



# Opinion on the welfare implications of nutritional management strategies for artificially-reared calves from birth to weaning

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## FAWC Opinions

FAWC Opinions are short reports to government<sup>1</sup> on contemporary topics relating to farm animal welfare. They are based on evidence and consultation with interested parties. They may highlight particular concerns and indicate issues for further consideration.

### **Opinions published by the Farm Animal Welfare Committee**

The welfare of farmed fish (2014)

The welfare of farmed and park deer (2013)

The welfare implications of breeding and breeding technologies in commercial livestock agriculture (2012)

Contingency planning for farm animal welfare in disasters and emergencies (2012)

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<sup>1</sup> Where there is reference to 'government' it means the Department for Environment, Food and Rural Affairs in England, the Scottish government and the Welsh government, and other responsible government departments and agencies.

## SCOPE

1. This study considers the welfare implications of nutritional management strategies for artificially-reared calves (calves reared away from the dam) typically originating from the dairy industry. It covers:

- The nutritional needs of calves from birth to weaning
- The lifelong consequences of perinatal management including colostrum provision

## BACKGROUND

2. FAWC was asked to review the nutritional management of artificially reared calves in particular because of concerns raised as a result of letters published in the veterinary press regarding the current regulatory requirements that all calves must be fed at least twice daily.

3. To comply with point 12 of Annex 1 to the Calves Directive 2008/119/EC (laying down minimum standards for the protection of calves), and further to comply with the Commission's interpretation of point 12 of the Annex to the Directive, all calves under the age of 28 days must be fed at least twice a day with liquid milk.<sup>2</sup>

4. For the purposes of this opinion FAWC gathered evidence through a review of peer reviewed literature, consultation with relevant stakeholders, farm visits and interviews with recognised experts.

### **Welfare concerns or contentious issues and/or opportunities to improve welfare**

5. Animal Health and Veterinary Laboratories Agency's (now called Animal and Plant Health Agency)<sup>3</sup> surveillance, necropsies and field observations since late 2011 had prompted two letters in the veterinary press, the second of which stated: "Our previous letter was triggered by a number of calves recently diagnosed at the AHVLA with abomasal disorders (abomasitis and/or bloat), which could be associated with being fed artificial milk once a day with no other supplementary feeds".<sup>4</sup> While some of these calves apparently came from farms with a history of risk based surveillance some originated from farms that otherwise had good health and welfare management.

6. Recent research has indicated that conventional programmes of milk feeding [2 litres (3 ½ pints) twice daily] results in calves not receiving adequate energy and protein to meet their needs for optimum growth and ensuring good welfare in the pre-

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<sup>2</sup> Legal position on 'once a day' feeding of calves. Defra 22 July 2013

<sup>3</sup> The Animal and Plant Health Agency (APHA) was created on 1 October 2014. It replaces the Animal Health and Veterinary Laboratories Agency (AHVLA).

<sup>4</sup> <http://veterinaryrecord.bmj.com/content/172/14/371.2.full.pdf+html>

weaning period. This has added importance in the first three weeks of life when they are unable to properly digest calf starter dry concentrate ration.<sup>5</sup>

7. Conventional calf rearing is usually two feeds a day of whole milk or milk substitute (milk powder), fed through an artificial teat or in a bucket. There are also mechanical machines which feed small groups of calves pre-set amounts of milk on demand which more closely mimics the way a calf is fed by the cow and 'ad libitum' systems, where the milk is available to the group at all times, replenished once or more often during the 24 hour period. However, some farmers have been feeding calves only once a day which is of concern in both welfare and legal terms.

8. Once-a-day feeding is sometimes confused by farmers and calf rearers with *ad libitum* feeding, where the milk is always available to the calves and replenished once during the day. Once-a-day feeding (feeding only one meal per day) is where milk is fed to calves once during a 24 hour period, with the milk powder often mixed in greater concentration.

9. Evidence from peer reviewed scientific papers indicates that up to 35 percent of calves suffer failure of passive antibody transfer (FPT) due to insufficient colostrum ingestion.<sup>6</sup> FPT is an immunological deficiency state that predisposes calves to secondary viral and bacterial infections and diseases. Colostrum is not only important for immune protection but also for the non-nutrient factors within colostrum that promote development and function of the gastrointestinal tract, for example, improved digestion, improved absorption and endocrine changes.<sup>7</sup> Veterinary investigations of poor calf health in some UK dairy herds have shown levels of FPT as high as 65-70 percent.

10. It was suggested by various persons and organisations that gave evidence to the Committee that actual morbidity and mortality rates are much higher than those officially recorded because births and deaths may not be recorded for those calves that die in the first days of life, despite the requirements under The Welfare of Farmed Animals (England) Regulations 2007 (WOFAR) to inspect and record any on-farm deaths. For example, it has been estimated that in 2008 the number of unregistered calves shot or that died before seven days old was over 80,000 animals in GB.<sup>8</sup> In a survey of 19 dairy herds, over a 10 year period around 20 percent of female calves were lost from birth to first service at 15 months.<sup>9</sup> These are high numbers that require further investigation as potentially they represent a welfare issue and a waste of precious resource for food production.

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<sup>5</sup> Lorenz, I. Mee, J.F. Earley, B. More. S.J. Calf health from birth to weaning. 1. General aspects of disease prevention. *Irish Veterinary Journal* 2011, 64:10.

Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. *J Dairy Sci.* 94:1071-108. 2011.

<sup>6</sup> Weaver, D.M., Tyler, J.W. VanMetre, D.C., Hostetler, D.E., Barrington, G.M., (2000). Passive transfer of colostrum immunoglobulins in calves. *Journal of Veterinary Internal Medicine.* 14(6):569-77.

<sup>7</sup> Hammon, H.M. Steinhoff-Wagner, J. Schönhusen, U. Metges, C.C. Blum, J.W. Energy metabolism in the newborn farm animal with emphasis on the calf: endocrine changes and responses to milk-borne and systematic hormones. *Domestic Animal Endocrinology* 43 (2012) 171-185.

<sup>8</sup> Beyond Calf Exports Stakeholders Forum: A final report on progress. 2013.

<sup>9</sup> Wathes, D.C, Brickell, J.S. Bourne, N.E. Swali, A. and Cheng, Z. (2008): "Factors influencing heifer survival and fertility on commercial dairy farms." *Animal* 2, 1135-1143.

## Number of animals involved, duration and extent of welfare issues

11. Legal requirements associated with cattle identification means that all births, movements and deaths must be recorded in a GB database. It cannot, however, be assumed that this is the complete dataset for births and deaths because stillbirths and deaths shortly after birth may not be recorded and therefore will not be officially registered. Between 2001 and 2013, the on-farm deaths of approximately 420,192 calves registered as born on dairy farms in England, Wales and Scotland have been recorded. On average, over this time period, more than 22 percent of recorded deaths occurred within the first two weeks of life and by six weeks of age over 50 percent of calf deaths had occurred. A further 23 percent of deaths were recorded between 6 and 12 weeks of age and just under a quarter of all calf deaths occurred between 3 and 6 months of age.

12. Detailed data for 2012-2013 is provided below for mortality in calves originally born on dairy farms in England & Wales. [In 2013 dairy-born registered calves comprised 58.8 percent of all calf births in England & Wales.]

### Births and deaths of calves originally born on dairy farms in England & Wales 2012-2013<sup>10</sup>

Year	Total born on milk registered holdings (England & Wales only)	Total number died on farm as a "calf" <sup>11</sup> (% total born)	Age: 0-14 days (% total calf deaths)	Age:15-42 days (% total calf deaths)	Age:43-90 days (% total calf deaths)	Age 91 – 180 days (% total calf deaths)
2012	1,186,892	42,209 (3.6%)	8189 (19.4%)	13361 (31.7%)	9744 (23.1%)	10899 (25.8%)
2013	1,183,115	39,714 (3.6%)	8164 (20.6%)	13297 (33.5%)	9695 (24.4%)	8532 (21.5%)

13. The data suggest that over half of all recorded deaths of dairy-born calves occurred in the first six weeks of life, a period of time when liquid feeding is providing the sole or principal source of nutrition for the calves. Ensuring appropriate immune status and correct feeding are critical requirements in order to resist disease challenge.

<sup>10</sup> Weston, J. Gartner, H, RADAR surveillance, AHVLA, Weybridge.

<sup>11</sup> calf as defined in European directive 2008/119/EC as a "bovine animal up to 6 months old"

14. It is reported that in the last eight years retention of male dairy calves has increased (245,586 in 2006 to 390,140 in 2012), live export has reduced (80,700 to 8,000) and numbers killed on farm has reduced (84,817 in 2006 to 54,670 in 2012).<sup>12</sup>

## **Legal context**

### ***European legislation***

15. The welfare of calves was first considered through Council of Europe Recommendations in an Appendix to their 1988 Cattle Recommendations where a specific recommendation was made on the feeding of calves. In 1993 stand-alone calf specific recommendations were agreed by member countries which include a requirement that calves should be fed with liquid milk a minimum of twice per day for the first four weeks of life.

16. European Community law on calves (defined as all bovines under the age of six months) was agreed in 1991 (91/629/EEC, now codified with its later amendments of 97/2/EC, 97/182/EC by 2008/119/EC) with a commencement date for the original legislation of January 1994, whilst the general farmed animal welfare rules (98/58/EC) are also applicable to calves. Both of these legislative areas are statutorily inspected under the requirements of cross compliance regulations, official food and feed controls (OFFC) legislation and Commission decision 2006/778/EC in the UK. The EU calves directive includes specific nutritional requirements associated with colostrum provision, iron content levels, an appropriate diet adapted to age, weight and behavioural and physiological needs to promote good health and welfare. There are further requirements associated with frequency of feeding and provision of water.

### ***National legislation***

17. The calves directive and the general framework directive (98/58/EC) have been transposed into national laws. Council of Europe recommendations have been variously transposed either through legislation, in England by the Welfare of Farmed Animals (England) Regulations 2007 (WOFAR) – with similar legislation in devolved administrations<sup>13</sup> – or are otherwise usually covered in species specific animal welfare codes. WOFAR requires that animals must be fed a wholesome diet which is appropriate for their age and species and which is fed to them in sufficient quantity to maintain them in good health, satisfying their nutritional needs and to promote a positive state of wellbeing. Specific rules for calves include, ensuring each calf receives bovine colostrum as soon as possible after it is born and, in any event, within the first six hours of life and that each calf must be fed at least twice per day.

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<sup>12</sup> Beyond Calf Exports Stakeholders Forum: A final report on progress. 2013.

<sup>13</sup> This is now secondary implementing legislation made under the Animal Welfare Act (2006) (England & Wales) (or equivalent secondary legislation made under the Animal Health & Welfare (Scotland) Act 2006) [rather than the Agricultural (Miscellaneous provisions) Act 1968] and so no longer restricted to agricultural land. However, the law does apply to farm animals used for a “farming purpose”.

18. These regulations also require all calves to be provided with a sufficient quantity of fresh drinking water every day and at all times during hot weather conditions or when they are ill.

19. WOFAR requires a record to be maintained of the number of mortalities found at each inspection. All housed calves must be inspected at least twice a day and all calves kept outside must be inspected at least once a day.

20. The Code of Recommendation for the welfare of livestock (Cattle) (2003)<sup>14</sup> and similar legislation in devolved countries provides guidance on the keeping of calves according to the minimum standards laid down in national legislation.

### **National and international considerations**

21. Whilst some laws and guidance relating to minimum requirements for the artificial rearing of calves are similar in other countries with significant dairy industries, there are also some differences. For example, in New Zealand, the Dairy Cattle Code of Welfare (June 2014) states: "Colostrum, milk or milk replacer should be fed at the rate of 10-15% of bodyweight per day during the first week after birth (i.e. about 2-7 litres per day) preferably divided into not less than 2 feeds per day". In the Republic of Ireland S.I. No 311 of 2010, European Communities (Welfare of farmed animals) Regulations states: "All calves shall be fed at least twice a day".

### **Commercial interests and developments**

22. FAWC took evidence from artificial milk suppliers who specialise in the provision of artificial milk replacer to dairy farms. There were differences in their products and how they should be used, i.e. volume, concentration and frequency of feeding.

23. Farmers want to maximise successful calf rearing. However, an overzealous drive to minimise the cost and labour involved can compromise successful calf rearing.

### **Advice by FAWC and EFSA**

24. The Farm Animal Welfare Council's<sup>15</sup> 1997 Report on the welfare of dairy cattle made a number of recommendations with regard to calves including on the provision of colostrum, the feeding regimen and the availability of water.

25. In 1995 the European Commission Scientific Veterinary Committee (Animal Welfare Section) Report<sup>16</sup> on the welfare of calves, made a number of recommendations on the rearing of all calves, including colostrum management, artificial feeding (i.e. non-dam feeding), housing and issues specific to veal calves.

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<sup>14</sup> Code of Recommendations for the Welfare of Livestock: Cattle. Defra. March 2003.

<sup>15</sup> The Farm Animal Welfare Council was closed in March 2011 following a review of public bodies. It was reconstituted as the Farm Animal Welfare Committee. Both Council and Committee use the acronym FAWC.

<sup>16</sup> [http://ec.europa.eu/food/fs/sc/oldcomm4/out35\\_en.pdf](http://ec.europa.eu/food/fs/sc/oldcomm4/out35_en.pdf).

This report states that animal welfare is poor if average growth is reduced substantially, for example, by 50 percent.

26. The European Food Safety Authority (EFSA) 2006 Opinion on the risks of poor welfare in intensive calf farming systems was an update in relation to additional evidence and research gathered since the 1995 Report.

27. The EFSA 2009 Scientific Opinion on overall farming system effects on dairy cow welfare and disease provided evidence relating to the calf-cow bond and recommended further research on the impacts on timing and methods of separation after birth.

28. The EFSA 2012 Scientific Opinion on the welfare of cattle kept for beef production and the welfare in intensive calf farming systems updates information on artificially reared calves including those destined for white and pink veal production systems.

## **EVIDENCE**

### ***Colostrum management***

29. All calves require high quality colostrum from cows exposed to the environment into which the calves are born. Calves that receive inadequate or poor quality colostrum (for good passive antibody transfer) are susceptible to disease. Cows require clean conditions in which to give birth, whether outdoors at pasture or confined in calving accommodation. Adequate colostrum will not protect calves born in unhygienic conditions.<sup>17</sup> High yielding dairy cows often have poor quality colostrum, which should be tested (using a refractometer either optical or digital). The recommendation in the literature is that colostrum fed to calves has a minimum quality of 50g of IgG/L<sup>18 19 20 21</sup> as quality of colostrum is as important as quantity.

30. Best quality colostrum is produced immediately after birth: for example, IgG (antibody) concentrations fall by 17, 27 and 33 percent when collected 6, 10 and 14

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<sup>17</sup> Weaver, D.M. Tyler, J.W. VanMetre, D.C. Hostelier, D.E. Barrington, G.M. Passive transfer of colostral immunoglobulins in calves. J Vet Intern Med. 2000 Nov-Dec; 14(6):569-77.

<sup>18</sup> Besser, T.E., Gay, C.C., Pritchett, L. 1991. Comparison of three methods of feeding colostrum to dairy calves. Journal of the American Veterinary Medical Association 198:419-422

<sup>19</sup> Pritchett, L.C., Gay, C.C., Hancock, D.D., Besser, T. E. 1994. Evaluation of the hydrometer for testing immunoglobulin G1 concentrations in Holstein colostrum. Journal of Dairy Science 77:1761-1767

<sup>20</sup> Chigerwe, M., Tyler, J.W., Schultz, L.G., Middleton, J.R., Steevens, B.J., Spain, J.N. 2008. Effect of colostrum administration by use of oesophageal intubation on serum IgG concentrations in Holstein bull calves. American Journal of Veterinary Research 69: 1158-1163

<sup>21</sup> Elizondo-Salazar, J.A., Heinrichs, A.J, 2009. Feeding heat- treated colostrum or unheated colostrum with two different bacterial concentrations to neonatal dairy calves. Journal of Dairy Science 92:4565-4571



hours after calving.<sup>22</sup> Colostrum quality can also be affected by very short dry periods (less than three weeks).<sup>23</sup>

31. It is increasingly common practice that calves are removed from their dairy mothers within the first 24 hours of life. Calves are sometimes removed from their dam immediately as part of the managerial system and also to prevent infection passing from mother to calf, e.g. salmonellosis or paratuberculosis (Johne's disease).

32. The provision of colostrum from the first milking within the first two hours of the calf's life, and no later than six hours after birth, is paramount to ensure adequate passive antibody transfer; a repeat feeding of this colostrum should be given within the next 6-12 hours.<sup>24 25</sup>

33. There are variations in recommendations for optimal volumes of colostrum provision. It is suggested that calves should be fed 10-12 percent of their birth body weight at the first colostrum feed which equates to approximately 4L for a 40 kg calf.<sup>26</sup> This calculation compensates for poor quality colostrum but this is too large a volume to provide as a single feed to a neonate. In practice, feeding 3L of colostrum in the first two hours followed by a further 3L feed within the next 6-12 hours should overcome problems with lower colostrum quality.

34. Evidence suggests that most dairy calves left with their dams will not suck sufficient colostrum even when observed sucking enthusiastically. Additionally, a delay in first time to suck after birth, particularly after assisted calving, means FPT is much more likely to occur.<sup>27</sup> Successful colostrum ingestion in only 39 percent of calves was recorded for calves left with their dams, when compared with rates of 81 percent and 90 percent in calves fed colostrum either by bottle and teat or oesophageal feeder (calf stomach tube), respectively.<sup>28</sup>

35. It is possible to assess if calves are getting sufficient colostrum by blood sampling calves and measuring total serum or plasma protein concentration using a refractometer. Such monitoring is inexpensive and could be done during the veterinary surgeon's routine herd health visits to assess calf health on selected farms.

36. Optimum colostrum provision results in long-term health benefits including reduced disease events in later life, lower mortality in the post-weaning period and

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<sup>22</sup> Moore, M. Tyler, J.W. Chigerwe, M. Dawes, M.E. Middleton, J.R. Effect of delayed colostrum collection on colostral IgG concentration in dairy cows. *J Am Vet Med Assoc* 2005; 226(8):1375-7.

<sup>23</sup> Rastani, R. R Grummer, R. R. Bertics, S.J. et al. Reducing dry period length to simplify feeding transition cows: Milk production energy balance and metabolic profiles. *J Dairy Sci* 2005; 88:1004-14.

<sup>24</sup> Weaver, D.M. Tyler, J.W. VanMetre, D.C. Hostelier, D.E. Barrington, G.M. Passive transfer of colostral immunoglobulins in calves. *J Vet Intern Med.* 2000 Nov-Dec; 14(6):569-77.

<sup>25</sup> Pritchett, L.C. Gay, C.C. Besser, T.E. Hancock, D.D. Management and production factors influencing immunoglobulin G<sub>1</sub> concentration in colostrum from Holstein cows. *J Dairy Sci* 1991;74:2336-2341

<sup>26</sup> Godden, S. Colostrum Management for Dairy Calves. *Vet Clin Anim* 24 (2008)19-39.

<sup>27</sup> Godden, S. Colostrum Management for Dairy Calves. *Vet Clin Anim* 24 (2008)19-39.

<sup>28</sup> Besser, T.E. Gay, C.C. Pritchett, L. Comparison of three methods of feeding colostrum to dairy calves. *J Am Vet Med Assoc.* 1991 Feb 1; 198(3):419-22.

improved feed efficiency. For dairy heifer calves it has been associated with higher first lactation yields, better fertility and reduced premature culling.<sup>29</sup>

### **Collection and storage of colostrum**

37. Best practice is to collect colostrum from a cow under hygienic conditions to minimise faecal contamination and disease risk (e.g. Johne's disease and salmonellosis). Commercial pasteurisation packages are available to reduce bacterial contamination and prolong refrigerated storage time for at least 8-10 days.<sup>30</sup> Pasteurisation may also improve passive antibody transfer.<sup>31</sup> Surplus colostrum can be frozen and kept for future use.

38. Not all colostrum is appropriate for pooling (combining spare colostrum from several cows) due to disease risk (Johne's) and a reduction in overall colostrum quality as a result of variation in IgG levels from individual milkings.

39. Colostrum should be thawed in a way that limits denaturing of antibodies (less than 60 degrees C) and should never be microwaved. Colostrum can be pasteurised in order to minimise risk of disease, and especially if colostrum is pooled.

### **Feeding**

40. Continued colostrum provision from the first six milkings can benefit the calf's health and welfare in the first two weeks of life.<sup>32</sup> Current advice recommends continuing to feed the calf any spare pasteurised colostrum/first milk 7-10 days after calving.

41. Conventional feeding programmes of two litres of milk twice a day provide calves with 10 percent of their birth weight (up to six weeks of age) as liquid milk per day.<sup>33</sup> It is now known that this is insufficient and results in underfeeding. Behavioural indicators including vocalisation<sup>34</sup> and reduced play behaviour<sup>35</sup> support the physiological evidence that restricted-fed calves are likely to be hungry for much of their early life.

42. Low nutrient intake may contribute to high rates of calf mortality and morbidity,<sup>36</sup> during the rearing period. In addition, further evidence suggests it

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<sup>29</sup> Godden, S. Colostrum Management for Dairy Calves. *Vet Clin Anim* 24 (2008)19-39.

<sup>30</sup> Bey, R. Godden, S. Lillegaard, H. et al. Improving cleanliness and shelf-life of refrigerated colostrum using heat-treatment and chemical preservatives. Proc. Annu. Meet. Minnesota Dairy Health Management Conference. St Paul Minnesota, May 15-17, 2007.

<sup>31</sup> Johnson, J. Godden, S. Molitor, T. et al. The effect of feeding heat-treated colostrum on passive transfer of cellular and humoral immune parameters in neonatal dairy calves. *J Dairy Sci* 2007; 90:5189-98.

<sup>32</sup> Andrews, A.H. Colostrum Not Just for 24 Hours. *Cattle Practice BCVA* 2004; Vol 12 Part 2.

<sup>33</sup> Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. *J Dairy Sci.* 94:1071-108. 2011.

<sup>34</sup> Thomas, T.J. Weary, D.M. Appleby, M.C. Newborn and 5-week-old calves vocalize in response to milk deprivation. *Applied Animal Behaviour Science.* 2001; 74:165-173.

<sup>35</sup> Krachun C, Rushen J & Passillé 2010 Play behaviour in dairy calves is reduced by weaning and by a low energy intake *Applied Animal Behaviour science* 122: 71-76.

<sup>36</sup> Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. *J Dairy Sci.* 94:1071-108. 2011.

negatively impacts on long term productivity for dairy heifers, including breeding age and first lactation milk production.<sup>37</sup>

43. Daily requirements of a 45 kg (birth weight) calf, are 325g of milk solids (2.6L whole milk), or for milk replacers 380g of solids (approximately 3L) providing maintenance with no growth under thermoneutral conditions.<sup>38</sup> Increasing the concentration of solids in reconstituted milk, or adding milk powder to cow's milk to increase energy density in a once-per-day feeding system, will not provide sufficient nutrients because this would still exceed the maximum volume that can be consumed. Also, it will contribute to digestive problems and scouring.

44. Beef calves typically suck their dam 8-12 times per day in the first week after birth.<sup>39</sup> Holstein calves left to suck their dams will consume 6 kg of whole milk per day in the first week of life. This increases up to 12 kg of milk per day by week 9.<sup>40</sup>

45. It is known that calves consume liquid milk equivalent to 20 percent<sup>41</sup> of their birth body weight (2.5 percent of birth weight as dry solids) when fed *ad libitum* compared with calves fed restricted diets. This approximates to normal growth when left on the dam.<sup>42</sup> Feeding *ad libitum* in the first three weeks of life delays rumen development and digestion of fibre.<sup>43</sup>

46. In the first four to six weeks of life, milk can be provided *ad libitum* without any detrimental effect on health, particularly recommended for calves with low birth weights. Calves should be fed at least 15 percent of their birth body weight daily to achieve over 50 percent of their growth capacity.<sup>44</sup> Calves fed more milk per day have higher weight gains and consequently express more natural behaviour (play and activity).<sup>45</sup>

47. Dairy calves weighing around 40 kg at birth should receive therefore the equivalent of at least 6L of whole milk or milk replacer equivalent in at least two equal feeds per day. Calves cannot consume 6L of milk in one feed. Consequently calves should not be changed to once-a day feeding of liquid milk for at least the first four weeks of life. This becomes even more important particularly as calf starter

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<sup>37</sup> Moallem, U.D. Werner, H. Lehrer, M. Zachut, L. Livshitz, S. Yakoby, and A. Shamay. 2010. Long-term effects of ad libitum whole milk prior to weaning and prepubertal protein supplementation on skeletal growth rate and first-lactation milk production. *J. Dairy Sci.* 93:2639-2650.

<sup>38</sup> Drackley, J.K. 2008. Calf nutrition from birth to breeding. *Vet. Clin. North Am. Food Anim. Pract.* 24:55-86.

<sup>39</sup> Reinhardt, V. Reinhardt, A. 1981. Cohesive relationships in a cattle herd. *Behaviour* 77:121-151.

<sup>40</sup> Passillé, A.M.B. Rushen, J. Calves' behaviour during nursing is affected by feeding motivation and milk availability. 2006. *Appl. Anim. Behav. Sci.* 101:264-275.

<sup>41</sup> Lorenz, I. Mee, J.F. Earley, B. More, S.J. Calf health from birth to weaning. I. General aspects of disease prevention. *Irish Veterinary Journal* 2011, 64:10.

<sup>42</sup> Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. *J Dairy Sci.* 94:1071-108. 2011.

<sup>43</sup> Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. *J Dairy Sci.* 94:1071-108. 2011.

<sup>44</sup> NRC: Nutrient requirements of dairy cattle (National Research Council) 7 edition. Washington DC National Academy Press 2001.

<sup>45</sup> Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. *J Dairy Sci.* 94:1071-108. 2011.

ration cannot be properly digested in the first three weeks of life and therefore should not be considered as a suitable substitute feed.

48. Calves on automated systems using a teat have feeds planned by computer programming but should be fed a minimum of 15 percent of body weight per day until they are ingesting a kg of solid (concentrate) per day. The automated feeders have the advantage of offering many small feeds of milk spread over a 24 hour period, which mimics natural rearing.

### ***Water provision***

49. Consistent evidence was presented by consultees to suggest that water is often not provided to calves in the first few weeks of life despite it being a legal requirement. It is essential that calves are provided with good quality water, beyond what is consumed as part of the liquid diet, because this is incorporated into the body mass in greatest amounts during growth of the young calf (65-75 percent of total body weight). Intake of calf starter ration is also greatly influenced by water intake.<sup>46</sup>

### ***Solid feeds***

50. Solid feed or calf starter ration available from the first few days promotes rumen development of the calf. The calf's appetite increases as it gains age, weight, and as rumen development progresses. Calves can be weaned when they are consuming a minimum of 1 kg of concentrate per day at around six weeks old. A smooth transition from milk to solid feed is important to minimise weight loss and distress at weaning.<sup>47</sup> A stepped approach to weaning from milk to solid food has been suggested for optimum growth of calves,<sup>48</sup> which involves feeding milk at 20 percent of birth body weight for their first 3-4 weeks of life with milk gradually reduced to 10 percent of their birth body weight for the remaining pre-weaning period.<sup>49</sup> This maximises growth in the early weeks of rearing whilst minimising impacts on growth rate at weaning. It is also important to ensure fibre provision from two weeks of age to reduce the occurrence of abnormal oral behaviours and to develop rumen function.

### ***Assessment of calf growth rate***

51. Measurement of calf weights during the early rearing period to weaning is the key to ensuring appropriate growth and for monitoring the health of the young calf. This can be performed using a conventional scales (preferably) or by the use of girth

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<sup>46</sup> Drackley, J.K. 2008. Calf nutrition from birth to breeding. Vet. Clin. North Am. Food Anim. Pract. 24:55-86.

<sup>47</sup> Weary, D. M, Jasper, J and Hötzel, M. J. 2008. Understanding weaning distress. Appl. Anim. Behav. Sci. 110:24-41.

<sup>48</sup> Khan, M.A. Weary, D. M. von Keyserlingk, A.G. Effects of milk ration on solid feed intake, weaning, and performance in dairy heifers. J Dairy Sci. 94:1071-108. 2011.

<sup>49</sup> Khan, M. A. Lee, H. J. Lee, W.S. Kim, H. S. Ki, K. S. Hur, T. Y. Suh, G.H. Structural Growth, Rumen Development, and Metabolic and Immune Responses of Holstein Male Calves Fed the Milk Through Step-Down and Conventional Methods. Dairy Research Division, 2007. J. Dairy Sci. 90:3376-3387.

measurement tapes. Feeding should be adjusted if performance and growth rates are not on target.

## **CRITICAL ISSUES**

52. There is a lack of clarity as to the true figure for deaths at birth, post natal and perinatal periods.

53. Many dairy calves left with their mothers for the first 12 hours receive inadequate colostrum by suckling.

54. Calves fed only 10 percent of birth weight as milk per day, are underfed.

55. Calves fed between 15-20 percent of birth weight as milk cannot digest this amount in one meal.

56. Many calves are not provided with any water in the first few weeks of life, and thereafter most are not provided with *ad libitum* water.

57. Many calves are not provided with solid feed (calf starter pencils) from the first week of rearing, which prevents early rumen development.

58. Early nutrition from birth to two months of age has a significant impact on subsequent development, growth and future productivity.

59. Many calves reared are not weighed or monitored for growth rates/weight gain during the rearing period. By constantly monitoring growth weights, diets can be changed if necessary in order to achieve target or recommended growth rates.

## **Ethical analysis**

60. Intensive rearing systems should meet the dietary and social needs of young calves, which are included in the Five Freedoms. Indeed, the act of removing a calf from a dam-calf relationship within a herd places an increased duty on the calf's human carer to meet its needs. This includes the obvious dam-replacement activities, such as ensuring frequent and sufficient colostrum provision, frequent and sufficient milk feeding until the calf is old enough to consume sufficient solid feed to be weaned, and providing alternative opportunities for social interaction with other calves. The act of removing a calf also creates new duties, such as managing the increased disease risks associated with early contact between calves of multiple origins that would not arise in a dam-calf rearing situation.

61. All new-born farmed animals, including calves, deserve a life worth living, including when the length of that life is numbered in days. A calf killed at a few days or weeks of age may be considered to have had a life worth living if it receives a level of care that results in an overall quality of life in which, from birth to death, positive experiences outweigh negative experiences. However, the standard for a good life is higher, and a calf cannot be said to have enjoyed such a life if it has not lived long enough to develop a diverse range of normal behaviours.

62. Calf-rearing is an important element of ethically sustainable dairy production, requiring investment in best practice management and stockmanship. Because a good life encompasses both positive welfare experiences and a relatively long and productive life, improving early rearing is a key objective for the dairy industry.

63. The UK dairy industry is characterised by declining cow and farmer numbers (by more than 50% since 1995) and roughly constant milk production due to an increased yield per cow.<sup>50</sup> Productivity has become key to the mainstream industry. From the narrow perspective of short-term outgoings, a restricted feeding programme may be viewed as economically beneficial because it reduces feed cost per unit of milk produced. However, the ongoing costs resulting from reduced overall productivity are likely to outweigh any short-term gains. These costs might include veterinary bills, reduced first lactation yield, disease and cross-infection, reduced feed efficiency and increased mortality (with associated killing and disposal costs). In contrast, adequate early feeding is likely to bring economic benefits through improved first yield, feed efficiency and disease resistance.

64. In dairy farming 'natural' suckler feeding should not be idealised if this means that a calf ingests insufficient colostrum. Farmer intervention in early feeding, which is a feature of the intensification of the industry, undoubtedly promotes welfare. Nevertheless, the trend towards increasing herd size means that the negative welfare impacts of poor decisions and interventions are multiplied through a larger herd. It is therefore increasingly important that traditions around early feeding are informed by evidence.

## **RECOMMENDATIONS**

65. Farmers must comply with the legislation and collect data on their farms of all calves born dead and dying in the immediate post natal and perinatal periods in order to determine the true rate of loss. Data of this nature is fundamental to triggering investigation as to causation of such deaths.

66. Farmers should ensure calves receive at least 3L of high quality first drawn colostrum within the first six hours (ideally within the first two hours after birth). A further 3L should be given 6-12 hours after birth.

67. Farmers must feed their calves at least twice per day up to six months of age. For the first four weeks of life it should be with whole milk or artificial milk. The total daily feed should be 15 to 20 percent of birth weight, as fresh whole milk or re-constituted milk powder which delivers an equivalent amount of metabolisable energy and protein, and should be divided between the daily feeds.

68. Farmers should not provide the daily liquid milk ration as a single feed for consumption in one meal, i.e. "once-a-day feeding", during the first four weeks of life. It is acceptable for the day's milk supply to be provided once per day when calves

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<sup>50</sup> The structure of the GB dairy farming industry - what drives change? The Andersons Centre, 2013.

are being fed 'ad libitum' (i.e. where they do not consume their total daily feed in one go but return several times to complete their feeding throughout the day).

69. Farmers must continue to check all housed calves at least twice per day and calves kept outside at least once per day, irrespective of the milk feeding systems used in the first months of life.

70. Farmers should provide calf starter ration from an early age to encourage rumen development, however, this cannot be regarded as a 'feed' in the first four weeks of life.

71. Calves require at least two liquid feeds per day to gain sufficient nutrition. Only when solid feed can be properly digested should it be considered a 'feed'. Roughage should be provided from two weeks of age.

72. All calves must be provided with a sufficient quantity of fresh drinking water every day from birth and at all times in hot weather or when they are ill. FAWC recommends that fresh water be provided at all times irrespective of hot weather or illness.

73. Farmers should weigh calves regularly to monitor growth rates, either in a weigh-crush or using a measuring growth/weight tape. Diets can be changed as necessary in order to achieve target or recommended growth rates.

## Appendix 1 – Acknowledgements

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## **Appendix 2 – Membership of FAWC (December 2014)**

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