JOURNAL OF DAIRY RESEARCH

EDITED BY

J. E. FORD, PH.D. National Institute for Research in Dairying, Shinfield, Reading, Berkshire

J. A. B. SMITH, C.B.E. PH.D., D.Sc. Hannah Dairy Research Institute, Ayr, Scotland

ASSISTED BY

PROF. L. F. L. CLEGG, (Canada)
SIR DAVID CUTHBERTSON, O.B.E., F.R.S.E., (Glasgow)
DR F. H. DODD, (Reading)
DR H. DONALD, F.R.S.E., (Edinburgh)
PROF. P. J. FOURIE, (South Africa)
DR T. GIBSON, (Edinburgh)
DR J. O. IRWIN, (London)
MR G. LOFTUS HILLS, (Australia)
DR L. A. MABBITT, (Reading)
DR W. A. MCGILLIVRAY, (New Zealand)
DR A. ROBERTSON, o.B.E., F.R.S., (Edinburgh)
DR K. C. SEN, (India)
DR C. C. THIEL, (Reading)
DR R. WAITE, (Ayr)
DR J. C. D. WHITE, (Ayr)

VOLUME 35, 1968

CAMBRIDGE UNIVERSITY PRESS

PUBLISHED BY THE SYNDICS OF THE CAMBRIDGE UNIVERSITY PRESS

Bentley House, 200 Euston Road, London, N.W. 1 American Branch: 32 East 57th Street, New York, N.Y. 10022

> Secretary J. C. F. COLES

Editorial Assistant MRS DOROTHY SKIDMORE

Printed in Great Britain at the University Printing House, Cambridge

Contents

No. 1 (February 1968)

PAGE

ORIGINAL ARTICLES	
An electron microscope study of the ultrastructure of bovine and human casein micelles in fresh and acidified milk. G. G. CALAPAJ	1
Anti-O chaining titre in colostral serum from cows infused prepartum with Salmonella pullorum-H. R. M. PORTER	7
The role of lysine residues in the coagulation of casein. R. D. HILL and BARBARA A. CRAKER	13
A modification of the acid degree value test for lipolytic rancidity in milk. A. C. HUNTER, JUDITH M. WILSON and GRACE W. BARCLAY	19
Seasonal variation in the viscosity index and adhesive strength of casein from the milk of individual cows. C. R. SOUTHWARD and R. M. DOLBY	25
Factors affecting the viscosity of caseinates in dispersions of high concentra- tions. J. F. HAYES, PAMELA M. SOUTHBY and L. L. MULLER	31
Oxidation of some milk lipid materials in model systems in presence of copper and ascorbic acid. A. M. EL-NEGOUMY and P. S. KU	49
The cell count of cow's milk and the micro-organisms cultured from the milk. P. S. BLACKBURN	59
Iron and vanadium requirements of lactic acid streptococci. B. REITER and J. D. ORAM	67
The effects of variations in pH, of the removal of calcium and of the addition of sulphur-bond inhibitors on the rate of setting of renneted milk. W. TUSZYŃSKI, J. BURNETT and G. W. SCOTT BLAIR	71
The folic acid activity of some milk foods for babies. J. E. FORD and K. J. SCOTT	85
A new approach to the measurement of the quantitative effects of inherent and environmental factors on the composition of the milk of individual cows and of herds, with particular reference to lactose content. J. P. WALSH, J. A. F. ROOK and F. H. DODD	91
The measurement of the effects of inherent and environmental factors on the lactose content of the milk of individual cows and of the herd bulk milk in a number of commercial herds. J. P. WALSH, J. A. F. ROOK and F. H. DODD	107
Rate of infection of milked and unmilked udders. F. K. NEAVE, J. OLIVER, F. H. DODD and T. M. HIGGS.	127
Studies on the change in the properties of the fat globule membrane during the concentrating of milk. G. C. CHEESEMAN and L. A. MABBITT	135

Contents

- -

. .

PAGE

303

.

REVIEWS OF THE PROGRESS OF DAIRY SCIENCE. Section D. Nutritive value of milk and milk products. Fat soluble vitamins in milk and milk products.	
S. Y. THOMPSON	149
No. 2 (June 1968)	
ORIGINAL ARTICLES	
Errors in fat testing of composite milk samples. A. K. R. McDowell	171
Fat testing of composite milk samples with the Milko-tester. A. K. R. McDowell	181
Biuret and urea in concentrates for milking cows. R. WAITE, M. E. CASTLE, J. N. WATSON and A. D. DRYSDALE	191
The composition of rumen fluid from cows fed biuret and urea. R. WAITE and AGNES G. WILSON	203
The detection of abnormal milk by electrical means. G. R. GREATRIX, J. C. QUAYLE and R. A. COOMBE	213
The effects of dietary tallow and cottonseed oil on milk fat secretion in the cow. W. STEELE and J. H. MOORE .	223
Neutral volatiles in Cheddar cheese made aseptically with and without starter culture. W. A. McGugan, Shirlie G. Howsam, J. A. Elliott, D. B. EMMONS, B. REITER and M. ELISABETH SHARPE	237
Studies on the laboratory soiling of milking equipment. BRANCA BAČIČ, CHRISTINA M. COUSINS and L. F. L. CLEGG	247
A pilot plant for the removal of cationic fission products from milk. I. Design and construction. R. F. GLASSCOCK, H. S. HALL, S. F. SUFFOLK and D. T. W. BRYANT	257
A pilot plant for the removal of cationic fission products from milk. II. Efficiency of the process and composition of the product. R. F. GLASSCOCK and D. T. W. BRYANT	269
The effect of intrammamary infection during the dry period on the milk pro- duction of the affected quarter at the start of the succeeding lactation. A. SMITH, F. H. DODD and F. K. NEAVE	287
The use of single or composite milk samples for the determination of fat. M. G. O'KEEFE	291
Electronic counting of cells in milk: examination of a chemical treatment for dispersal of milk fat. L. W. PHIPPS	295
Factor affecting vacuum within the teatcup liner during milking. C. C. THIEL,	

REVIEWS OF THE PROGRESS OF DAIRY SCIENCE. Section G. Deposits from whole milk in heat-treatment plant—a review and discussion. H. BURTON . 317

P. A. CLOUGH, D. R. WESTGARTH and D. N. AKAM . . .

iv

Contents

No. 3 (October 1968)

PAGE

Original Articles	
The prediction of dairy performance of cows from the lactation induced by treatment with oestrogen. M. NAITO, Y. KANO, E. OKUBO, H. NEMOTO, T. MIYA, K. KASHIWAGI, M. SAKURAI, T. KATSUKI and K. MORITA	331
Further studies on the effects of dietary cottonseed oil on milk-fat secretion in the cow. W. STEELE and J. H. MOORE	343
The effects of mono-unsaturated and saturated fatty acids in the diet on milk- fat secretion in the cow. W. STEELE and J. H. MOORE	353
The effects of a series of saturated fatty acids in the diet on milk-fat secretion in the cow. W. STEELE and J. H. MOORE	361
The digestibility coefficients of myristic, palmitic and stearic acids in the diet of sheep. W. STEELE and J. H. MOORE	371
The effect of regular intravenous injections of oxytocin at milking time on the proportion of the yield obtained as residual milk in the ewe. M. MORAG	377
Detection of cow's milk in goat's milk by gel electrophoresis. R. Aschaffen- BURG and JANET E. DANCE	383
Growth and proteinase production in <i>Pseudomonas</i> spp. cultivated under various conditions of temperature and nutrition. H. S. JUFFS, A. C. HAYWARD and H. W. DOELLE	385
Some properties of the extracellular proteolytic enzymes of the milk-spoiling organism <i>Pseudomonas aeruginosa</i> ATCC 10145. H. S. JUFFS and H. W. DOELLE	395
The passage of staphyloccoci through the bovine teat canal. D. FORBES	399
The composition of the milk of young and of old cows. R. WAITE	407
The sterilizing effect against <i>Bacillus subtilis</i> spores of hydrogen peroxide at different temperatures and concentrations. P. SWARTLING and B. LINDGREN	423
Chemical methods for assessing lipid oxidation in ultra-high-temperature creams. W. K. DOWNEY .	429
A preliminary study by gel filtration and ultracentrifugation of the interaction of bovine milk caseins with detergents. G. C. CHEESEMAN	439
REVIEWS OF THE PROGRESS OF DAIRY SCIENCE. Section G. Genetics. Genetic variants of milk proteins: their breed distribution. R. ASCHAFFENBURG.	447

Index of Subjects

Age, milk composition, 407

Babies, milk foods, folic acid activity, 85

Bacillus subtilis, spore death-rate, hydrogen peroxide, different concentrations, temperatures, 423

Bacterial infection, cell counts, milk, 59

Biuret, in concentrates, milk yield and composition, 191

rumen fluid, composition, 203

- **Casein**, coagulation, role of lysine residues, 13 interaction with detergents, 439 micelles, ultrastructure, fresh, acidified milk, 1
 - viscosity index, adhesive strength, seasonal variation, 25
- Caseinates, viscosity, factors affecting, 31
- Cheddar cheese, neutral volatile components, made aseptically, with and without starter culture, 237
- Cheesemaking, concentrating milk and fat retention of curd, 135

Concentrates, containing, biuret and urea, milk yield and composition, 191 rumen fluid, composition, 203

fatty acids, milk fat yield and composition, 353, 361

- tallow, cottonseed oil, milk fat yield and composition, 223, 343
- Cottonseed oil, in concentrates, milk fat yield and composition, 223, 343
- Creams, UHT, lipid oxidation, assessment, 429

Dairy products, see also individual products

fat soluble vitamins, content (review), 149

Detergents, interaction with caseins, 439

Digestibility, fatty acids, fed sheep, 373

Disease, see Mastitis

- Dry period, infection, udder, subsequent milk yield, 287
- Fatty acids, in concentrates, digestibility coefficients, sheep, 371
 - milk fat yield and composition, 353, 361
 - milk fat, feeding concentrates containing, fatty acids, 353, 361

tallow, cottonseed oil, 223, 343

Flavour, Cheddar cheese, analyses, neutral volatile components, 237 oxidized, dairy products, 49

UHT creams, 429

- Folic acid, activity, milk foods, babies. 85
- Gel electrophoresis, detection, cow's milk in goat's milk, 383
- Gel filtration, estimation, interaction, caseins with detergents, 439

Genetic variants, breed distribution, milk proteins (review), 447

Goats, milk, detection of cow's milk, gel electrophoresis, 383

Heat treatment, milk, deposits (review), 317

Hydrogen peroxide, at different concentrations, temperatures, death-rate, spores, Bacillus subtilis, 423

- Lactation, induced, prediction of dairy performance, 331
- Lactose, content, milk, factors affecting, 91, 107
- Lipids, oxidation, model systems, copper, ascorbic acid added, 49 UHT creams, 429
- Lipolysis, milk, modified acid degree value test, 19
- Mastitis, subclinical, detection by electrical means, 213
- Milk, abnormal, detection by electrical means, 213 cell counts, bacterial infection, 59
 - electronic, after chemical dispersal, milk fat, 295
 - concentration, fat retention by curd, 135
 - lipolytic rancidity, modified acid degree value test, 19

removal of fission products, pilot plant, 257, 269 renneted, coagulation, factors affecting, 71

- Milk composition, feeding concentrates containing, biuret, urea, 191 fatty acids, 353, 361 tallow, cottonseed oil, 223, 343
 - folic acid activity, 85
 - lactose content, factors affecting, 91, 107
 - prediction, induced lactation, 331

vitamins, fat soluble, content (review), 149

- young, old cows, 407 Milk deposits, on heat treatment (review), 317
- Milk fat, content, composite milks, errors in testing, 171
 - estimation by Milko-tester, 181
 - herd bulk milk, sampling, testing, biological variances, 291
 - fatty acids, milk, feeding concentrates containing, fatty acids, 353, 361

tallow, cottonseed oil, 223, 343

lipids, oxidation, model systems, copper, ascorbic acid added, 49

UHT creams, 429

Milk fat yield, feeding concentrates containing, fatty acids, 353, 361

tallow, cottonseed oil, 223, 343

- Milk proteins, genetic variants, breed distribution (review), 447
- Milk serum, anti-O chaining titre, Salmonella pullorum-H, 7

viii

- Milk yield, after bacterial infection, udder, dry period, 287
 - feeding concentrates containing, biuret, urea, 191 fatty acids, 353, 361
 - prediction, induced lactation, 331
- Milking, udder infection, 127, 399
 - interval, oxytocin injections, residual milk, ewes, 377
- Milking machines, laboratory soiling, 247
- vacuum in teatcup liner, factors affecting, 303 Milko-tester, estimation of fat content, composite milks, 181
- Nutritive value, fat soluble vitamins, milk, milk products (review), 149
- Oestrogen, induced lactation, prediction of dairy performance, 331
- Oxidation, lipids, model systems, 49 UHT creams, 429
- Oxytocin, injections, milking interval, residual milk, ewes, 377
- Pseudomonas spp., growth, proteinase production, varying temperature, nutrition, 385
- P. aeruginosa, proteinases, properties, 395
- Radioactive nuclides, removal from milk, pilot plant, 257, 269
- Rancidity, lipolytic, milk, modified acid degree value test, 19
- Rennet, coagulation, milk, factors affecting, 71 curd, fat retention, effect of concentrating milk, 135
- Rennin, coagulation, casein, role of lysine residues, 13
- Residual milk, ewes, length of milking interval, oxytocin injections, 377

- Rumen, fluid, composition, feeding concentrates containing biuret, urea, 203
 - fermentation pattern, feeding concentrates containing fatty acids, 353, 361
- Salmonella pullorum-H, anti-O chaining titre, milk serum, 7
- Sheep, dietary fatty acids, digestibility coefficients, 371
- residual milk, length of milking interval, oxytocin injections, 377
- Staphylococci, infection, udder, dry period, subsequent milk yield, 287 milked, unmilked, 127
- Staphylococcus aureus, passage through teat canal, 399
- Streptococci, infection, udder, dry period, subsequent milk yield, 287 milked, unmilked, 127
- Streptococcus cremoris, iron, vanadium requirements, 67
- Str. lactis, iron, vanadium requirements, 67
- Tallow, in concentrates, milk fat yield and composition, 223
- Udder, infection, effect of milking, 127, 399 dry period, subsequent milk yield, 287 teat canal, passage of staphylococci, 399
- Ultracentrifugation, estimation, interaction, caseins with detergents, 439
- Urea, in concentrates, milk yield and composition, 191

rumen fluid, composition, 203

Vitamins, see also Folic acid

fat soluble, content, milk, milk products (review), 149

Index of Authors

AKAM, D. N., 303 Aschaffenburg, R., 383, 447

Bačič, Branca, 247 Barclay, Grace W., 19 Blackburn, P. S., 59 Bryant, D. T. W., 257, 269 Burnett, J., 71 Burton, H., 317

CALAPAJ, G. G., 1 CASTLE, M. E., 191 CHEESEMAN, G. C., 135, 439 CLECG, L. F. L., 247 CLOUGH, P. A. 303 COOMBE, R. A., 213 COUSINS, CHRISTINA M., 247 CRAKER, BARBARA A., 13

DANCE, JANET E., 383 DODD, F. H., 91, 107, 127, 287 DOELLE, H. W., 385, 395 DOLBY, R. M., 25 DOWNEY, W. K., 429 DRYSDALE, A. D., 191

Elliott, J. A., 237 El-Negoumy, A. M., 49 Emmons, D. B., 237

Forbes, D., 399 Ford, J. E., 85

GLASCOCK, R. F., 257, 269 GREATRIX, G. R², 213

HALL, H. S., 257 HAYES, J. F., 31 HAYWARD, A. C., 385 HIGGS, T. M., 127 HILL, R. D., 13 HOWSAM, SHIRLIE G., 237 HUNTEB, A. C., 19

JUFFS, H. S., 385, 395

Kano, Y., 331 Kashiwagi, K., 331 Katsuki, T., 331 Ku, P. S., 49 LINDGREN, B., 423

MABBITT, L. A., 135 McDowell, A. K. R., 171, 181 McGugan, W. A., 237 Miya, T., 331 Moore, J. H., 223, 343, 353, 361, 371 Morag, M., 377 Morita, K., 331 Muller, L. L., 31

NAITO, M., 331 NEAVE, F. K., 127, 287 NEMOTO, H., 331

O'KEEFFE, M. G., 291 Okubo, E., 331 Oliver, J., 127 Oram, J. D., 67

Phipps, L. W., 295 Porter, R. M., 7

QUAYLE, J. C., 213

REITER, B., 67, 237 ROOK, J. A. F., 91, 107

SAKURAI, M., 331 SCOTT, K. J., 85 SCOTT BLAIR, G. W., 71 SHARPE, M. ELISABETH, 237 SMITH, A., 287 SOUTHBY, PAMELA M., 31 SOUTHWARD, C. R., 25 STEELE, W., 223, 343, 353, 361, 371 SUFFOLK, S. F., 257 SWARTLING, P., 423

THIEL, C. C., 303 THOMPSON, S. Y., 149 TUSZYŃSKI, W., 71

WAITE, R., 191, 203, 407 WALSH, J. P., 91, 107 WATSON, J. N., 191 WESTGARTH, D. R., 303 WILSON, AGNES G., 203 WILSON, JUDITH M., 19

GENERAL

Papers submitted for publication should be sent to Dr J. E. Ford (*The Journal of Dairy Research*), National Institute for Research in Dairying, Shinfield, Reading. England. Submission of a paper will be held to imply that it reports unpublished original work, that it is not under consideration for publication elsewhere, and that if accepted for the *Journal* it will not be published elsewhere in English or in any other language, without the consent of the Editors.

FORM OF PAPERS

The onus of preparing a paper in a form suitable for sending to press lies in the first place with the author who, in his own interests, should follow these directions carefully, and consult a current issue of the *Journal* for guidance on details of typographical and other conventions.

Every paper should be headed with its title, the names and initials of the authors (women supplying one given name) and the name and address of the laboratory where the work was done.

Papers should be in English, the spelling being that of the *Shorter Oxford English Dictionary*. They should be typed with double spacing, on one side only of the sheets, and with ample margins for editorial annotations.

Papers should in general be divided into the following parts in the order indicated: (a) Summary, brief and self-contained; (b) Introductory paragraphs, briefly explaining the object of the work but without giving an extensive account of the literature; (c) Experimental or Methods; (d) Results; (e) Discussion and Conclusions; (f) Acknowledgements without a heading; (g) References. Only with some exceptional types of material will headings different from (c), (d) and (e) be necessary.

The use of footnotes should be avoided if possible. Underlining should be used only to indicate italics. Proper nouns, including trade names, should be given a capital initial letter. Wherever possible numerals should be used unless this leads to ambiguity. The typescript should carry the name and address of the person to whom the proofs are to be sent, and give a shortened version of the paper's title, not exceeding 45 letters and spaces, suitable for a running title in the published pages of the work.

TABLES

Tables should be numbered and should carry headings describing their content. They should be comprehensible without reference to the text. They should be typed on separate sheets and their approximate positions in the text indicated.

ILLUSTRATIONS

Line drawings, which must be originals, should be numbered as Figures and photographs as Plates, in Arabic numerals. Drawings should be in indian ink, on Bristol board or cartridge paper. However, a technique which may be more convenient to authors is to use a double-sized piece of tracing paper, or translucent graph paper faintly lined in *blue* or *grey*, folded down the centre with the drawing on one half and the other half acting as a flyleaf.

Attached to every figure and plate there should be a translucent flyleaf cover on the outside of which should be written legibly: (a) title of paper and name of author; (b) figure or plate number and explanatory legend;

c) the figures and lettering, which are intended to appear on the finished block, in the correct positions relative to the drawing underneath. For each paper there should be also a separate typed sheet listing figure and plate numbers with their legends, and the approximate positions of illustrations should be indicated in the text.

As a rule the photographs and diagrams should be about twice the size of the finished block and not larger over-all than the sheets on which the paper itself is typed. For general guidance in preparing diagrams, it is suggested that for a figure measuring $9 \text{ in.} \times 6 \text{ in.}$ all lines, axes and curves, should have a thickness of 0.4 mm, -, Graph symbols in order of preference thus should be $\bigcirc \bullet, \triangle \blacktriangle, \square \blacksquare, \times +, and for a 9 in. \times 6 in.$ graph the open circles should be 1 in. in diam. The open triangles should be large enough to contain circles of $\frac{3}{32}$ in. diam. and the open square circles of $\frac{1}{3}$ in. diam. The crosses should have lines 1 in. long. The block symbols should be slightly smaller than the corresponding open symbols. Scale marks on the axes should be on the inner side of each axis and should be $\frac{1}{2}$ in. long.

REFERENCES

In the text, references should be quoted by whichever of the following ways is appropriate: Arnold & Barnard (1900); Arnold & Barnard (1900*a*); Arnold & Barnard (1900*a*, *b*); (Arnold & Barnard, 1900). Where there are more than 2 authors all the surnames should be quoted at the first mention, but in subsequent citations only the first surname should be given thus, Brown *et al.* (1901). If there are 6 or more names *et al.* should be used in first instance. Also, if the combinations of names are similar, e.g. Brown, Smith & Allen (1954); Brown, Allen & Smith (1954), the names should be repeated each time. Reference to anonymous sources is not acceptable.

References should be listed alphabetically at the end of the paper, titles of journals being abbreviated as in the World List of Scientific Periodicals. Authors' initials should be included, and each reference should be punctuated in the typescript thus: Arnold, T. B., Barnard, R. N. & Compound, P. J. (1900). J. Dairy Res. 18, 158. References to books should include names of authors, names of editors, year of publication, title, town of publication and name of publisher in that order, thus, Arnold, T. B. (1900). Dairying. London: Brown and Chester.

It is the duty of the author *to check all references* and to ensure that the correct abbreviations are used.

SYMBOLS AND ABBREVIATIONS

The symbols and abbreviations used are those of British Standard 1991: Part 1: 1954, *Letter Symbols, Signs and Abbreviations.*

DESCRIPTIONS OF SOLUTIONS

Normality and molarity should be indicated thus: N-HCl, 0-1 M-NaH₂PO₄. The term '%' means g/100 g solution. For ml/100 ml solution the term '% (v/v)' should be used and for g/100 ml solution the correct abbreviation is '% (w/v)'.

REPRINTS

Order forms giving quotations for reprints are sent to authors with their proofs.

Journal of Dairy Research Volume 35, Number 3, October 1968

CONTENTS

ORIGINAL ARTICLES The prediction of dairy performance of cows from the lactation induced by treatment with oestrogen M. NAITO, Y.KANO, E. OKUBO, H. NEMOTO, T. MIYA, K. KASHIWAGI	
	age 331
Further studies on the effects of dietary cottonseed oil on milk-fat secretion in the cow W. STEELE and J. H. MOORE	343
The effects of mono-unsaturated and saturated fatty acids in the diet or milk-fat secretion in the cow W. STEELE and J. H. MOORE	1 353
The effects of a series of saturated fatty acids in the diet on milk-fat secre- tion in the cow W. STEELE and J. H. MOORE	- 361
The digestibility coefficients of myristic, palmitic and stearic acids in the diet of sheep	
W. STEELE and J. H. MOORE	371
The effect of regular intravenous injections of oxytocin at milking time on the proportion of the yield obtained as residual milk in the ewe M. MORAG	n 377
Detection of cow's milk in goat's milk by gel electrophoresis R. ASCHAFFENBURG and JANET E. DANCE	383
Growth and proteinase production in <i>Pseudomonas</i> spp. cultivated under various conditions of temperature and nutrition H. S. JUFFS, A. C. HAYWARD and H. W. DOELLE	r 385
Some properties of the extracellular proteolytic enzymes of the milk- spoiling organism <i>Pseudomonas aeruginosa</i> ATCC 10145 H. S. JUFFS and H. W. DOELLE	- 395
The passage of staphylococci through the bovine teat canal D. FORBES	399
The composition of the milk of young and of old cows R. WAITE	407
The sterilizing effect against <i>Bacillus subtilis</i> spores of hydrogen peroxide at different temperatures and concentrations P. SWARTLING and B. LINDGREN	e 423
Chemical methods for assessing lipid oxidation in ultra-high-temperature creams W. K. DOWNEY	429
A preliminary study by gel filtration and ultracentrifugation of the inter- action of bovine milk caseins with detergents G. C. CHEESEMAN	
Reviews of the progress of Dairy Science. Section G. Genetics. Genetic variants of milk proteins: their breed distribution B. ASCHAFFENBURG	
	/

Printed in Great Britain at the University Printing House, Cambridge