Data in brief 26 (2019) 104520

Contents lists available at ScienceDirect

Data in brief

journal homepage: www.elsevier.com/locate/dib

Data Article

A low-field Nuclear Magnetic Resonance dataset of whole milk during coagulation and syneresis

E. Curti, A. Pardu, S. Del Vigo, R. Sanna, R. Anedda*

Porto Conte Ricerche s.r.l., S.P. 55 Porto Conte-Capo Caccia, Km 8.400 Loc, Tramariglio, Alghero (SS), Italy

ARTICLE INFO

Article history:
Received 27 April 2019
Received in revised form 28 August 2019
Accepted 6 September 2019
Available online 16 September 2019

Keywords:
Dairy science and technology
Milk thermization and pasteurization
Low-field NMR
T_2 relaxation
Cheese production
Curd syneresis
Cow's and goat's milk

ABSTRACT

We report the relaxometric dataset obtained on renneted milk during syneresis by Time-Domain Nuclear Magnetic Resonance spectroscopy (TD-NMR). Data were obtained on cow's milk provided by two different producers in two different lactation seasons (April and October) and on a group of goat's milk samples (one season, November–December, one producer). TD-NMR data refer to spin-spin relaxation times (T_2) decay curves and distributions measured at 40 °C at seven time points after rennet addition, up to 70 minutes of syneresis. Curd was cut 30 min after rennet addition without removing the NMR tube from the TD-NMR instrument. The dataset here reported is related to the research article entitled "Non invasive monitoring of curd syneresis upon renneting of raw and heat-treated cow's and goat's milk" [E. Curti, A. Pardu, S. Del Vigo, R. Sanna, R. Anedda, Non-invasive monitoring of curd syneresis upon renneting of raw and heat-treated cow's and goat's milk, Int. Dairy J. 90 (2019) 95–97].

DOI of original article: https://doi.org/10.1016/j.idairyj.2018.11.003.
* Corresponding author.
E-mail address: anedda@portocontericerche.it (R. Anedda).

https://doi.org/10.1016/j.dib.2019.104520

Specifications Table

Subject area	*Food Chemistry*
More specific subject area	*Dairy Science*
Type of data	*xlsx file (XY data table)*
How data was acquired	*Low-field Nuclear Magnetic Resonance Spectrometer (20* MHz, *0.47 T, Bruker the miniSpec, Germany)*
Data format	*Raw and processed (CONTIN software, Bruker, Germany) T_2 CPMG decays*
Experimental factors	*Fresh whole milk was analyzed raw and heat-treated*
Experimental features	*1. Heat treatment of milk (72°C, 1 minute)* *2. Addition of rennet, coagulation and syneresis* *3. Acquisitions of T_2 [transverse relaxation time, Carr-Purcell-Meiboom-Gill (CPMG) pulse sequence] decays at selected syneresis time points, up to 70 minutes* *4. Analysis of T_2 data decays with CONTIN software to obtain T_2 distributions* *5. Comparison of T_2 distributions of raw and heat-treated milk and curd*
Data source location	*Porto Conte Ricerche S.r.l., Tramariglio, Alghero (SS), Italy*
Data accessibility	*Data are included in this article, as a supplementary file*
Related research article	*Curti, E. Pardu, A., Del Vigo, S. Sanna, R., and Anedda R. Non invasive monitoring of curd syneresis upon renneting of raw and heat-treated cow's and goat's milk. Int. Dairy J.* 90 (2019) 95–97. https://doi.org/10.1016/j.idairyj.2018.11.003

Value of the Data

- The dataset is useful to demonstrate and understand the effect of heat treatments of milk on the microstructural features of curd during syneresis
- The dataset can be useful to both researchers involved in the application of NMR relaxometry in dairy science and to dairy technologists
- The dataset can be used as a comparison in studies investigating the effect of other parameters (e.g. season, cattle diet, cattle species, rearing environment, climate) on milk and curd microstructural features.
- To the best of our knowledge, this is the first published NMR relaxometry dataset on whole milk
- Our dataset would serve as a starting point for the implementation of NMR in process and quality control of dairy products

1. Data

TD-NMR technique showed its ability and suitability in unraveling dairy products features and quality attributes [1–3]. Heating is known to affect milk functional properties [4,5] and, consequently, the following processing steps in cheese manufacturing. With TD-NMR being able to highlight molecular changes related to coagulation and syneresis [6,7], a TD-NMR T_2 dataset of whole milk is here presented, to deepen the knowledge of the syneresis process. Both raw (T_2 decays, Fig. 1a) and processed (T_2 distributions, Fig. 1b) data of raw and heat-treated cow's and goat's milk (after rennet addition, and up to 70 minutes of syneresis) [1] are provided as supplementary files, with an explanatory legend. Representative examples of the differences between the NMR relaxometric profiles of raw and heat-treated milk (Fig. 2a) and curd (Fig. 2b) are also reported.

2. Experimental design, materials, and methods

2.1. Sample preparation

Fresh whole raw milk was collected and heat-treated at 72 °C. Raw and heat-treated milk samples were put into NMR glass tubes and inserted inside the magnet to equilibrate at 40 °C. Liquid rennet (Naturen®, Christian Hansen, Parma, Italy) was added to milk inside the NMR tubes, where curd evolution was monitored during coagulation and syneresis.

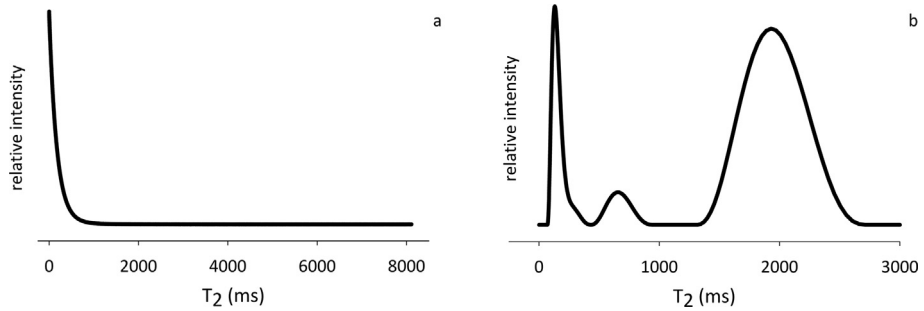

Fig. 1. Dataset on curds during syneresis. Representative graphical examples of (a) CPMG signal decays and (b) T_2 quasi-continuous distributions obtained by using CONTIN software.

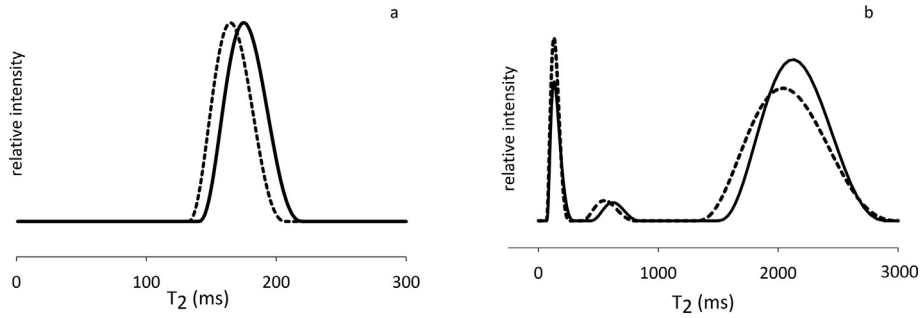

Fig. 2. (a) T_2 quasi-continuous distributions (CONTIN) of milk immediately after rennet addition (at T_0) and (b) on curds after 70 min (T_6). Solid lines refer to raw milk and derived curd, dashed lines represent the heat-treated counterparts.

2.2. Curd syneresis monitoring

T_2 distributions were acquired at T_0 (just after rennet addition),T_{3C} (curd cutting), and every 10 minutes until 70 minutes (T_4, T_5, T_6 and T_7).

2.3. TD-NMR analysis

A low-field Nuclear Magnetic Resonance spectrometer was used (Bruker the miniSpec, Germany). ^1H T_2 decays were acquired with a Carr-Purcell-Meiboom-Gill (CPMG) pulse sequence (recycle delay: 6 s; interpulse spacing 0.05 ms; 8 scans; 8000 data points) [Bruker the miniSpec (20MHz, 0.47T), Germany] and T_2 quasi-continuous distributions (400 points; range: 1–3000 ms) were obtained (CONTIN Bruker software).

Acknowledgments

The authors would like to thank Azienda Agricola Fauro (Alghero, Italy) for supplying bovine milk and Dr. Elia Bonaglini and Azienda Sechi (Siligo, Italy) for providing goat's milk. This work has been funded by Sardinia Regional Government by means of Sardegna Ricerche (art. 26 L.R. 37/98).

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104520.

References

[1] E. Curti, A. Pardu, S. Del Vigo, R. Sanna, R. Anedda, Non-invasive monitoring of curd syneresis upon renneting of raw and heat-treated cow's and goat's milk, Int. Dairy J. 90 (2019) 95–97.
[2] G. Mulas, T. Roggio, S. Uzzau, R. Anedda, A new magnetic resonance imaging approach for discriminating Sardinian sheep milk cheese made from heat-treated or raw milk, J. Dairy Sci. 96 (12) (2013) 7393–7403. https://doi.org/10.3168/jds.2013-6607.
[3] G. Mulas, R. Anedda, D.L. Longo, T. Roggio, S. Uzzau, An MRI method for monitoring the ripening of Grana Padano cheese, Int. Dairy J. 52 (2016) 19–25. https://doi.org/10.1016/j.idairyj.2015.08.011.
[4] P. Lambelet, R. Berrocal, F. Ducret, Low resolution NMR spectroscopy: a tool to study protein denaturation: I. Application to diamagnetic whey proteins, J. Dairy Res. 56 (2) (1989) 211–222. https://doi.org/10.1017/S0022029900026431.
[5] P. Lambelet, R. Berrocal, F. Renevey, Low-field nuclear magnetic resonance relaxation study of thermal effects on milk proteins, J. Dairy Sci. 59 (4) (1992) 517–526. https://doi.org/10.1017/S0022029900027187.
[6] C. Tellier, F. Mariette, J. Guillement, P. Marchal, Evolution of water proton nuclear magnetic relaxation during milk coagulation and syneresis: structural implications, J. Agric. Food Chem. 41 (1993) 2259–2266. https://doi.org/10.1021/jf00036a007.
[7] C.L. Hansen, S. Rinnan, S.B. Engelsen, T. Janhøj, E. Micklander, U. Andersen, F. van Den Berg, Effect of gel firmness at cutting time, pH, and temperature on rennet coagulation and syneresis: an in situ ^{1}H NMR relaxation study, J. Agric. Food Chem. 58 (1) (2010) 513–519. https://doi.org/10.1021/jf902264y.