a scale, and a cam-operated valve in the drain.

R. Whitaker


Details are given for the design of the ends of the plates of a plate-type heat exchanger which insures proper alignment of plates.

R. Whitaker

DAIRY PLANT MANAGEMENT AND ECONOMICS

L. C. THOMSEN, SECTION EDITOR


Competition plays a part in establishing prices paid for market milk by dealers and prices received by producers, but milk prices are administered to a much greater extent than prices of other foods. In setting the prices charged dealers for market milk, the most common fault is to over-price the milk sold for fluid use. Insufficient consideration is given frequently to the need for keeping the supply of approved milk in close adjustment to the fluid sales. Ordinarily the supply should not exceed fluid sales in November by more than 15%. Data is presented showing (1) supply of approved milk in excess of fluid sales in selected northeastern markets November, 1945, 1950, and 1951, (2) daily receipts of approved milk in May and June in excess of the daily receipts in November selected markets in the northeast, 1951, and (3) supply and utilization of milk in the New York metropolitan area and in some upstate marketing areas, 1951. The price of fluid milk should be maintained at a level which will yield an adequate blended rate to producers. The prices paid different producers should reflect differences in the true value of their milk as determined by the butter-fat content, and by the producer's location in the milk shed or distance from his point of delivery. In pricing milk to consumers, it is common practice to charge the same price to all retail customers without regard to the differences in costs of services. The most important cause of differences in costs of serving families with milk is the quantity delivered. Volume discount plans are being used successfully in a number of cities.

C. J. Babcock


Data is presented showing (1) farmers' prices for dairy products and all farm products, (2) hypothetical demand and supply functions for total milk production, (3) hypothetical demand and supply functions for milk for specified uses, (4) effect of a decrease in demand for butter, and (5) effect of an increase in demand for fluid milk. The market for milk solids-not-fat, population, growth, improved efficiency of large dairy plants, expansion of milk distributing areas, and raising milk quality are discussed. It is pointed out that the sag in dairy prices relative to other farm prices may have passed its low point. A stationary level of milk production against a rising population has offset much of the lost demand for milk fat, and has brought total demand for nonfat solids into closer balance with the supply. Although the value of milk fat may suffer from still further encroachment of vegetable oils into dairy products markets, dairy prices and milk production will probably remain fairly steady until the growing population and increased use of solids-not-fat raise the value of that component of milk to offset the loss in value of fat. Expanding milk distribution areas and a rising level of quality of manufacturing milk gives promise of increased dairy efficiencies comparable with those attained in competing industries.

C. J. Babcock


Some of the employees who are not needed on a full time basis during the winter months can be used for sales promotion work. Delivery personnel, for example, might be used part time for delivery and spend the remainder of their time for sampling and demonstration work in stores. Other employees who could be trained for this type of work could be used in a similar manner, under the direction of the sales manager.
It is suggested that part of the time might be devoted to sampling the feature flavor of the month and specialty items in the various retail outlets. Demonstrations could include the making of milk shakes, sundaes, and other items which can be made in the home. The plan as suggested will enable the ice cream manufacturer to profitably retain useful employees on the payroll during the slack season. Furthermore increased emphasis on merchandising will tend to build morale and enthusiasm of the dealers which will mean bigger and more profitable stops in the year ahead.

W. J. Caulfield


College educators and dairy plant managers are concerned about the low enrollment and scarcity of men in the field of dairy technology. Plant managers contend that it is difficult to keep a college graduate on the job, that he is impatient and unwilling to put in the time required to learn the business. Technically trained men are seldom picked as managers. Plant executives feel that many college men lack personality and training in business management. The blame for this situation may be due to improper training by colleges or to the fact that after employment by industry, the graduates often are forgotten, become discouraged, and transfer to other fields.

A revaluation of course work in the field of dairy technology and certain adjustments are suggested. Some of the suggestions made are to spend less time on the art and practice of dairy manufacturing and more time on theoretical and applied training in engineering including building construction, mechanics, electricity, refrigeration, and plant sanitation. More attention should be spent on personality development and more training given in business management, industrial organization, commercial and food laws, and salesmanship. Students should be screened so that those who desire to take graduate work could be permitted to take more basic training in chemistry, bacteriology, mathematics, foreign language and less of business management and engineering courses. Students going into industry should be required to spend their summers or possibly two half years working in industry to obtain practical experience and know-how before they graduate. It is recommended that colleges and industry should work together in preparing students for the field of dairy technology. Industry should establish educational and training plans for college graduates entering employment.

If more students are to be attracted to the field of dairy technology, they must be shown that a worthwhile goal lies ahead. The college graduate must realize that he needs to start at the bottom and prepare himself for that better job by years of patient training and experience. Finally these trained men must be paid an adequate wage while learning and during their march toward the top so that they will be kept happy.

W. H. Martin


The dairy industry is confronted with increased competition from products in which butter fat is being substituted with other fats. This holds true not only in the case of butter but for many other products. Restrictive legislation can no longer be relied upon by the dairy industry to prevent the appearance of filled milk products. This is especially true in the light of the conclusion of the Feed and Nutrition Board that fortified oleomargarine in a mixed diet is nutritionally equivalent to butter.

The current trend is bound to devalue milk fat. The sales of skim milk solids, however, is being rapidly expanded. As long as the price of butter fat remains high and the price of skim milk low, the introduction of filled milk products will be encouraged. If the price of skim milk were increased to its true value and the price of butter fat reduced, the price advantage which filled milk products enjoy at present over the genuine products would tend to disappear.

It is predicted that adjustments in the dairy industry will tend to bring about a balance between the products which create skim milk and those which use skim milk. The future emphasis will be upon the complete utilization of milk for human food; this is one sure way of insuring a price for milk which will sustain a prosperous dairy industry.

Opposing the trend toward a reduction in the price of butter fat and an increase in the price of solids-not-fat are: (1) tradition, (2) price supports for butter, (3) lack of a simple test for measuring the solids-not-fat content of milk and (4) the form in which many of our agricultural statistics are assembled which show fat utilization only.

The author emphasizes that there is little or no hope of stopping the introduction of filled milk products. If this is the case, then it becomes especially important to safeguard the integrity of the genuine products. Substitute products must not be permitted to be sold as the genuine article.

W. J. Caulfield

HERD MANAGEMENT

H. A. Herman, Section Editor


R. Whitaker


151. Le tendance des laits à cailler. Recherches des causes et des remèdes. (The tendency of milks to curdle. Studies of the causes and remedies.) J. Keillivng and J. Casalis. Le Lait, 32, 318: 486-489. Sept.-Oct., 1952. Various causes of unsatisfactory coagulation in milk are discussed briefly, including the presence of penicillin, bacteriophage (never encountered as a problem by the authors), and over heating milk for mother cultures. Milk which is retained in the udder spontaneously, as remedies. J. Keillivng and J. Casalis. Le Lait, 32, 318: 486-489. Sept.-Oct., 1952. Various causes of unsatisfactory coagulation in milk are discussed briefly, including the presence of penicillin, bacteriophage (never encountered as a problem by the authors), and over heating milk for mother cultures. Milk which is retained in the udder spontaneously, as a result of incomplete milking or through oversight, is frequently resistant to rennet coagulation. S. Patton

152. Homogeniseret mælk i Europa. (Homogenized milk in Europe.) Robert Hansen. Nord. Mejeri-Tidsskr., 18, No. 5. May, 1952. Homogenized milk was sold for the first time in Oslo, Norway, in April, 1952. The daily output of one milk plant was several times greater than was anticipated. In a H.T.S.T. pasteurizer the milk was heated to 50-55° C. and homogenized at 180 atmospheres. It was planned to pasteurize at 65° C. and homogenize at 150 atmospheres to reduce the susceptibility of the milk to development of the tallowy flavor caused by exposing milk to sunlight. Homogenized milk has been sold for several years in Sweden. The large Stockholm milk plant, "MJolk-centrale," sells homogenized vitamin D-fortified milk, which is 10% of its total sales of milk. In 1949 homogenized milk was first sold in Nürnberg, Germany. To each liter of milk was added 1,000 units of vitamin D₃. The milk was pasteurized by the short-time method at 85° C. and homogenized at 170-200 atmospheres. In the large, new fluid milk plant in Sossenheim near Frankfurt am Main in Germany milk is vitaminized, pasteurized, and homogenized at a rate of 10,000 l./hour. G. H. Wilster

153. Dairy trends in the midwest. D. Anderson, Dairy Branch, PMA, Washington, D. C. Am. Dairy Prod. Rev., 14, 11: 46-47. Nov., 1952. Since the war dairy production has decreased and prices also have decreased as compared to other farm products. Better markets for dairy products, including fat and solids-not-fat and higher prices on lower production costs will encourage more production. More effective promotion and sales programs are needed. T. J. Claydon

154. Milk in bottles ready for baby. Staff, Food Eng., 29, 11: 141. Nov., 1952. Sunrise Dairies, Hillside, N. J., uses a square half-pint bottle with a special threaded top for homogenized vitamin D milk for babies. These bottles are filled on the regular bottling line. In the home, the bottle can be fitted with a standard screw type nipple, and no further sterilization of the milk is required. The milk is not intended to replace formulae for babies. T. J. Claydon

155. Progress in canned fresh milk. Staff, Food Eng., 29, 11: 90-92. Nov., 1952. The production of aseptically canned whole fresh milk continues to expand. Latest and largest processor is the International Milk Processors, Inc. at Ridgegal, Wisconsin. Most of its 2,400 gal./hr. output is placed in 6-oz. cans and sold in vending machines. Modification of the Graves-Stambaugh milk collection method with pipeline milkers and smaller stainless-steel tanks has adapted this system to Wisconsin conditions. Changes and improvements in plant equipment have speeded processing and facilitated automatic control. T. J. Claydon


NUTRITIVE VALUE OF DAIRY PRODUCTS

Robert Jenness, Section Editor

157. Failure of cobalt added to the rations of dairy cows to increase the vitamin B₁₂ potency of the milk. A. M. Hartman and L. P. Dryden, Bur. of Dairy Ind., U.S.D.A., Washington, D. C. Arch. Biochem. Biophys., 40, 2: 310-313. Oct., 1952. A mineral salt mixture supplying cobalt at a level of 1 p.p.m. of the grain mixture was fed continuously for 2-10 mo. to 4 groups of pure-bred Holstein and Jersey cows, 2 groups on pasture, and 2 on barn rations. Vitamin B₁₂ activity of the milk was determined by a 4-wk.
rat growth assay (Hartman and Dryden, unpublished). The milk of cows fed supplementary cobalt did not differ significantly in vitamin B₃ potencies from that of cows denied additional cobalt. The values found in this study are in harmony with results reported by others employing microbiological assay methods.

H. J. Peppler


Comparative analyses of cow and human colostrum and milks are comprehensively reviewed, including gross composition, properties, amino acids, vitamins, and minerals. It is reported that most modified cow's milk formulae now in use are objectionable because they form hard compact coagula in the infant's stomach; secondly, they contain cow's milk fat, which is composed of an entirely different balance of fatty acids than is human milk fat. Consequently these formulae are not well utilized by infants. Comparative advantages and disadvantages of a number of modified milks with methods of formulation are presented.

S. Patton

ICE CREAM

C. D. Dahle, Section Editor


Tests on a commercial basis have demonstrated that the use of a specially-developed highly-selective clarifier can be used successfully for the clarification of ice cream mix. In this machine the centrifugal force factor is so adjusted that no significant loss of mix ingredients will occur. In one continuous run 25,000 lb. of mix was processed before the bowl was cleaned. The bowl residue weighed less than 6 lb. and tested less than 1.5% fat. In a similar trial, 27,000 lb. of mix was clarified and the bowl residue weighed 4 lb. 6 oz. and was found to test 62% total solids and 0.95% fat.

The tests have demonstrated further that clarification will eliminate the sediment problem. Mixes which had a sediment score of 25-75 points before processing were scored 0 (perfect) after clarification.

The new clarifier is available in two sizes, 500 and 600 gal./hr. The clarifier can be installed either between the pasteurizer and homogenizer or between the homogenizer and cooler. If installed ahead of the homogenizer an extra pump and surge tank will be necessary. Location in this position will, however, give protection to the homogenizer valves. It is reported that the machine can be cleaned, sterilized, and assembled in 10 min.

W. J. Caulfield


Kronborg Fløde-Is was the first ice cream factory in Denmark to adopt continuous pasteurization of ice cream mix a short time ago. Several advantages for this method are given: (a) the process is continuous, (b) pasteurization is the last step in making mix, (c) cooling is done in an enclosed plate cooler, and (d) there is less tendency for the mix to have a cooked flavor. The mix is heated to 65°C, homogenized, pasteurized at 82-85°C, and cooled to 6°C. Chilled water is used as the cooling medium.

G. H. Wilster


Types of vegetable oils include those from coconut, palm kernel, tucum nut, and babassu nut. These oils, hydrogenated and unhydrogenated, have melting points of 76 to about 90°F. They may be mixed with small amounts of hydrogenated cottonseed or soy bean oil to raise the melting point to 110°F. Oils in this group have sharp melting points. They are very hard at temperatures below 50°F. and melt at temperatures above 76°F. They are easily hydroized in the presence of moisture to form esters which have soapy flavors. This type of oil is usually used in food products of low moisture content and for fillings and coatings for biscuits and candies. These fats do not oxidize easily and resist the development of rancidity. In the presence of moisture and sugar there is danger of off flavors developing due to the action of fat splitting microorganisms. Oils in this group have a characteristic nutty flavor which will carry through in most food products.

Cottonseed oil, soybean oil, peanut oil, and corn oil have melting points of 30-140°F., depending on how much they have been hydrogenated. Unhydrogenated oils melt at 30-45°F. and most of the hydrogenated oils at 90-115°F. The unhydrogenated oils in this group, such as cooking and salad oils, are not suitable for use in margarine and frozen desserts because they melt too fast and have flavors not desirable in these products. When these oils are hydrogenated, the melting points can be controlled, so that they will have a desirable meltdown and a bland or neutral flavor. They are made up of long chain fatty acids and are not easily hydrolyzed in the presence of moisture and do not develop soapy flavors. The unhydrogenated oils in this group oxidize easily and develop rancid flavors at warm temperatures.

When cottonseed, peanut, and soybean oils are hydrogenated they lose their identity. For this reason they are labeled "made from hydrogenated vegetable oils." The unhydrogenated oil products, such as salad and cooking oils, must state on the label the kind of oil used. Coconut
oil may be blended with hydrogenated cotton seed, soybean, and peanut oils. This blend carries the same disadvantage as straight coconut oil, only in slightly less degree.

W. H. Martin


The introduction of ice milk in either the soft or hardened state represents an attempt on the part of the industry to attract the price conscious consumer. For the same reason vegetable fat frozen desserts have been introduced in certain areas. Ice milks designed for serving direct from the freezer should be drawn at an overrun of 30-50% and at a temperature of approximately 19° F. to insure a stiff, dry appearing product with adequate melting resistance. The use of corn syrup solids to supply ¼ to % of the sugar solids in the ice milk mix is a common practice. If an excessive amount of corn syrup solids is used, however, the product may be sticky or gummy and have a corn syrup flavor. It is suggested that double the amount of emulsifier used in ice cream should be used in ice milk mixes.

A breakdown in body due to destabilization of both the fat and protein is one of the most serious production problems encountered with soft ice milk. The use of properly homogenized mixes, avoiding the use of ingredients in the ice milk mix which have been heat treated sufficiently to destabilize the protein, and the use of a well insulated freezer, which will require less agitation to maintain the proper temerature, should prove helpful in preventing this defect.

In the production of hardened ice milk a total solids content of about 38% is essential to attain proper body and texture. The total solids may be increased by using corn syrup solids and/or dry milk solids with a reduced lactose content. Ice milk with approximately 38% total solids when frozen with an overrun of 65-80% will exhibit good storage and heat shock properties. Fast freezing to a stiff dry consistency and rapid hardening are essential to the production of a high quality product to be sold in the hardened state.

The ice cream industry should be alert to possible competition with frozen desserts compounded from vegetable fat, which can be manufactured at a cost considerably below that of ice cream.

W. J. Caulfield


It was concluded from observations made by the author that hardened ice milks containing 5% fat, 14% serum solids, 12% sucrose, 4.5% corn syrup solids, and 0.3 to 0.5% stabilizer are lacking in richness and cannot be expected to be comparable with high quality ice cream. It was determined that the quality of hardened ice milk could be improved by: (a) increasing the total solids content of the mix to approximately 38%, (b) substituting nonfat dry milk solids with high quality sweet cream buttermilk powder, (c) using C.M.C. or locust bean gum as stabilizer in place of gelatin or sodium alginate, and (d) increasing the milk solids, both butter fat and milk solids-not-fat. None of the ice milks studied developed sandiness even after the heat shock treatment.

The author emphasizes that no ingredient should be used in compounding an ice milk mix which will not meet the approval of the consumer. If an ingredient is used to substitute a portion of the fat or milk solids-not-fat, the consumer should be informed of it and any price advantage should be passed on to him.

W. J. Caulfield


A rapid, yet sensitive, method for the detection of foreign fats in frozen desserts is described. The test is based upon the fluorescence of various fats and oils when examined with a lamp having a wave length of 2540 Angstrom units. It was determined that pure samples of a given fat will fluoresce a specific color. Buttersfat fluoresced bright yellow; cocoa fat, intense blue; cotton oil, tan; corn oil, blue green; lard, violet, and peanut oil, blush white.

In applying the test to frozen desserts, the fat is extracted by means of the Minnesota fat test for ice cream. The fat collected in the neck of a 20% ice cream test bottle is examined in a semi-darkened room with the lamp, and the color noted. Controlled experiments indicate that substitution of as little as 5% butter fat with a foreign fat can be detected by this method.

Two possible limitations of the test are: (a) casein and some other milk constituents fluoresce a blush white color, and (b) butter fat which has been exposed to sunlight for a prolonged period fluoresces a light bluish color. The use of certified dyes or colors did not interfere with the test. The test shows considerable promise for use as a preliminary screening in detecting possible adulteration of ice cream with foreign fats.

W. J. Caulfield


The use of 8% dried corn syrup solids in combination with 22% sucrose, 5.7% total milk solids and 0.4% stabilizer resulted in a sherbet which was superior in flavor, body, and texture to comparable sherbets containing only sucrose or a combination of sucrose and dextrose. The use of corn syrup solids effectively prevented
surface crusting and caused no difficulties in freezing, overrun control, or hardening.

W. J. Caulfield


Eight individually wrapped slices of ice cream and 8 "plastic-paks" of chocolate sauce are wrapped together in one polar-sealed insulated package. The package contains 28 oz. of ice cream and 8 packets of sauce weighing 0.5 oz. each and sells at retail for 75 cents at drug stores and 69 cents at food stores. The wholesale price is $2.20 per gal. compared to $2.00 for Hood's pint packages. The corrugated paper serves as an insulator as well as a container.

W. H. Martin


The replacement of the individual air compressor supplied with each of four cream freezers with one central compressed air supply has saved more than 100 production hours per year for the Erie County Milk Association, Erie, Penna. Steady operation of the small air compressors led to serious maintenance problems, which necessitated frequent shut downs and loss of production time.

Filtered compressed air is supplied to the freezers by means of one nonlubricated air compressor operated with a 3 HP electric motor. The compressor and motor are mounted on an air tank in which a pressure of 60 p.s.i. is automatically maintained.

Advantages claimed for the central compressed air system are: (a) it has reduced maintenance costs, (b) it has provided insurance against product contamination, (c) it has improved product quality, and (d) it has eliminated costly production shut downs.

W. J. Caulfield


Low-fat mixes may be classified into three principal groups: (1) mix to be frozen and sold in the hardened form in packages and for use in the manufacture of chocolate coated bars and stick confections, (2) mix for milk shake base, which is frozen and used in the preparation of milk shakes and malts, and (3) mix to be frozen and served direct from the freezer. The fat content of these products will range from 2-6%. The reduced fat content is compensated for in part by an increase in the solids-not-fat, sweetener, and stabilizer content over that normally used in ice cream.

The same ingredients and processing procedures are used in compounding ice milk mixes which are employed in making ice cream mixes. In freezing, the overrun and drawing temperature needs to be adjusted for the use that is to be made of the product. A product which is to be packaged and sold in the hardened state should contain less than 70% overrun, whereas if it is going into bulk, bars, or stick confections an overrun of 90-95% will prove satisfactory. When the product is to be served direct from the freezer, the overrun should be limited to 30-35%, and the drawing temperature should be approximately 18-19°F.

Suggested composition standards are presented at varying fat levels for each class of ice milk discussed.

W. J. Caulfield


Frozen puree prepared from fully matured tangerines is the basis for a new sherbet flavor which has met with marked success in a number of markets. One company reportedly has produced an excellent flavored sherbet by combining 50 lb. of tangerine puree with 95 gal. of sherbet base.

W. J. Caulfield


The sale of certain products at a price which does not produce a satisfactory profit may be justified for the purpose of liquidating inventories, interesting the public in a new item, or in selling an off-season special.

For the regular delivery line every new flavor or product should be carefully scrutinized cost wise to determine whether or not the item in question can be sold at a profit. It is much sounder policy not to introduce an unprofitable item than to discontinue its production once it has been offered to the trade. Many plants, however, could increase their profits by discontinuing the production of unprofitable items in their present line. Such procedure is considered just as sound as a cut in volume.

W. J. Caulfield


The heating of ice cream mixes to 177.5°F. for 30 sec. gave results similar to those obtained by heating to 160°F. for 30 min. in trials using natural flora as well as a test organism.

W. H. Martin


Through the ingenious use of 3 automatic units, H. P. Hood & Sons, Boston, has achieved a production of chocolate-coated ice cream bars faster than 165 per min. An English Stone-street unit receives ice cream directly from continuous freezers, forms it into bars, quick freezes and discharges them into a specially designed chocolate enrobing unit. After pas-
sage through a refrigerated tunnel, bars are conveyed to a Rose wrapping machine. Equipment has been designed for easy cleaning.

T. J. Claydon


The water ice pop mix consists of sugar, flavor, color, stabilizer, fruit, and water. The mix is frozen in suitable molds without agitation. The sugar content ranges from 16-19%, and the source is cane or corn sugar, corn syrup, and corn syrup solids. Low sugar results in a brittle icy pop; high sugar results in excessive sweetness, bleeding, and crystallization if stored for any length of time. A small amount of corn sugar, 10-20% of the total sugar, improves the pop. The use of over 25% corn sugar results in brittleness, crystallization, and white spots in the frozen confection. Liquid sugar may be used.

Orange flavor is most popular, accounting for over 50% of the total consumption; cherry, grape, strawberry, raspberry, and lemon-lime are also popular. Citrus flavors are usually made from citrus essential oils and are considered pure. Other flavors are made from true fruit extracts reinforced with imitation flavors and must be labeled accordingly.

Flavor emulsions dispersed in water are highly concentrated; 6-12 oz. will flavor 32 gal. of mix. Flavor syrup may be used; 1/2 to 1 gal. will flavor 30 gal. of mix.

With the exception of root beer, banana, and chocolate flavored pops, citric or tartaric acid in the form of a 50% solution is added to give a tart taste. Some states require a minimum of 0.35% acid.

Some stabilizers are not compatible with acid, which reduces their effectiveness. Karaya gum, locust bean gum, and pectin were originally used; however, arabic gum, cellulose gum (CMC), propylene glycol ester of alginic acid, and carrageenan have been used with satisfactory results. The stabilizer should be tasteless and odorless and should have the property of binding water and aiding in the dispersion of solids, flavor, and color in water.

Brine for freezing should be maintained at -20 to -30° F., and the molds should be filled 1/2 to 3/4 in. from the top to allow for expansion during freezing. Slow removal of stick holders from molds and inefficient stabilizer may cause pops to stick to bags. The use of a chill funnel before bagging will aid in the elimination of this defect.

W. H. Martin


Percentage of sales is a good yardstick for the establishment of an advertising budget. Somewhere between 2 and 5% of sales provides a sound budget. A team of advertising media should be used rather than one single medium. It may include newspaper, radio, television, point-of-sale material, direct mail, billboards, hand bills, etc. The customer must be invited to the store, induced to enter the store, and invited to make a purchase. Full page newspaper ads have produced best results for High's. Some full-page ads are run in color and something definite is advertised. In Washington the cost ranges from $750 to $1100 per page, with art work extra.

W. H. Martin


Ice cream plant sanitation starts with the ingredients; water, sugar, milk products, eggs, flavor, and color should all be checked. Liquid sugar storage tanks should be kept full or washed frequently. Air borne yeasts, molds, and bacteria may gain entrance into the tank unless all vents are equipped with suitable air filters. Sterilizing lamps have been found effective in reducing or minimizing this source of contamination.

Pasteurization temperature must be adequate; 155-160° F. for 30 min., 170° F. for 20 min. or 175° F. for 25 sec. are now being used. Elimination or shortening the thawing-out period for frozen products may be accomplished by the use of machines which crush, shave, or melt them quickly. Care should be used in opening containers to protect the contents from contamination.

If refrigerated flavor tanks are not provided, the containers should be of the smallest size to eliminate long holding of the flavored mix before freezing. All containers for ice cream should be protected from contamination and all filling done by machine. Ice cream sandwiches, stick confections, and novelties must be handled in such a manner as to eliminate contamination.

Improved machinery for handling ice cream, laboratory control to check the total and coliform count of the products, elimination of rags and sponges, elimination of dripping and spillage and operating on dry floors are a few of the requirements being adopted by many plants to insure the sanitary quality of the product.

W. H. Martin


In 37 of the 48 states “ice milk” in some form is being sold. It is estimated that there are over 10,000 stores in the U. S. selling a soft product under more than 100 names. This survey indicated that there was no uniformity of state laws on ice milk. Pros and cons of the
use of vegetable fats in frozen desserts are presented.

W. H. Martin


Production of novelties was increased from 53 to 83 doz. per man-hr. by making a study of each operation and making changes which sped up production. For 1,000 doz. per hour operation a —38°F. brine gave best results. When the dipping temperature dropped below 102°F., the number of bars coated per pound dropped approximately one for each degree drop in temperature. A low temperature for bars going into the dip tank is important in order to keep down the amount of moisture added to the coating.

W. H. Martin


Ice cream costs increased 13.58 cents per gal. in 1951 over 1950 costs. Products cost increased 0.0817 cents, manufacturing costs 0.369 cents, selling advertising cost 0.0060 cents, delivery service cost 0.0101 cents, and administrative cost 0.0021 cents. These figures are based on the study of 136 companies made by the International Association of Ice Cream Manufacturers.

W. H. Martin


Goldenrod uses a hardening tunnel 90 ft. long and 16 ft. wide. Inside are 4 conveyors of cyclone belt, each 70 ft. long and 6 ft. wide, placed in pairs one over the other. After the packages are hardened, they are dropped on a wide belt which takes them to the packing table. For refrigeration, 21,000 ft. of 2" ammonia coils are used. Ten inches of vacuum gives a —42°F. ammonia and an air temperature of —28°F. At the end of the coils are four 42-in. fans which turn 22,000 cu. ft. of air per fan per minute. The speed of the belts varies with the packages, pt-brick belts are set for a 70 min. ride, and cup and sandwiches pass through the tunnel in 45 min.

W. H. Martin


A horizontal freezer for producing soft ice cream and other foods for immediate consumption. The draw-off valve is connected to the mix inlet valve by a handle, movement of which allows a proportionate amount of mix into the rear of the machine when the frozen ice cream is drawn from the front.

R. Whitaker


A dry mix to be reconstituted with water for making a whipped topping. The dry mix consists of 1-15% edible neutral water soluble protein, 5-40% carbohydrate, 35-85% refined fat, 0.3-20% glycerated fat type stabilizer, and 0.1-15% moisture.

R. Whitaker

PHYSIOLOGY AND ENDOCRINOLOGY

R. F. REECE, SECTION EDITOR


A procedure for the quantitative determination of L-a-glycerylphosphorylcholine (GPC) in tissues of rat, lamb, and bovine was developed to determine the importance of GPC as an intermediary in the phospholipide metabolism of mammalians. In addition to the pancreas, considerable amounts of GPC were found in spleen, liver, and kidney of the lamb and bovine. The general biological importance of GPC as an intermediary of the metabolism of lecithin in mammalians is discussed. H. J. Peppier


Lactating Jersey cows were injected intravenously with CO2 labeled precursors (bicarbonate, acetate, propionate, and butyrate), milked after 10 hr., and the casein isolated and hydrolyzed. The amino acids of the casein hydrolysate were separated on a cation exchange column of Dowex 50.

Acetate and butyrate were the major precursors for transferring carbon to non-essential amino acids. CO2 was the major precursor of amino acids that are considered essential. It was concluded that microorganisms of the rumen furnish essential amino acids to the cow, but the tissues synthesize only non-essential amino acids in quantity.

H. J. Peppier