

**ADVISORY COMMITTEE ON MICROBIOLOGICAL SAFETY OF FOODS****INTERIM ASSESSMENT OF WHETHER THE MICROBIOLOGICAL RISK ASSOCIATED WITH CONSUMPTION OF RAW DRINKING MILK (AND CERTAIN RAW MILK PRODUCTS) MADE IN THE UK HAS CHANGED SINCE 2015****Introduction**

1. In July 2015, following a policy review, the FSA Board agreed with recommendations to continue with existing controls governing the sale and marketing of RDM. The Board generally agreed that the level of risk associated with the product was acceptable when appropriate hygiene controls were applied, this was against a back-drop of a small and stable RDM market and minimal outbreaks associated with the product.

2. In the last 12-18 months, there has been a noticeable increase in the number of RDM producers and RDM-related outbreaks. The FSA is currently looking at different strands of information (microbiological, economic and social science aspects) to inform a wider work programme including a Board discussion scheduled for March 2018. The microbiological risk assessment branch has been asked to assess whether the risk associated with consumption of raw drinking milk (and certain unpasteurised products made using raw milk) made in the UK has changed since 2015

3. The approach will be to assess:

- whether newly registered RDM producers in the UK present a greater likelihood of producing unsafe product than more established producers and;
- whether there has been a change in the profile of vulnerable groups becoming ill and;
- the aetiological agents involved.

4. The purpose of this paper is therefore to:

- introduce work the FSA is carrying out to assess the microbiological risk associated with raw drinking milk (and certain raw milk products), which is currently at an interim stage, and:
- describe the initial data that has been considered, and:
- seek views in relation to the key issues that will be assessed (as described in the above), and:
- seek views on other types of data and analysis that may inform the assessment.

## **Scope**

5. The assessment focusses on raw cows' drinking milk, although milk from other species (e.g. sheep and goats) is also being taken into account.

6. The emphasis is on raw milk for drinking. Cream, smoothies, milkshakes and ice-cream made using raw milk have been included following a request by risk managers, in particular as the latter three product types could potentially increase raw milk consumption among children. Other products made using raw milk such as butter and cheese are outside the scope of this assessment.

7. The data will represent England, Wales and Northern Ireland as the sale of raw drinking milk in Scotland is not permitted. The assessment does not consider the risk associated with consumption in the UK of raw drinking milk produced outside the UK.

## **Human illness linked to raw drinking milk and certain raw milk products**

8. From the beginning of 2015 to the end of December 2017, 5 reported outbreaks in the UK (4 in England and 1 in Wales) involved human illness linked to consumption of RDM (Table 1). There were 41 laboratory confirmed cases, 5 reported hospitalisations and no deaths. One of the outbreaks occurred in 2016 and 4 occurred in 2017.

9. In 2017, a case of illness was also linked to consumption of RDM from a farm in England through descriptive epidemiological and microbiological evidence. As only a single case of illness was reported, this is not regarded as an outbreak according to usual definitions but is included here as further evidence of RDM-associated illness.

10. In addition, FSA investigated 4 incidents involving single cases (two of Cryptosporidiosis, one of Salmonellosis and one of *E. coli* O157) potentially associated with consumption of RDM. However, these are not included in Table 1 because there is currently no further evidence to show that their illness was caused by RDM rather than a different exposure.

11. In 2014, there was a single outbreak. Prior to that, the last UK outbreaks associated with RDM occurred in England & Wales in 2002. In Northern Ireland only 2 outbreaks linked to raw milk have been reported, both in 1991. There has therefore been a notable increase in outbreaks associated with RDM in the UK since 2015.

12. All outbreaks in Table 1 were associated with RDM from cows. No outbreaks associated with RDM from other species (e.g. sheep or goats) were reported.

13. Data was sought on outbreaks associated with unpasteurised products made with raw drinking milk (in particular cream, smoothies, milkshakes and ice-cream) for inclusion in Table 1. In the *Campylobacter* outbreak in Wales in 2017, 8 cases reported consuming milkshake made with raw milk (6 of these cases reported consuming only the milkshake). 3 of the cases were children. One outbreak related to consumption of a strawberry smoothie which affected 83 individuals (1 laboratory confirmed with *Staphylococcus aureus*) has not been included in Table 1 as it is not clear whether raw milk was used in the production of the smoothie. No outbreaks associated with cream, smoothies or ice-cream were reported during the relevant timeframe.

**Table 1. Outbreaks involving human illness associated with RDM (and certain raw milk products) in the UK (01/01/2014 to 20/12/2017)<sup>a, b</sup>** Data in columns 1-11 was provided by Public Health England (PHE). Data in the final column was provided by FSA Field Operations.

Year of outbreak	Region	Agent	Vehicle description	Total cases affected	Laboratory confirmed cases	Hospitalised	Number of deaths	Age and gender <sup>c</sup>	Evidence <sup>d</sup>	Comment (data source)	1) Registration date 2) Start date 3) Trading time <sup>e</sup>
2014	South West England	STEC O157 PT21/28	Raw cows' drinking milk	9	9	2	0	7 cases children, 2 cases adult	Descriptive epidemiological	(eFOSS)	Pre 2012  September 2014
2016	North West England	<i>Campylobacter jejuni</i>	Raw cows' drinking milk	69	16	0	0	Mean age of cases was 44 years (range 1-74); 61.9% male	Microbiological and analytical epidemiological	Microbiological: WGS identified nine <i>Campylobacter jejuni</i> isolates, seven from human faeces and two from raw milk samples. SNP address 1.2.2.2.2.7 (outbreak report)	15/08/13  12/12/16  > 3 years trading (i.e. 40 months)
2017	South East England	STEC O157 PT21/28 stx2	Raw cows' drinking milk	7	7	5	0	5 cases children	Microbiological and descriptive epidemiological	Microbiological evidence: Case, food and animal isolates all fell within a 5 SNP cluster. SNP address 4.4.4.590.3896.4108.% Descriptive epidemiological: All cases either has some link with the farm or consumed raw milk from the farm. (HPZone/Vessy/GDW)	15/05/12  26/09/17  > 5 years trading (i.e. 64 months)
2017	South West England	<i>Campylobacter</i> spp	Raw cows' drinking milk	5	5	0	0	Male x 4, female x 1, age between 41-69 years	Descriptive epidemiological	(eFOSS)	21/10/16  27/06/17  <12 months trading (i.e. 8 months)

2017	North West England	<i>Campylobacter</i> spp	Raw cows' drinking milk	4	4	0	0	Male x 2, female x 2, ages between 2-69 years	Microbiological and descriptive epidemiological	Microbiological evidence: Case and milk isolates all fell within a 0-SNP cluster. SNP address 2.2.2.2.3.3.3 (eFOSS)	29/06/16 26/06/17 Only just 12 months trading (i.e. 12 months)
2017	Wales	<i>Campylobacter</i> spp	Raw cows' drinking milk and milkshake made with the RCDM	18	9	U	0	7 cases were aged under 16 (aged 5-13)	Microbiological and descriptive epidemiological	(Personal communication Public Health Wales/ Ceredigion County Council)	27/6/16 08/08/17 < 24 months trading (i.e. 13 months)
2017	North West England	<i>Salmonella</i> Dublin	Raw cows' drinking milk	1	1	U	0	1 child	Microbiological and descriptive epidemiological	This incident was not reported as an outbreak due to only one individual being affected. An indistinguishable strain of <i>S. Dublin</i> was detected in bulk milk and farm environmental samples. SNP address. 1.1.1.2.2.2.2 (Personal communication – Health Protection Team)	29/06/16 05/07/17 Only just 12 months trading (i.e. 12 months)

<sup>A</sup> A food-borne outbreak is defined 'an incidence, observed under given circumstances, of two or more human cases of the same disease and/or infection, or a situation in which the observed number of human cases exceeds the expected number and where the cases are linked, or are probably linked, to the same food source' (Directive 2003/99/EC<sup>1</sup>).

<sup>B</sup> Data for 2017 is provisional. Data on foodborne disease outbreaks were extracted from the Electronic Food and Non-Foodborne Outbreak Surveillance System (eFOSS). eFOSS is a dynamic database and, as such, data are subject to change. Five of the outbreaks/incidents reported in Table 1 had not yet been formally reported into eFOSS so the information provided was obtained from the outbreak reports and/or direct communication with the outbreak/incident investigators. There may be additional outbreaks or further information on the outbreaks reported in Table 1 added to eFOSS before the annual data is finalised in May 2018. Data presented for RDM and unpasteurised products made with raw milk associated products. Where not specified that the vehicle was RDM or an RDM product, these outbreaks have not been included in the table.

<sup>C</sup> The age cut-off for children is not defined in eFOSS therefore it is not possible to provide number/proportion of children under 5 years of age.

<sup>D</sup> Categories of evidence are defined in the EFSA Manual<sup>2</sup> on reporting of foodborne outbreaks as follows:

- o Descriptive epidemiological evidence: suspicion of a food vehicle in an outbreak based on the identification of common food exposures, from the systematic evaluation of cases and their characteristics and food histories over the likely incubation period by standardised means (such as standard questionnaires) from all, or an appropriate subset of, cases
- o Analytical epidemiological evidence: a statistically significant association between consumption of a foodstuff and being a case in an analytical epidemiological study (e.g. cohort or case-control study)
- o Microbiological evidence: detection of a causative agent in a food vehicle or its component or in the food chain or its environment combined with detection in human cases, or clinical symptoms and an onset of illness in outbreak cases strongly indicative/pathognomonic to the causative agent identified in the food vehicle or its component or in the food chain or its environment.

<sup>E</sup> Registration date = date on which FBO was registered to sell RDM.

<sup>E</sup> Start date = date on which issue was reported to FSA Field Operations.

<sup>E</sup> Trading time = time period between registration to sell RDM and date on which the issue described in the table was reported to FSA Field Operations. Figure are rounded to the nearest whole month.

U - Unknown

## **Human illness linked to raw drinking milk (and certain raw milk products) compared with trading time**

14. To assess how the number of outbreaks associated with newly registered RDM producers compares with those associated with more established producers, data on trading time (including for the FBO associated with the single case of salmonellosis, although noting that this is not technically regarded as an outbreak) was extracted from Table 1 and presented in Table 2.

<b>Trading time</b>	<b>Number of outbreaks</b>
12 months or less	3
More than 12 months but less than 24 months	1
24 months or more	2

**Table 2. Number of outbreaks in relation to trading time**

15. There does not appear to be a correlation between the amount of trading time (i.e. the period between the FBO being registered to sell RDM and the date on which the outbreak was reported to FSA Field Operations).

16. It may be worth noting that of the outbreaks included in Table 1, the farms associated with the greatest number of confirmed cases, and with the greatest number of reported hospitalisations, had been trading for more than 24 months before the outbreaks occurred.

### **Vulnerable groups**

17. Table 1 indicates that most of the outbreaks in 2016 and 2017 (i.e. 4/5), and the single reported salmonellosis case in 2017, involved children.

### **Pathogens involved in outbreaks associated with raw drinking milk**

18. The pathogens associated with human illness shown in Table 1 were *Campylobacter* spp., STEC O157 and non-typhoidal *Salmonella*. This is in line with a Scientific Opinion published by EFSA in 2015<sup>3</sup>, which identified these as among the main pathogens for which there is a clear link between drinking raw milk and human illness in the EU. It is also consistent with what has been seen in the UK historically.

### **Incidents involving raw drinking milk and certain raw milk products**

19. In 2012 to the end of 2017 there were 5 incidents in the UK involving RDM which did not involve reported cases of human illness (Table 3). All the incidents were reported in England and all occurred 2017.

20. No incidents involving unpasteurised cream, milkshakes, ice cream or smoothies made using raw milk were reported during this period.

**Table 3. Incidents (not involving reported human illness) associated with RDM and certain raw milk products in the UK (2012-2017)**

Region	Adverse microbiological results from milk samples	Vehicle description	Registration date <sup>A</sup>	Start date <sup>B</sup>	Trading time <sup>C</sup>
North West England	<i>Campylobacter</i> (with low levels of <i>Listeria monocytogenes</i> and <i>Listeria innocua</i> detected in follow up samples)	Raw cows' drinking milk	21/04/16	02/02/17	<12 months trading (i.e. 9 months)
North West England	<i>Campylobacter</i> & low levels of <i>L. monocytogenes</i>	Raw cows' drinking milk	02/09/16	07/02/17	<12 months trading (i.e. 5 months)
East of England	Borderline levels of coagulase-positive Staphylococci & unsatisfactory levels of coliforms	Raw cows' drinking milk	28/01/17	20/07/17	<12 months trading (i.e. 5 months)
South West England	Low levels of <i>L. monocytogenes</i> (with unsatisfactory aerobic colony counts at 30°C for 72 hours and borderline coagulase-positive Staphylococci detected in follow-up samples)	Raw cows' drinking milk	Pre 2012	27/07/17	> 5 years trading
North West England	<i>E. coli</i> O157 (with unsatisfactory aerobic colony counts at 30°C for 72 hours and borderline coagulase-positive Staphylococci detected in follow-up samples)	Raw cows' drinking milk	29/06/16	09/08/17	<24 months trading (i.e. 13 months)

<sup>A</sup>Registration date = date on which FBO was registered to sell RDM.

<sup>B</sup> Start date = date on which issue was reported to FSA Dairy Operations team.

<sup>C</sup> Trading time = time period between registration to sell RDM and date on which the issue described in the table was reported to FSA Dairy Operations team. Figure are rounded to the nearest whole month.

### **Incidents involving raw drinking milk (and certain raw milk products) compared with trading time**

21. To assess how the number of incidents involving newly registered RDM producers compares with those associated with more established producers, data on trading time was extracted from Table 3 and presented Table 4.

<b>Trading time</b>	<b>Number of outbreaks</b>
12 months or less	3
More than 12 months but less than 24 months	1
24 months or more	1

**Table 4. Number of incidents in relation to trading time**

22. Out of five incidents, three were associated with newly established producers, although due to the small numbers involved it is difficult to determine how significant this is.

### **Enhanced surveillance**

23. National enhanced surveillance systems for STEC and *Listeria monocytogenes* collect standardised information which can be used to observe risk factors over time. Data provided by PHE relating to RDM from enhanced surveillance systems are presented in Table 3. Enhanced surveillance provides information on exposure to potential sources of illness and can identify several risk factors which might or might not include RDM. However, it may be difficult to use such information to provide a measure of risk associated with the consumption of RDM for 'sporadic' cases, especially in the absence of information for the normal population.

**Table 3. RDM consumption reported to enhanced surveillance systems, (01/01/2015-20/12/2017).** Data provided by PHE and were extracted from the National Enhanced Surveillance System for STEC (NESSS) and the *Listeria monocytogenes* enhanced surveillance system.

<b>Pathogen enhanced surveillance system</b>	<b>Cases reporting RDM exposure</b>	<b>% cases reporting RDM exposure</b>	<b>Country</b>
STEC	19 <sup>a</sup>	1.48%	England
<i>Listeria monocytogenes</i>	13	2.43%	England

<sup>a</sup>Excludes STEC cases linked to outbreaks

24. The 'Update on FSA review of controls for raw drinking milk' published in 2015<sup>4</sup> states that data from investigations associated with enhanced surveillance for STEC illness showed that 51/2384 (i.e. 2.14%) of cases in England reported RDM consumption, and so this does not appear to have increased since then.

### **Microbiological status of raw drinking milk and certain raw milk products: surveillance**

25. Several surveys<sup>5,6,7,8,9,10,11,12</sup> have been undertaken between 1995 and 2016 to investigate the microbiological status of RDM and raw cream, providing data on the presence and levels of pathogens and hygiene indicators in milk from cows and other species. These surveys are summarised in Table 4.

26. In the most recent survey Willis *et al.* reviewed the microbiological results for RDM samples collected in England and submitted to PHE laboratories between 2014 and 2016<sup>12</sup>. The study focused mainly on cows' RDM (613 samples). Goats' RDM samples were also of relatively well represented (260 samples), but RDM from other species was underrepresented with very few samples (between 3 and 9 samples from ewes, buffaloes and camels). Most samples (n=770) were collected for the purposes of routine monitoring of microbiological quality. The remaining samples were taken to follow up previous poor results (n=114) or in response to a public health incident associated with consumption of RDM (n=18). The interpretation of results was done in accordance with EC Regulation 2073/2005<sup>13</sup>, Health Protection Agency's Guidelines for Assessing the Microbiological Safety of Ready-to-Eat Foods (2009)<sup>14</sup> and the Food Safety and Hygiene Regulations, 2013<sup>15</sup>. Overall, 454/770 samples (59.0%) taken for routine monitoring were of a satisfactory quality, whilst eight (1.0%) were 'unsatisfactory and potentially injurious to health' due to the presence of shiga-toxin producing *E. coli* (STEC), *Campylobacter* spp. or elevated levels of *L. monocytogenes* or CPS. In contrast, 16/114 (14.0%) of samples taken in follow-up to a previous unsatisfactory result and 5/18 (27.8%) of samples related to illness were potentially injurious. A total of 229/902 samples (25.4%) gave unsatisfactory results due to elevated Aerobic Colony Counts and/or coliforms. *L. monocytogenes* was detected at levels of <100 cfu/ml in 66/902 samples (7.3%). Table 5 summarises the results by reason for sampling.

27. The findings are not necessarily directly comparable between the surveys and studies listed above, as in some cases the methods and sampling approach used varied. For example, the recent study by Willis *et al.*<sup>12</sup>, included analysis for non-O157 STEC, whereas the surveys conducted before 2000 limited analysis for pathogenic *E. coli* to the serogroup of O157. Also, direct comparisons between the most recent data<sup>12</sup> and previous surveys<sup>5,6,7,8</sup> are difficult without the full set of data, e.g. to discriminate by animal species

28. The FSA is not aware of any published surveys of RDM or raw cream taking place between 2000 and 2014.

29. The surveys carried out between 1995 and 2000 showed that pathogenic micro-organisms were present in low numbers of samples of raw milk from cows, sheep and

goats. Pathogens were not consistently detected in all surveys and the frequency of each pathogen detected varied between the different surveys. As these surveys do not represent routine year on year surveillance it is difficult to compare surveys and identify any trends. Most of the surveys also determined levels of indicator *E. coli* and other indicator organisms in samples. These were present at varying levels in most samples, in some cases exceeding the limits set in legislation.

30. Work previously presented to the Advisory Committee on the Microbiological Safety of Food (ACMSF) on health risks to consumers associated with unpasteurised milk and unpasteurised cream for direct human consumption (ACM/1008)<sup>16</sup> reviewed most of the surveys listed in Table 4<sup>5,6,7,8,9,11</sup> and concluded that it was not possible to correlate the results for levels of faecal indicators such as *E. coli* and presence of pathogens for individual survey samples as this data was not available. However, according to Willis *et al.*<sup>12</sup>, only 6.9% of the samples categorised as potentially injurious to health due to the presence of pathogens had unsatisfactory results for the Aerobic Colony Count and coliform tests. Moreover, for 75.9% of the samples contaminated with pathogens, the corresponding hygiene indicator tests gave satisfactory results. Thus, the review of recent RDM samples collected in England between 2014 and 2016 strongly suggests that microbiological parameters such as Aerobic Colony Counts and coliforms have poor predictive value for identifying food safety concerns in RDM<sup>12</sup>. For this reason, the microbiological parameters of direct public health significance in the surveys/studies discussed in this paper should be a prominent consideration in assessing any changes in risk to consumer health from RDM and raw cream over time.

**Table 4. Summary of microbiological results from surveys of raw drinking milk and raw cream between 1995 and 2016**

Survey	Survey of raw cows' milk, 1995-96 n = 1591	Survey of raw cows' milk, 1996-97 n = 1097	Survey of raw cream, 1997 n = 30	Survey of raw goats' & sheep's milk, 1997-98 n = 111	Survey of raw goats' & sheep's milk, 1998 n = 126	Survey of raw goats', sheep's & buffaloes' milk, 1997-99 n = 384	Survey of raw cows' milk intended for heat treatment, 1999-2000 n = 610	Survey of raw cows', goats', sheep's, buffaloes' & camels' milk, 2014-16 n = 902
Reference	5	6	7	8	9	10	11	12
<i>Campylobacter</i> spp.	0	2 (19)	-	0	0	0.5 (2)	0.8 (5)	0.3 (3)
<i>E. coli</i> O157	0	0.3 (3)	0	0	0	0.5 (2)	0.2 (1)	1.4 (13) incl. non-O157 STEC
<i>Salmonella</i> spp.	0.06 (1)	0.5 (5)	-	0	0	0	0.3 (2)	0.9 (8)
<i>Listeria monocytogenes</i>	2 (32)	-	-	-	0	3 (11)	17 (101)	7.5 (68) Detection by enrichment 0.2 (2) >100 cfu/ml
<i>Listeria</i> spp.	6 (91) Detection by enrichment	-	-	-	0	-	37 (223)	4.9 (44) Detection by enrichment, <100 cfu/ml
<i>S. aureus</i> >10cfu/ml	6 (89)	1 (12) >500 cfu/ml	-	8 (9)	19 (24) >20 cfu/ml 1.6 (2) >10,000 cfu/ml	8 (29)	19 (113) CPS	22.7 (205) CPS >20 cfu/ml 0.3 (3) CPS >10,000 cfu/ml

Survey	Survey of raw cows' milk, 1995-96 n = 1591	Survey of raw cows' milk, 1996-97 n = 1097	Survey of raw cream, 1997 n = 30	Survey of raw goats' & sheep's milk, 1997-98 n = 111	Survey of raw goats' & sheep's milk, 1998 n = 126	Survey of raw goats', sheep's & buffaloes' milk, 1997-99 n = 384	Survey of raw cows' milk intended for heat treatment, 1999-2000 n = 610	Survey of raw cows', goats', sheep's, buffaloes' & camels' milk, 2014-16 n = 902
Reference	5	6	7	8	9	10	11	12
<i>E. coli</i> >10cfu/ml	24 (386)	3 (27) >100 cfu/ml	23 (7)	6 (7)	25 (31) >3 cfu/ml, <100 cfu/ml	17 (65)	52 (316)	-
Coliforms ≥ 100 cfu/ml	25 (390)	-	-	32 (36)	12 (15)	25 (95)	56 (343)	18.2 (164)
Total Viable Counts > 20,000 cfu/ml	16 (255)	4 (39) >50,000 cfu/ml	-	37(41) >10,000 cfu/ml	44 (56) >10,000 cfu/ml	23 (89) >10,000 cfu/ml	56 (344) >10,000 cfu/ml	19.3 (174)
<i>Mycobacterium avium</i> subspecies <i>paratuberculosis</i>	-	-	-	-	-	0	1.6 (4/243)	-

Table adapted from ACM/1008<sup>16</sup>. CPS; coagulase positive staphylococci, STEC; shiga-toxin producing *E. coli*.

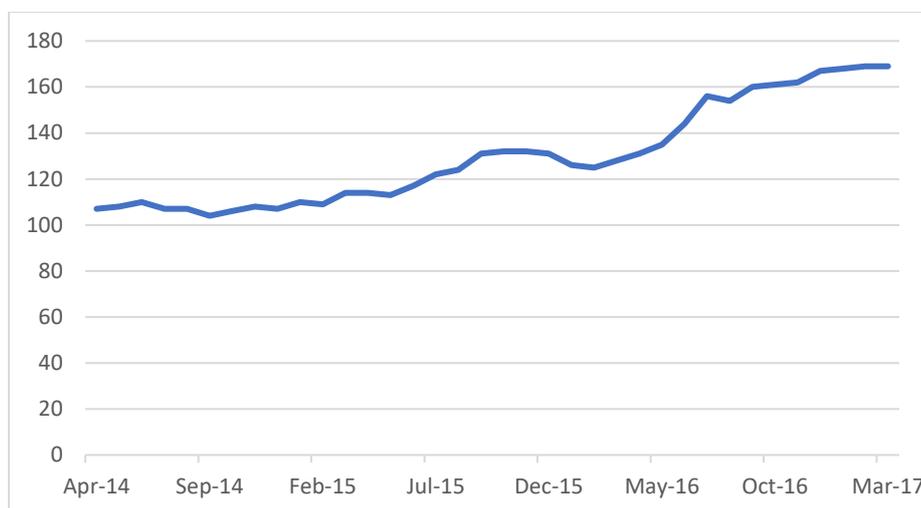
**Table 5. Overall microbiological quality of raw drinking milk samples taken in England between January 2014 and December 2016 (Willis *et al.*, 2017) compared to the reason for sampling.**

Reason for sampling	Number of samples	No. (%) satisfactory (including <i>Listeria monocytogenes</i> <100 cfu/g)	No. (%) borderline	No. (%) unsatisfactory (relates to ACCs, coliforms and <i>Listeria</i> spp., excluding <i>Listeria monocytogenes</i> )	No. (%) unacceptable/potentially injurious (relates to <i>Listeria monocytogenes</i> > 100 cfu/g, CPS > 10,000 cfu/g or detection of <i>Salmonella</i> , STEC or <i>Campylobacter</i> )
Routine	770	454 (59.0)	109 (14.2)	199 (25.8)	8 (1.0)
Follow-up of recent failure	114	40 (35.1)	29 (25.4)	29 (25.4)	16 (14.0)
Investigation of illness	18	11 (61.1)	1 (5.6)	1 (5.6)	5 (27.8)
<b>Total</b>	902	505 (56.0)	139 (15.4)	229 (25.4)	29 (3.2)

Table adopted from Willis *et al.*, 2017<sup>12</sup>. CPS; coagulase positive staphylococci, STEC; shiga-toxin producing *E. coli*. The interpretation of results was done in accordance with EC Regulation 2073/2005<sup>13</sup>, Health Protection Agency's Guidelines for Assessing the Microbiological Safety of Ready-to-Eat Foods (2009)<sup>14</sup> and the Food Safety and Hygiene Regulations (2013)<sup>15</sup>.

## **Number of registered producers**

31. The number of registered RDM producers in England and Wales has increased from 107 in April 2014 to 169 in March 2017. Current figures for December 2017 identify 176 establishments of which 144 produce raw cows' milk, and the remaining 32 produce raw milk from other species (i.e. 27 goats, 2 buffalo and 3 sheep).



**Figure 1. Number of registered raw drinking milk producers (all species) in England and Wales**

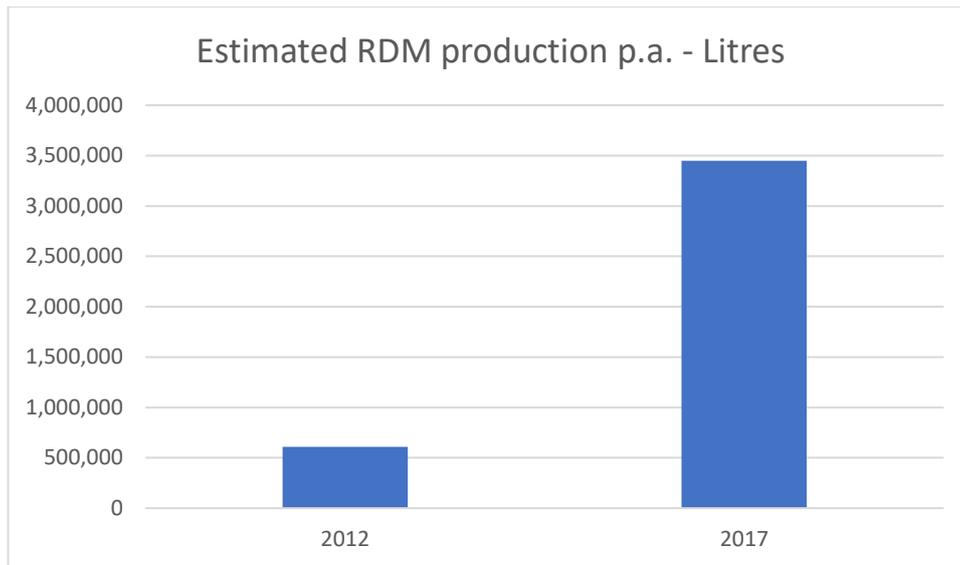
32. There are very few registered raw cows' drinking milk producers in Northern Ireland, although the numbers have risen from 1 in 2014 to 5 at present. A single raw goats' drinking milk producer currently operates in Northern Ireland and was registered in July 2015.

33. In total, in the UK there were 108 RDM producers in April 2014 and 181 in December 2017.

34. There is little evidence that milkshakes, smoothies and ice cream made using raw milk are on sale in the UK, other than the milkshakes sold by the food business operator involved in the *Campylobacter* outbreak in Wales in 2017. Data is not collected on the number of farmers registered to make these products in the UK. A general search on the internet and of the Mintel database for these products in the UK did not yield results.

## **Volume of production**

35. According to economic analysis conducted by FSA as part of the current work on raw drinking milk, production of raw drinking milk in the UK increased from around 610,000 litres in 2012 to around 3-3.9 million litres in 2017 (Figure 2). A relatively small proportion of this relates to Northern Ireland, where average production is currently 1,200 litres per week. The economic analysis estimated that around 9% of RDM-producing dairies only produce RDM.

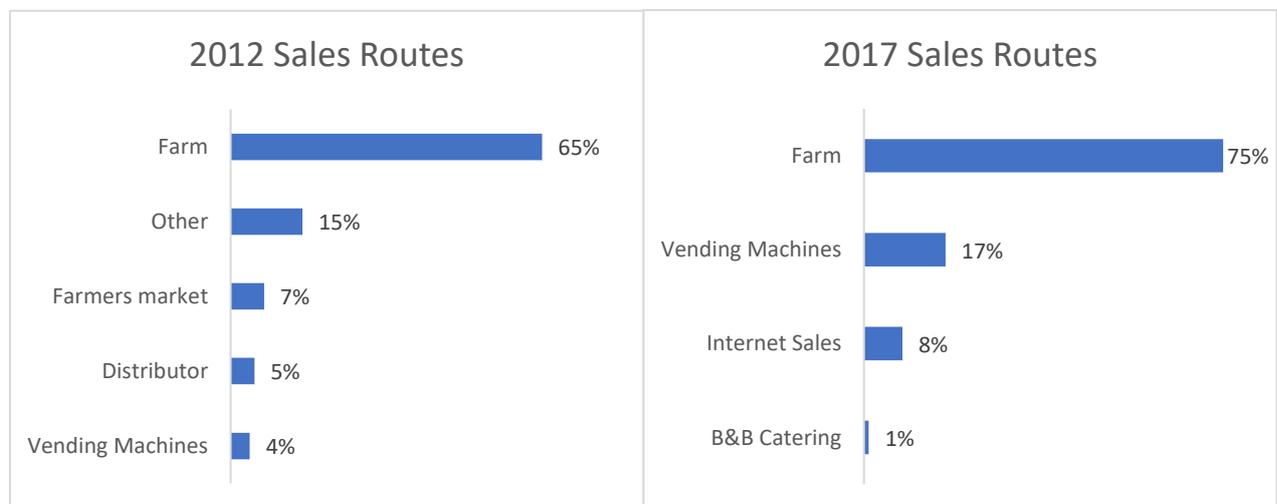


**Figure 2. Estimated RDM production in the UK per year during 2012 and 2017 (in litres).** Reproduced from economic analysis conducted by FSA.

36. No information is available on the volume of production of unpasteurised milkshakes, smoothies and ice cream made using raw milk in the UK.

**Sales routes**

37. The proportion of sales completed through different sales routes was assessed in economic analysis conducted by FSA as part of the current work on raw drinking milk. The findings are reproduced in Figure 3. These charts provide an illustrative comparison; however, the 2012 data comes from a producer survey questionnaire as part of a consultation document<sup>17</sup> and the 2017 data was taken from producer inspection responses.



**Figure 3. RDM sales routes in the UK in 2012 and 2017.** Reproduced from economic analysis conducted by FSA.

38. According to the economic analysis, vending machines serving RDM on farm sites have given producers a new route to access their consumer base. Initial suggestions are that there are 18 vending machines currently in operation in the UK. These vending machines produce sales representing around 17% of total RDM sales, showing that it has become a significant avenue for distribution. In 2012 an estimated 4% of sales were done through vending machines, evidencing the expansion of this sector of the market<sup>17</sup>.

### **Consumption**

39. The National Diet and Nutrition Survey<sup>18</sup> does not include data on consumption of raw milk or raw milk products. However, consumption data from this dataset for milkshakes, ice cream and smoothies (pasteurisation status unknown but most/all assumed to be pasteurised) may provide a proxy indication of whether a higher proportion of children than adults would consume the raw milk version of these products (see Annex 1). Age stratification was used because consumption by vulnerable groups such as children under five is of particular interest. The data were collected over a six-year period between 2008 and 2014. For ice cream and milkshakes, a higher proportion of children compared to adults (aged 19 years and over) consumed these products. This was seen for both age groups of children; those under five years old, and those aged five to eighteen, though consumption was higher in the latter group. There were no data for 'smoothies containing milk', only for 'smoothies containing dairy products' (dairy products in this category are presumed to be yoghurt). A higher proportion of adults than either group of children consumed 'smoothies containing dairy products.'

40. Overall, it may be possible to extrapolate this data to suggest that children may be more likely than adults to consume raw milk ice cream and milkshakes than adults, but less likely to consume raw milk smoothies than adults, if these products are placed on the market. However, other factors may also be important such as whether the products are packaged and marketed in a way that is attractive to children.

### **Action**

41. The paper reports work in progress on this issue and the committee is asked to note the recent outbreaks in England and Wales associated with RDM. Members are invited to:

- Comment on the data presented in this paper
- Suggest any other data or types of analysis that may inform the assessment

22 January 2018

Microbiological Risk Assessment Branch  
Science, Evidence and Research Division  
Food Standards Agency

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## **Annex 1**

National Diet and Nutrition Survey consumption data by age group for milkshakes, ice cream and smoothies made with dairy products (pasteurisation status unknown but most/all assumed to be pasteurised). The information relates to combined data from 2008/2009 to 2013/2014 (there are no data after 2014). Individuals were asked to complete a diary of food and drink consumption over four consecutive days (with the start date randomly allocated). The totals will not always add together numerically due to weighting.

**Table 1: Chronic consumption estimates for Milkshakes from NDNS years 1 to 6**

<b>UK Population age group</b>	<b>Number of consumers</b>	<b>Percent consumers</b>	<b>Mean consumption rate (g/kg bw/day)</b>	<b>Mean consumption rate (g/person/day)</b>
<b>Adults (aged 19+ yrs)</b>	77	2.5	1.39	108.66
<b>Children (aged less than 5 yrs)</b>	62	7.1	3.78	63.05
<b>Children (aged 5 to 18 yrs)</b>	287	11.2	2.27	94.62

**Table 2: Chronic consumption estimates for Ice cream from NDNS years 1 to 6**

<b>Survey Population</b>	<b>Number of consumers</b>	<b>Percent consumers</b>	<b>Mean consumption rate (g/kg bw/day)</b>	<b>Mean consumption rate (g/person/day)</b>
<b>Adults (aged 19+ yrs)</b>	540	17.2	0.17	13.01
<b>Children (aged less than 5 yrs)</b>	275	33.9	0.61	9.61
<b>Children (aged 5 to 18 yrs)</b>	773	31.0	0.36	12.35

**Table 3: Chronic consumption estimates for Smoothies made with dairy products\* from NDNS years 1 to 6**

<b>Survey Population</b>	<b>Number of consumers</b>	<b>Percent consumers</b>	<b>Mean consumption rate (g/kg bw/day)</b>	<b>Mean consumption rate (g/person/day)</b>
<b>Adults (aged 19+ yrs)</b>	4	0.17	0.99	90.78
<b>Children (aged less than 5 yrs)</b>	1	0.04	4.56	75.88
<b>Children (aged 5 to 18 yrs)</b>	6	0.2	1.80	67.01

\* From the NDNS categorisation reported, it is assumed that the dairy products contained in these smoothies would be yogurt