

# Feeding behaviour and weaning of milk-fed dairy calves

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Thanks: Fernando Borderas, Carla Krachun, Brigid Sweeney, Elsa Vasseur, Sue Vickers, Dan Weary, Nina von Keyserlingk, Gosia Zdanowicz



Agriculture and  
Agri-Food Canada

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Agroalimentaire Canada

Canada

In North America, dairy calves are typically

- separated from their mother at birth
- raised in individual housing until weaned off milk
- fed milk or milk replacer at 8-10% BW/d in two meals from a bucket
- weaned off milk at 6-8 weeks of age
- mortality rate 8-12% before weaning



# Issues

1. Early care of calves: colostrum intake, heat lamp
2. How much milk to feed
3. Predicting illness with automated milk feeders
4. Weaning off milk

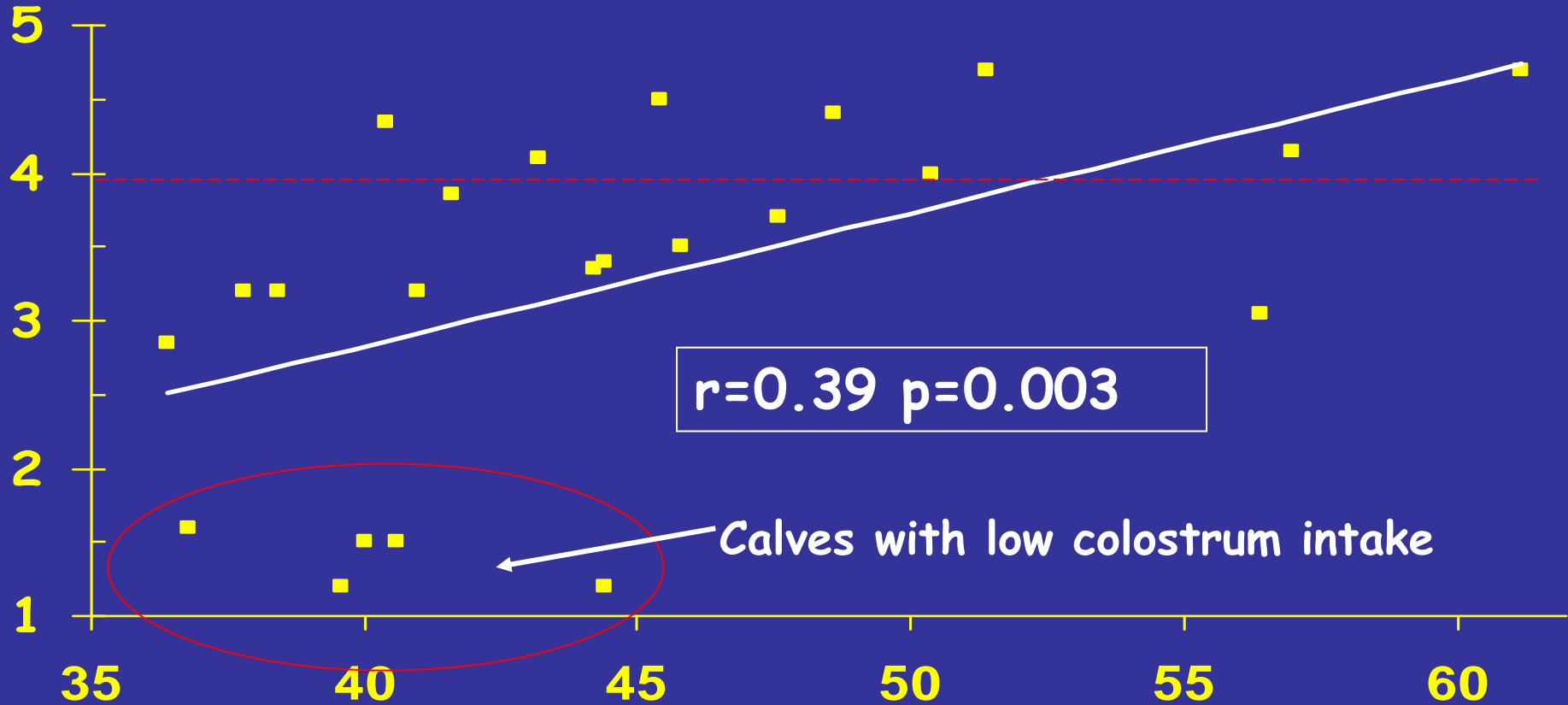
# Sucking motivation of the newborn and colostrum intake

- Sucking motivation of newborn and colostrum intake
- no effect of time since birth (2h versus 6h) or of heat lamp
- effects of body weight and calf vigour



# Motivation to ingest colostrum at first meal varies between calves and is related to birth weight

Colostrum drunk (L)



$r=0.39$   $p=0.003$

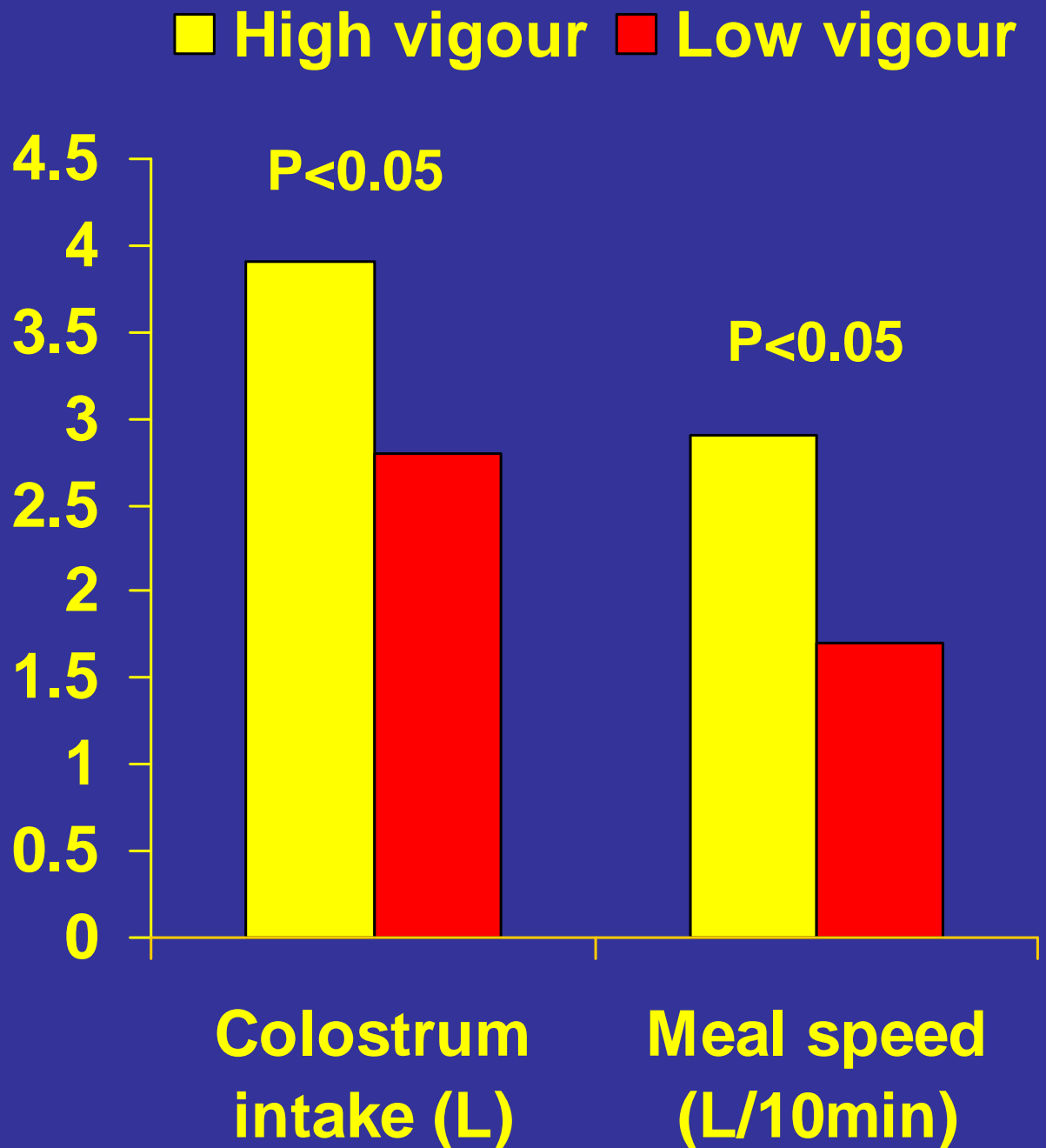
Calves with low colostrum intake

Birth weight (kg)

High calf vigour at birth led to increased colostrum intake and drinking speed

High vigour  $\geq 55\%$  of first hour after birth standing

Low vigour  $< 55\%$  of first hour after birth standing



# Do calves need an external source of heat ?

## Low temperatures

- Increase mortality
- Increase protein degradation
- Impair absorption of IG from colostrum
- Increase pneumonic lesions



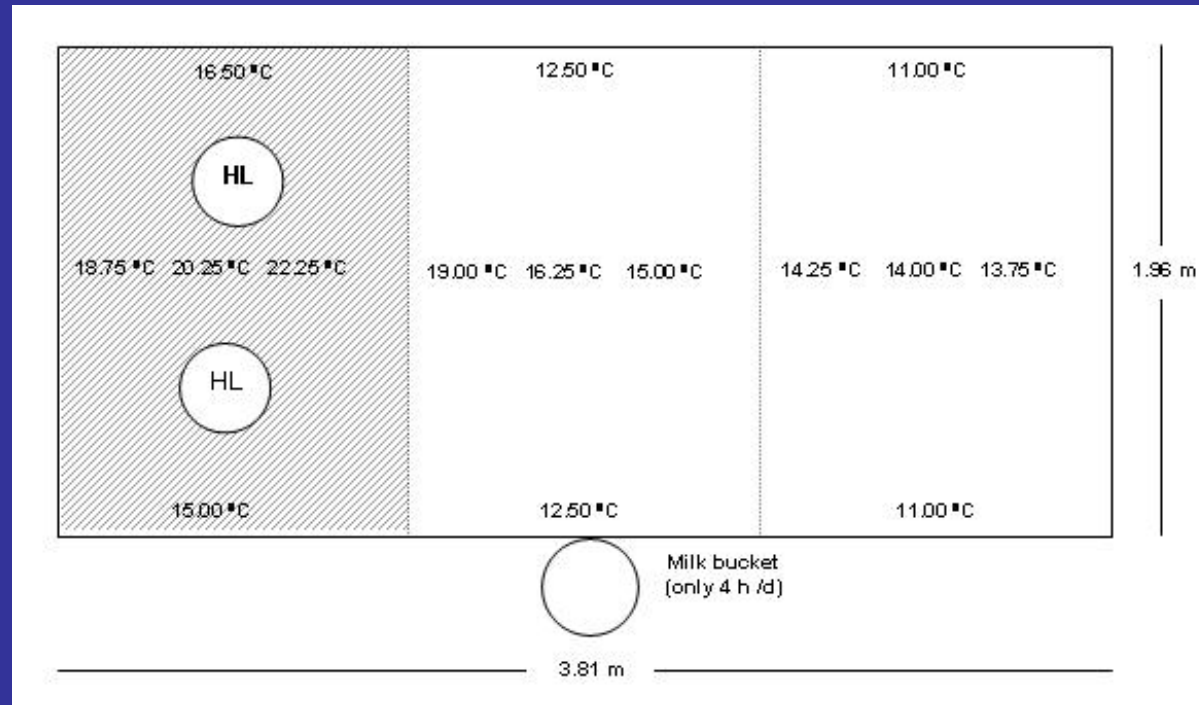
# Do calves recognize and use an external source of heat?



**Borderas, T.F.**, A.M.B. de Passillé, and J. Rushen. 2009. Temperature preferences and feed level of the newborn dairy calf. *Appl. Anim. Behav. Sci.* D.08-291

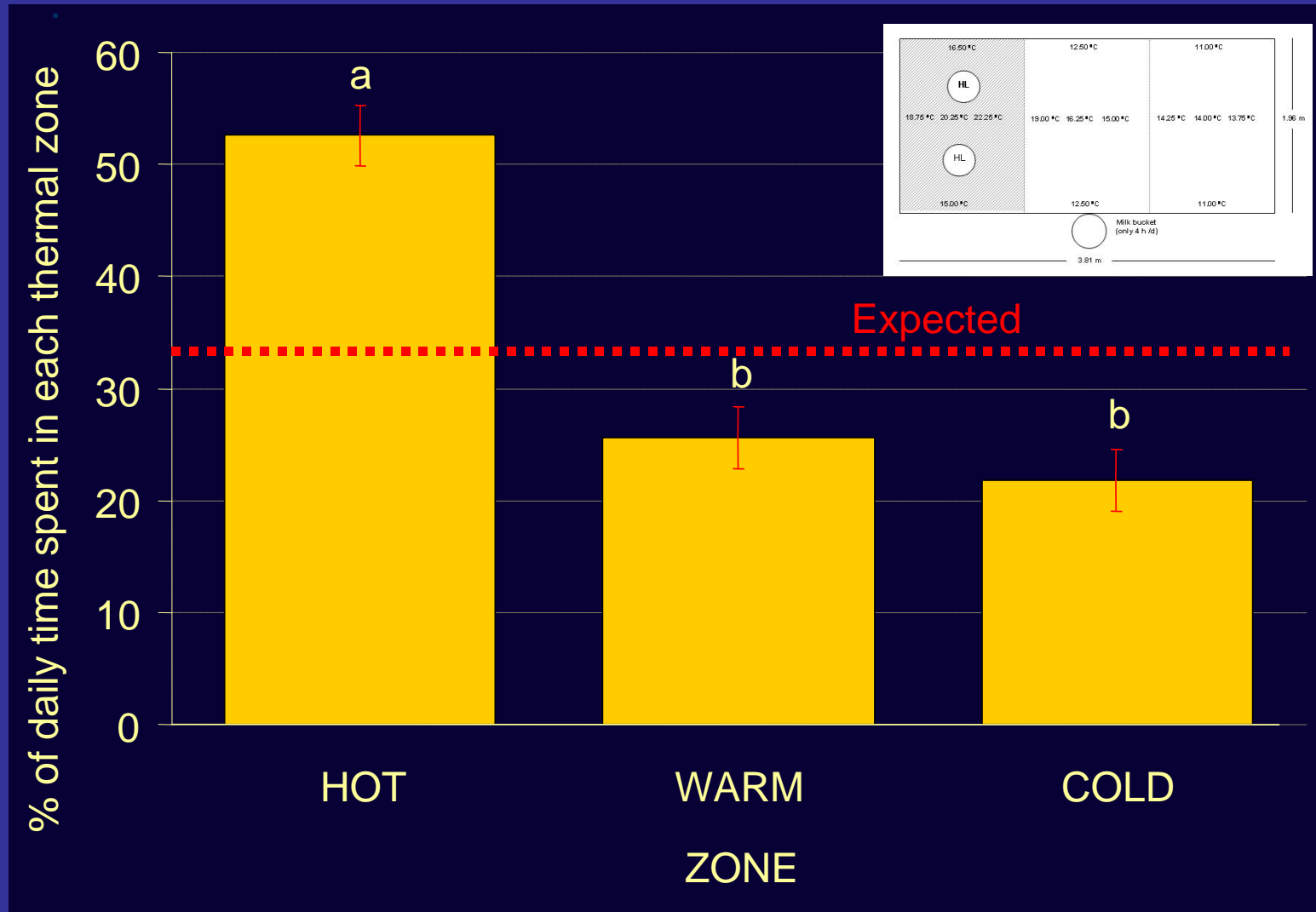


# Preference test layout



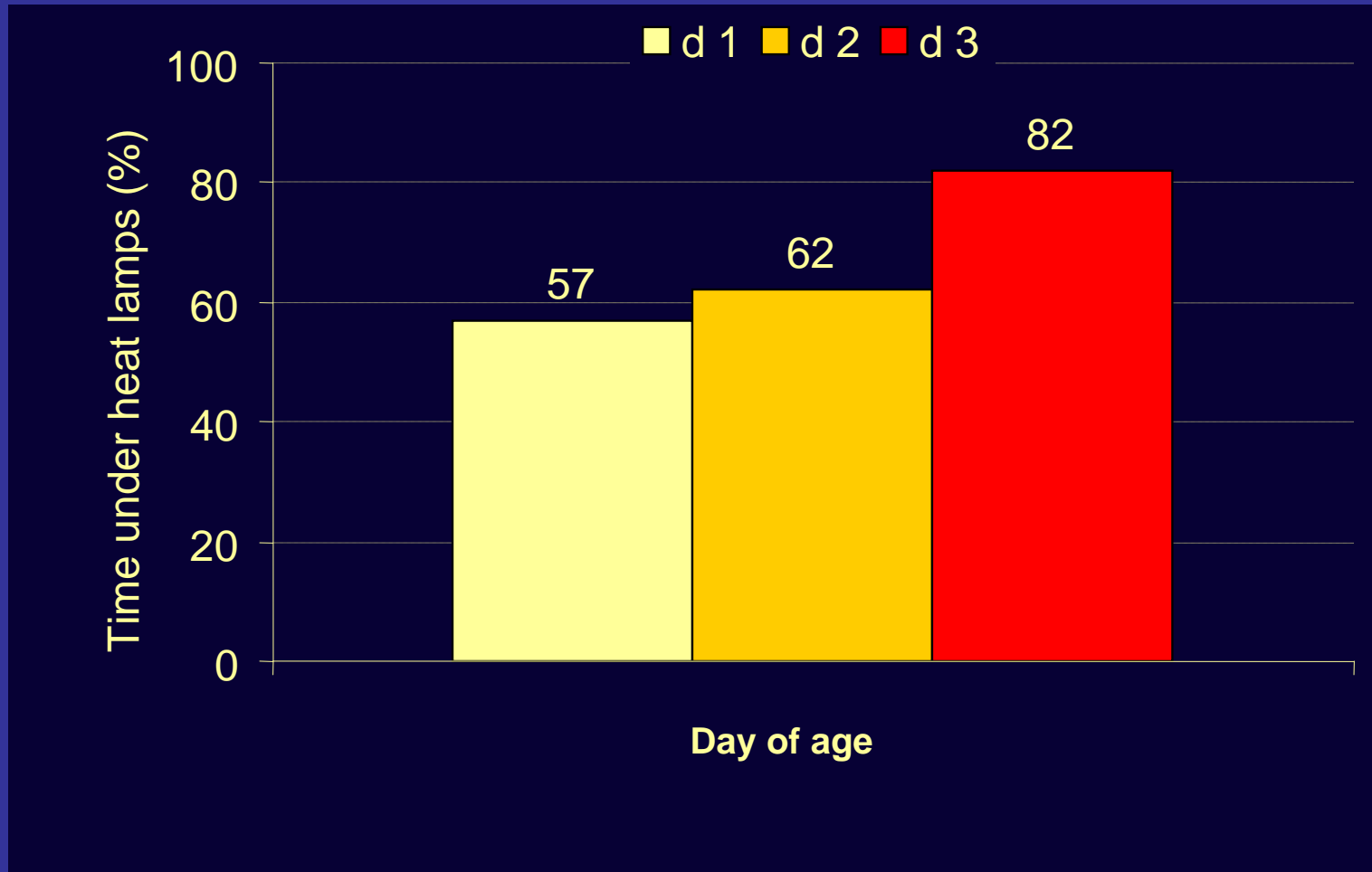
**Borderas, T.F.,** A.M.B. de Passillé, and J. Rushen. 2009. Temperature preferences and feed level of the newborn dairy calf. *Appl. Anim. Behav. Sci.* D.08-291

# Calves prefer heat



**Borderas, T.F.,** A.M.B. de Passillé, and J. Rushen. 2009. Temperature preferences and feed level of the newborn dairy calf. *Appl. Anim. Behav. Sci.* D.08-291

# Calves use heat source more as they age



**Borderas, T.F.**, A.M.B. de Passillé, and J. Rushen. 2009. Temperature preferences and feed level of the newborn dairy calf. *Appl. Anim. Behav. Sci.* D.08-291

# An external source of heat could help identify ill calves

Even well fed calves (30 % BW) show a strong preference for an external source of heat



# Temperature recording



**Borderas, T.F.**, A.M.B. de Passillé, and J. Rushen. 2009. Temperature preferences and feed level of the newborn dairy calf. *Appl. Anim. Behav. Sci.* D.08-291

How much milk should  
we feed?

What is "natural", biological?



## Conventional feeding

- fed milk at 4-6L/d
  - grow about 0.5kg/d
  - weaned off milk at 6-8 weeks of age



## Nursing from cow

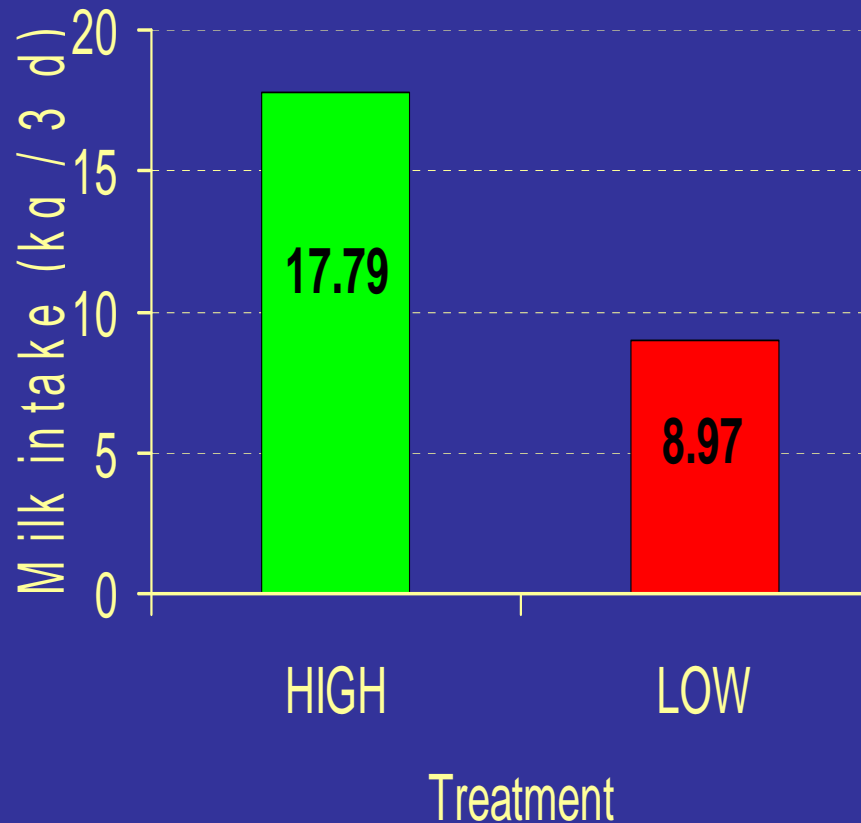
- drink 8-12L/d of milk,
  - grow about 1kg/d
  - are weaned at 8-10 months of age



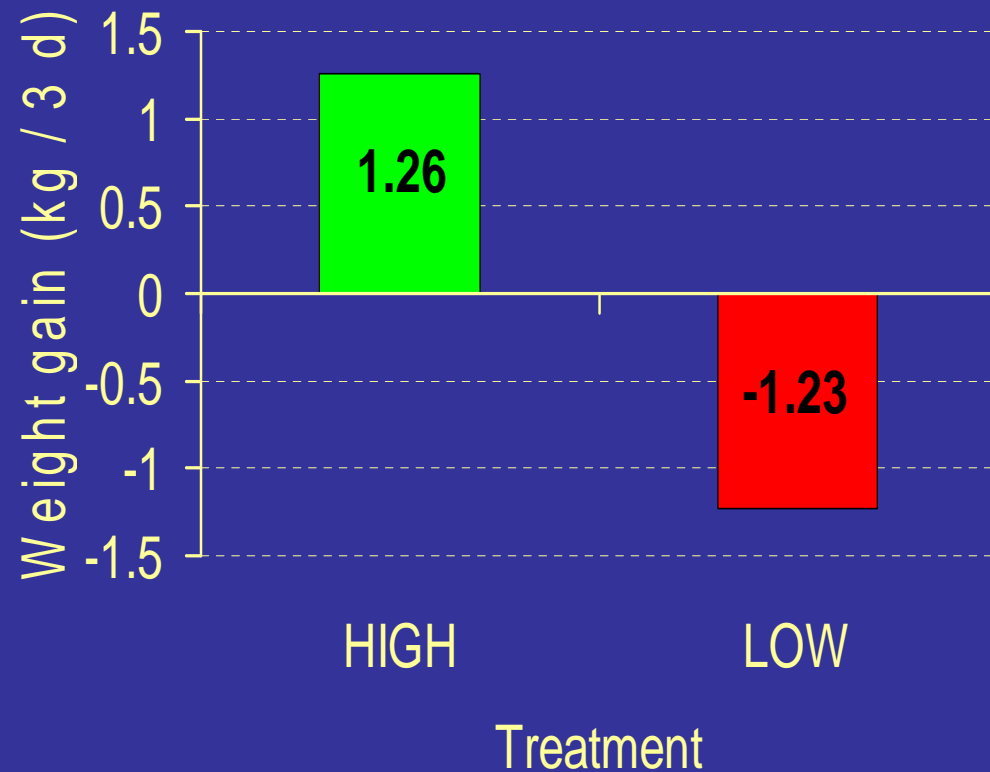
de Passillé, A.M.B., Rushen, J. (2006) *Applied Animal Behaviour Science*, 101 264-275.

# Conventional feeding during the first 3d of life leads to weight loss

## Milk intake kg/3d



## Weight gain kg/3d



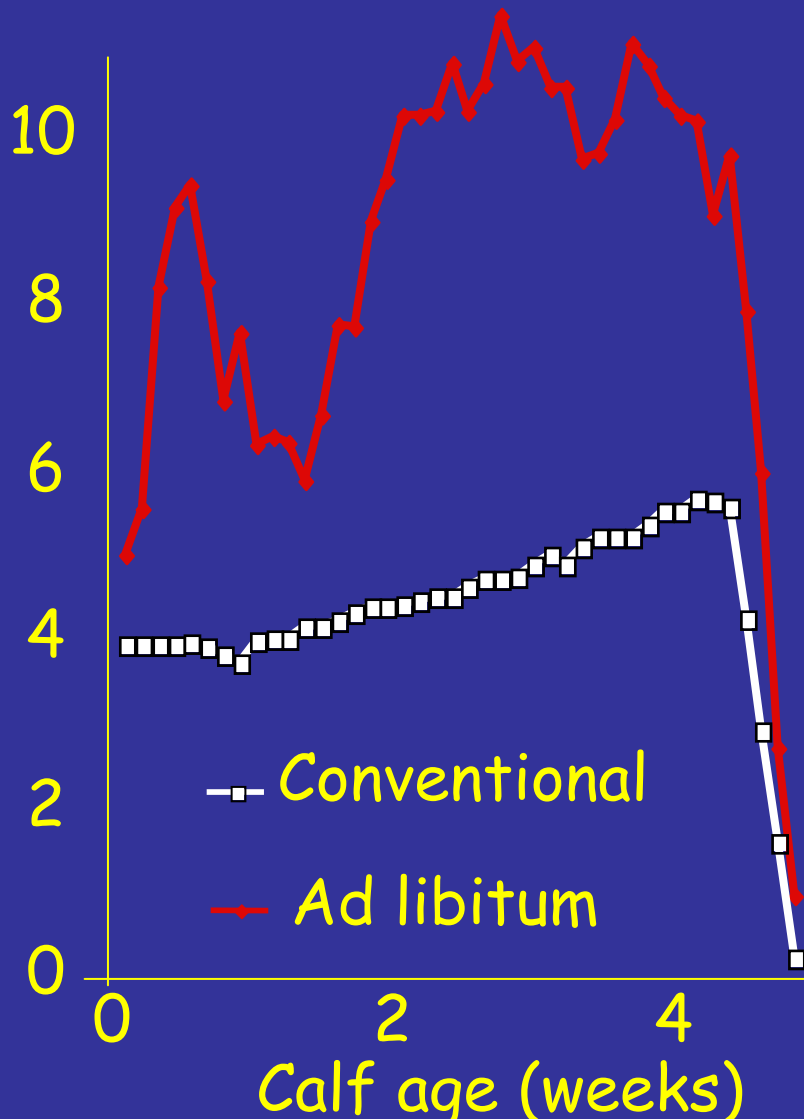
**Borderas, T.F.**, A.M.B. de Passillé, and J. Rushen. 2009. Temperature preferences and feed level of the newborn dairy calf. *Appl. Anim. Behav. Sci.* D.08-291



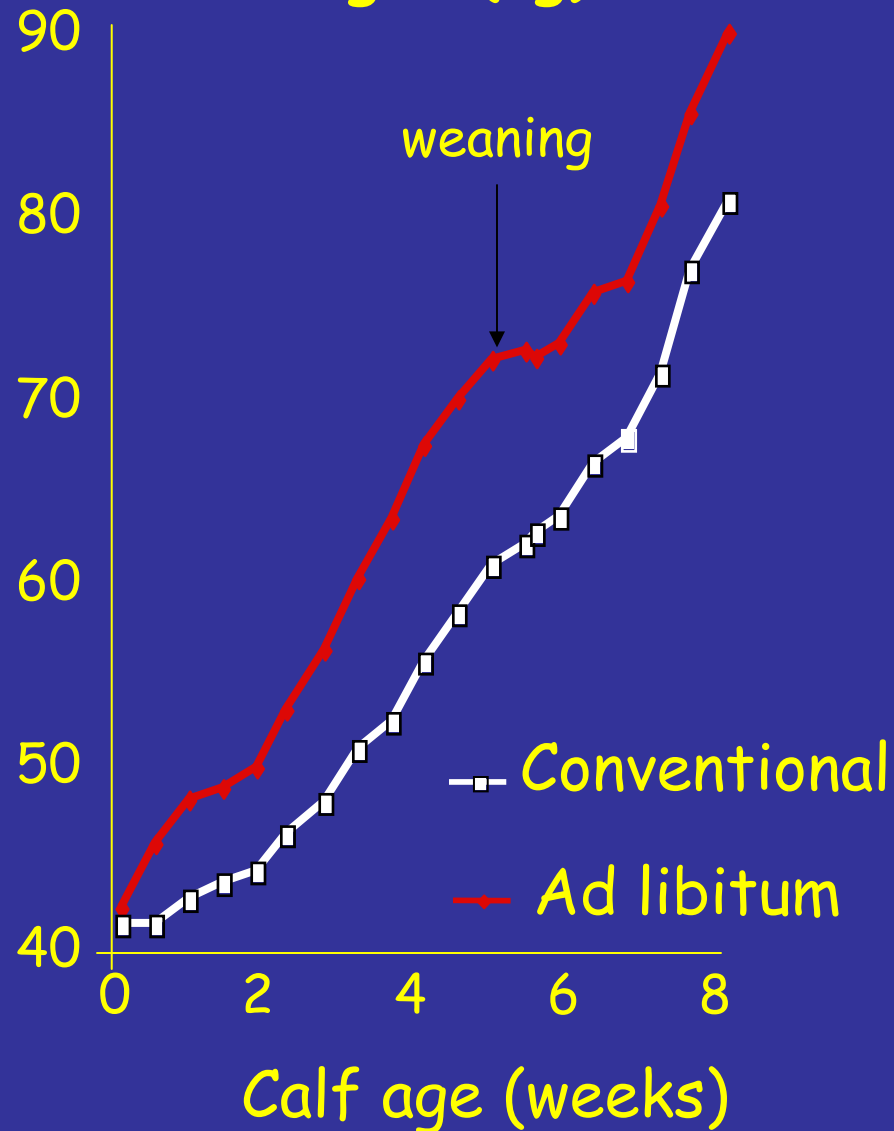


# Ad lib milk feeding of dairy calves

## Milk consumed (kg/d)



## Calf weight (kg)

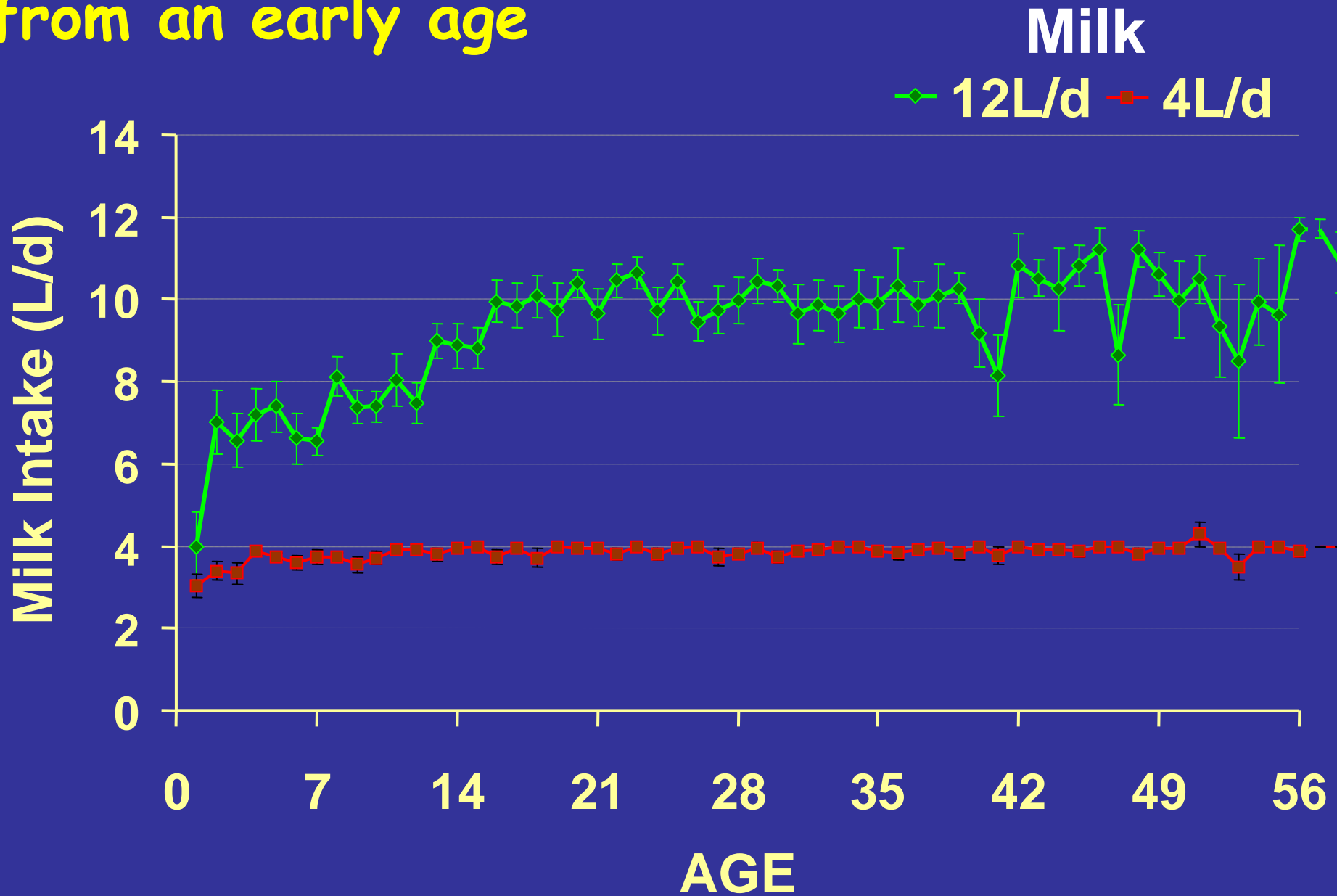


# Compared feeding and growth of calves fed either 12L/d of milk or 4L/d of milk from an automated milk feeder

**Borderas, T.F., A.M.B. de Passillé, and J. Rushen. 2009. Feeding behavior of calves fed small or large amounts of milk. J. Dairy Sci.**



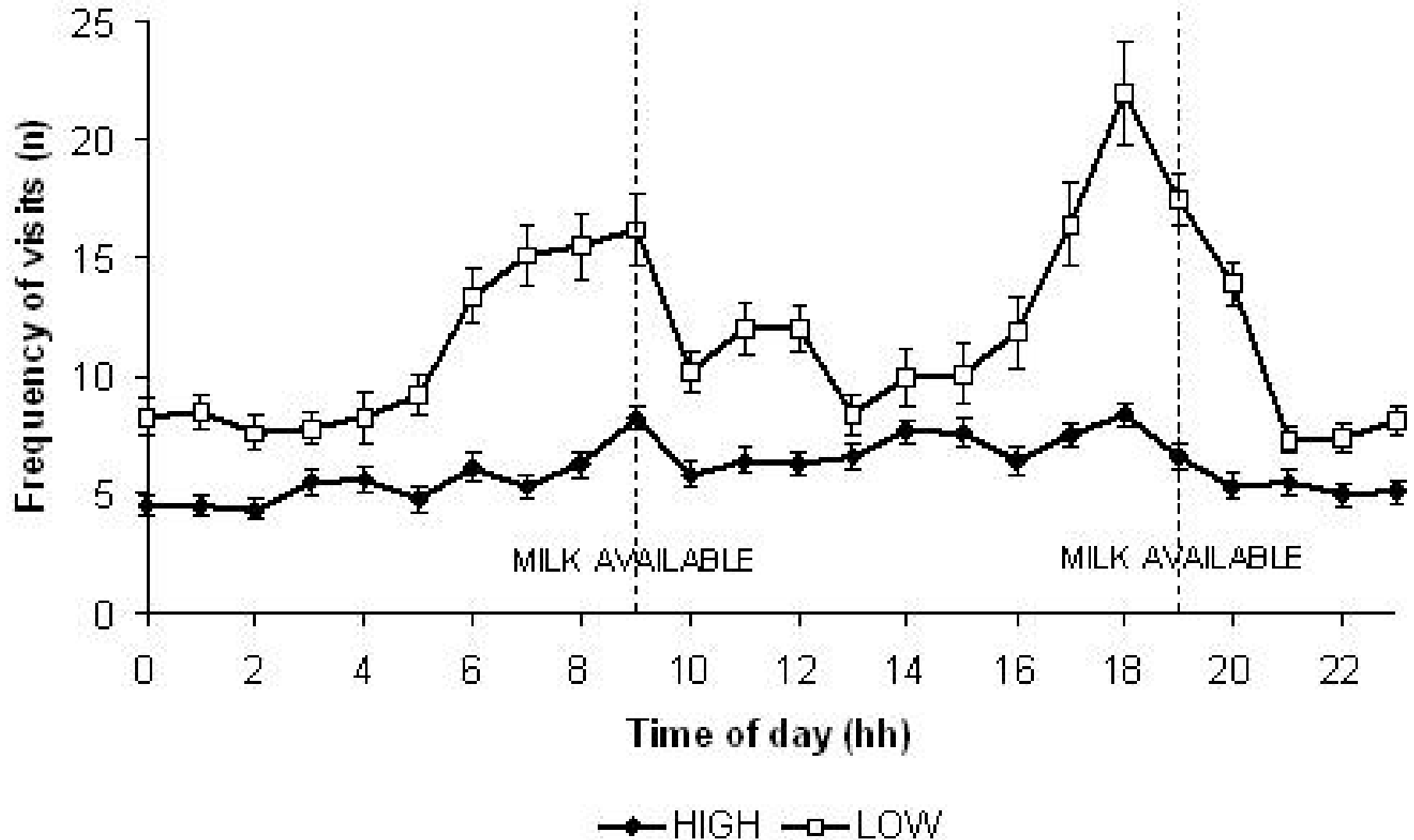
# Calves drink large volumes of milk even from an early age



Calves fed large amounts of milk have more, smaller meals of milk but make fewer visits to the milk feeder

Milk meals	Ad lib fed	Restrict fed
Total visits to feeder /d	7.4	26
Meal frequency /d	5.3	2
Meal Size (kg)	1.6	2.3

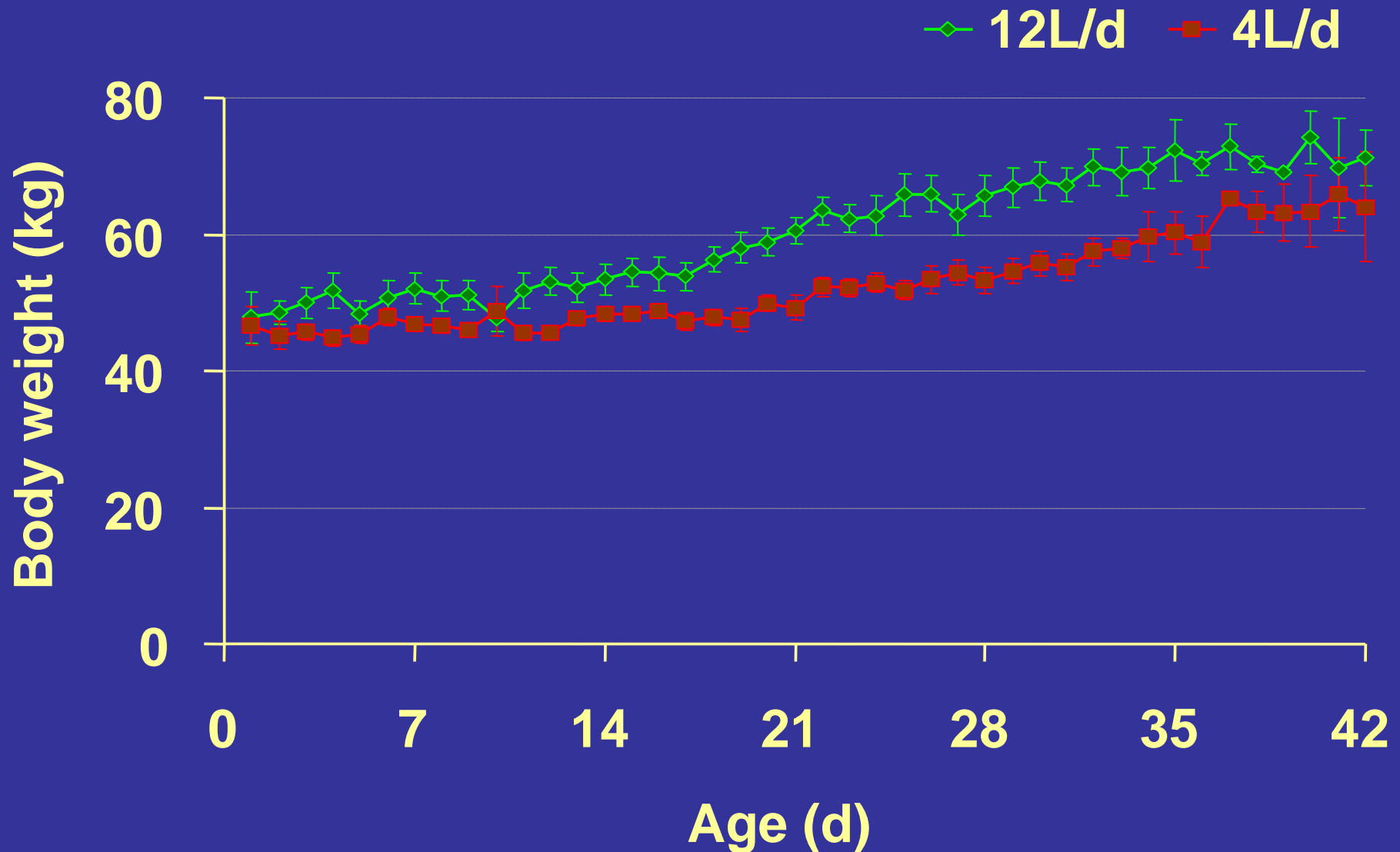
# Low milk fed calves visit around time when milk becomes available



# A high intake of milk reduces intake of solid starter



# Increased milk intake increased growth rates despite lower starter intake

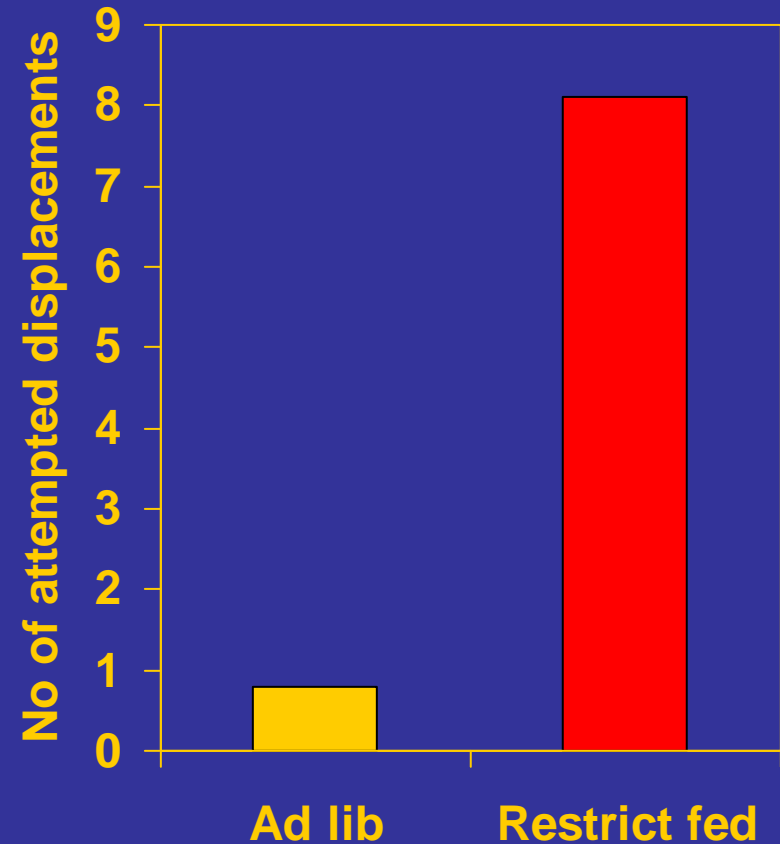


# No Effects on calf health

	High milk fed	Restrict fed
Gastro intestinal problems	13/25	8/25
Respiratory	9/25	8/25
Total morbidity	15/25	15/25



# Ad lib feeding reduced attempted displacements at the milk feeder



Feeding dairy calves larger amounts of milk (12L/d or ad libitum):



Increases weight gain during the milk-feeding period

Improves feed conversion efficiency

Reduces behavioural signs of hunger

Does not reduce the health of the animals

May increase milk production during the first lactation

How to wean calves off  
large amounts of milk

Group-housed calves show little cross-sucking if fed sufficient quantities of milk and have enough opportunities to suck

.....but what happens when they are weaned?



Can gradual weaning reduce the growth check observed during and after weaning in *high milk fed* calves?

Does gradual weaning reduce cross-sucking?

## Optimal weaning strategies for high-milk-fed dairy calves

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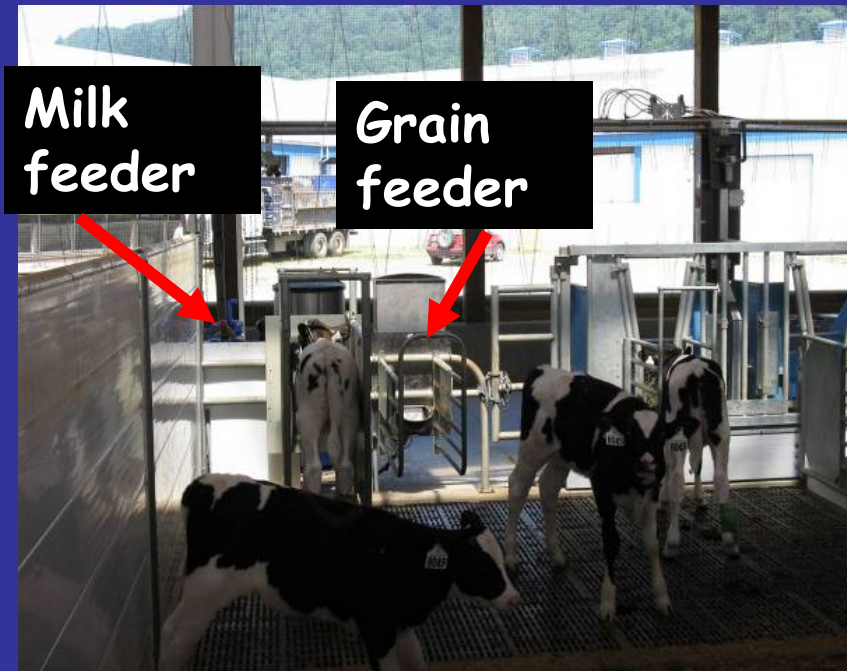
Agriculture and  
Agri-Food Canada

# Methods

Calves fed with  
automated milk +  
grain feeders

4 calves/pen

9 repetitions



Calf is recognised by the feeder,  
milk and grain intake are recorded  
and can be controlled

# Treatments

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1. Abrupt weaning - 12L/d until 41d
2. Start 19d of age reduce milk allowance by 0.5L/d for 22d weaning
3. Start 31d of age reduce milk allowance by 1.1L/d for 10d weaning
4. Start 37d of age reduce milk allowance by 2.4L/d for 4d weaning

# 11 Days of x-sucking observations

Day

9 All offered 12L/d of milk

18 ← Start 22d weaning

24

30 ← Start 10d weaning

36 ← Start 4d weaning

39

40

41 ← Abrupt weaned

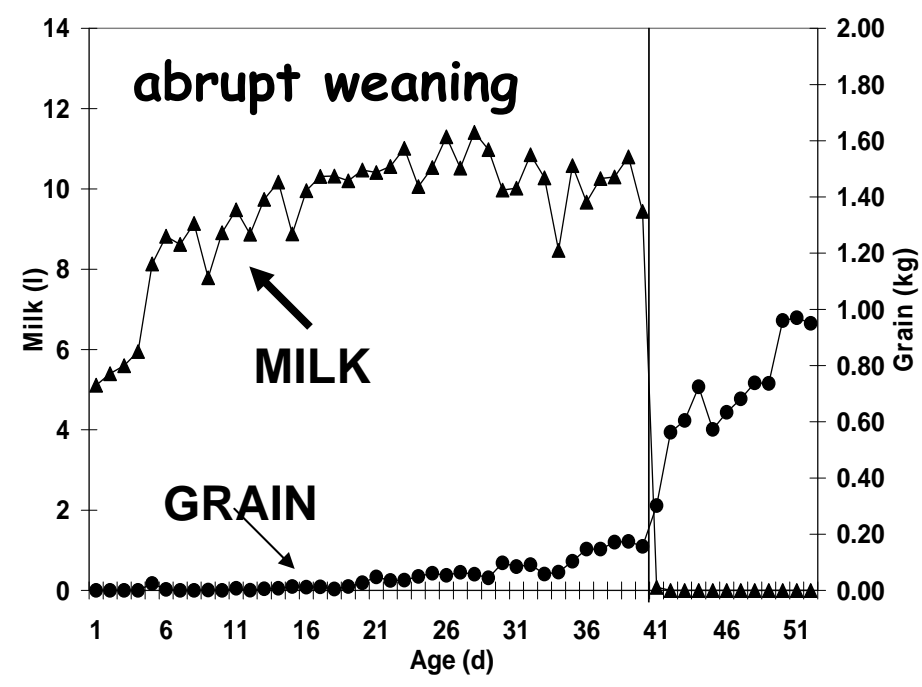
Weaning completed -  
no milk

42

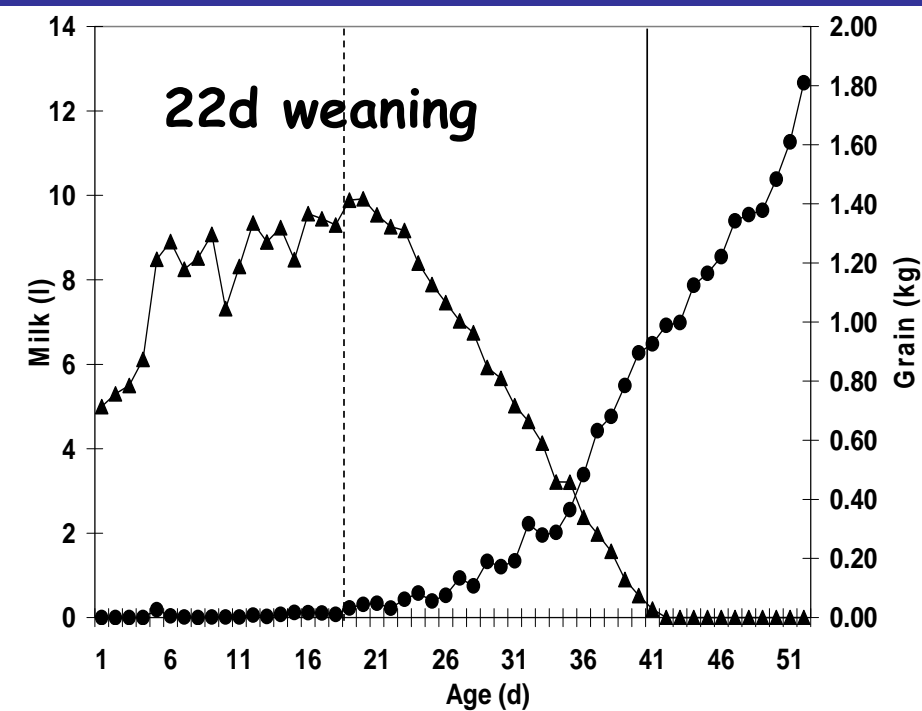
46

49





**Gradual weaning  
increased grain  
intake during and  
after weaning**



**Digestible energy (DE)  
intake estimated for  
milk, grain and total  
energy intake**

1. Gradual weaning decreases *energy intake* before weaning but increases energy intake after weaning

2. Abrupt weaning leads to little cross-sucking before weaning but much cross-sucking after

3. Gradual weaning that begins too early (22d) leads to increased cross-sucking before weaning is completed

We measured each calf's level of feeding motivation by the frequency of visits to the milk feeder and the grain feeder and time standing or lying down.

Time spent standing or lying was recorded by activity loggers attached to a leg



A calf's frequency of visits to the milk feeder and to the grain feeder and time spent standing were positively correlated, suggesting that they all reflect feeding motivation

*However, the duration of cross-sucking was not positively correlated with any of these*

## Conclusions:

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When fed high quantities of milk from a teat feeder, calves show little cross-sucking

Abrupt weaning results in an increase in cross-sucking

Gradual weaning does not reduce cross-sucking after weaning

Gradual weaning that starts too early (e.g. before 4 weeks of age) increases cross-sucking before weaning

## Conclusions:

Individual differences in cross-sucking after weaning may not be related to individual differences in feeding motivation

Or may be an alternative way of responding to hunger (rather than visiting the dry feeders)



Can delaying the age at which calves fed large amounts of milk are weaned off milk:

- increase calves' intake of starter before weaning

- reduce weight loss during and after weaning

- reduce behavioural signs of hunger at weaning?

Calves kept in groups of 9;

fed milk and starter from an automated feeder



Treatments:

a). Fed 6L/d milk, weaned off milk at 48d of age

b). Fed 12L/d of milk, weaned off milk at 48d of age

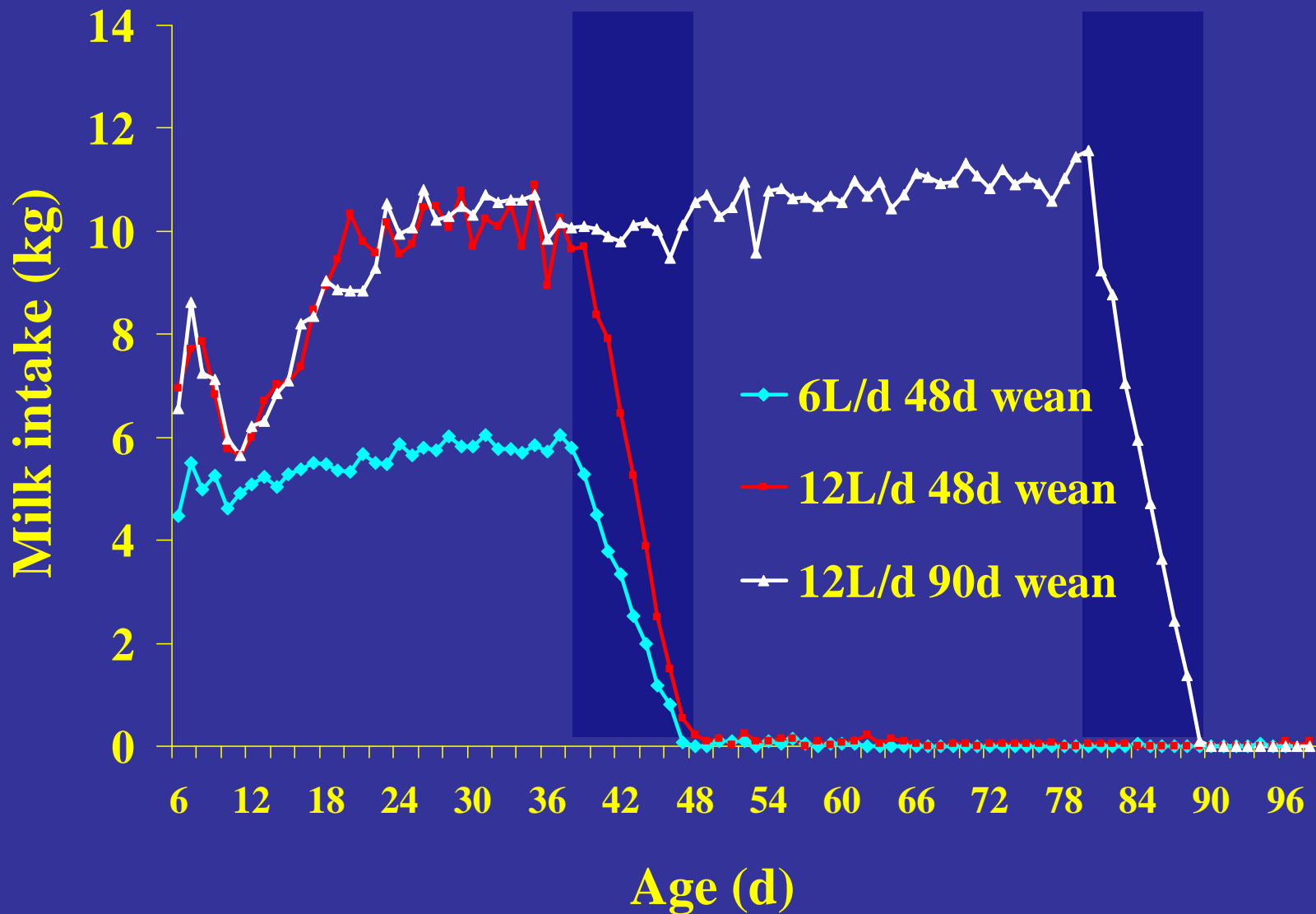
c). Fed 12L/d of milk, weaned off milk at 90d of age

3 calves from each treatment in each group;

Gradual weaning took place over 10d



# Milk intake



## Conclusions:

High milk intake reduced grain intake but later weaned calves increased grain intake more quickly when weaning began

Calves did not eat enough starter to compensate for lost milk. Energy intake decreased at weaning. This was less for later weaned calves

Weaning at 48d led to a drop in body weight among high milk fed calves. This did not occur when calves were weaned at 90d of age

During weaning calves visited the feeder frequently – a sign of hunger. This increase was less for later weaned calves

Which aspects of feeding behaviour of milk-fed calves are affected by illness.

Does the amount of milk fed influence the effect of illness on feeding behaviour?



Calves kept in groups and fed with automated feeding system.

Fed either high (12L/d or ad lib) or low (4L/d) amounts of milk or milk replacer

# Detecting illness through automated monitoring of behavioral changes



Changes in behaviour are one of the first signs that an animal is ill

# Daily health checks

General condition

Dehydration

Rectal temperature

Faecal consistency

Navel status



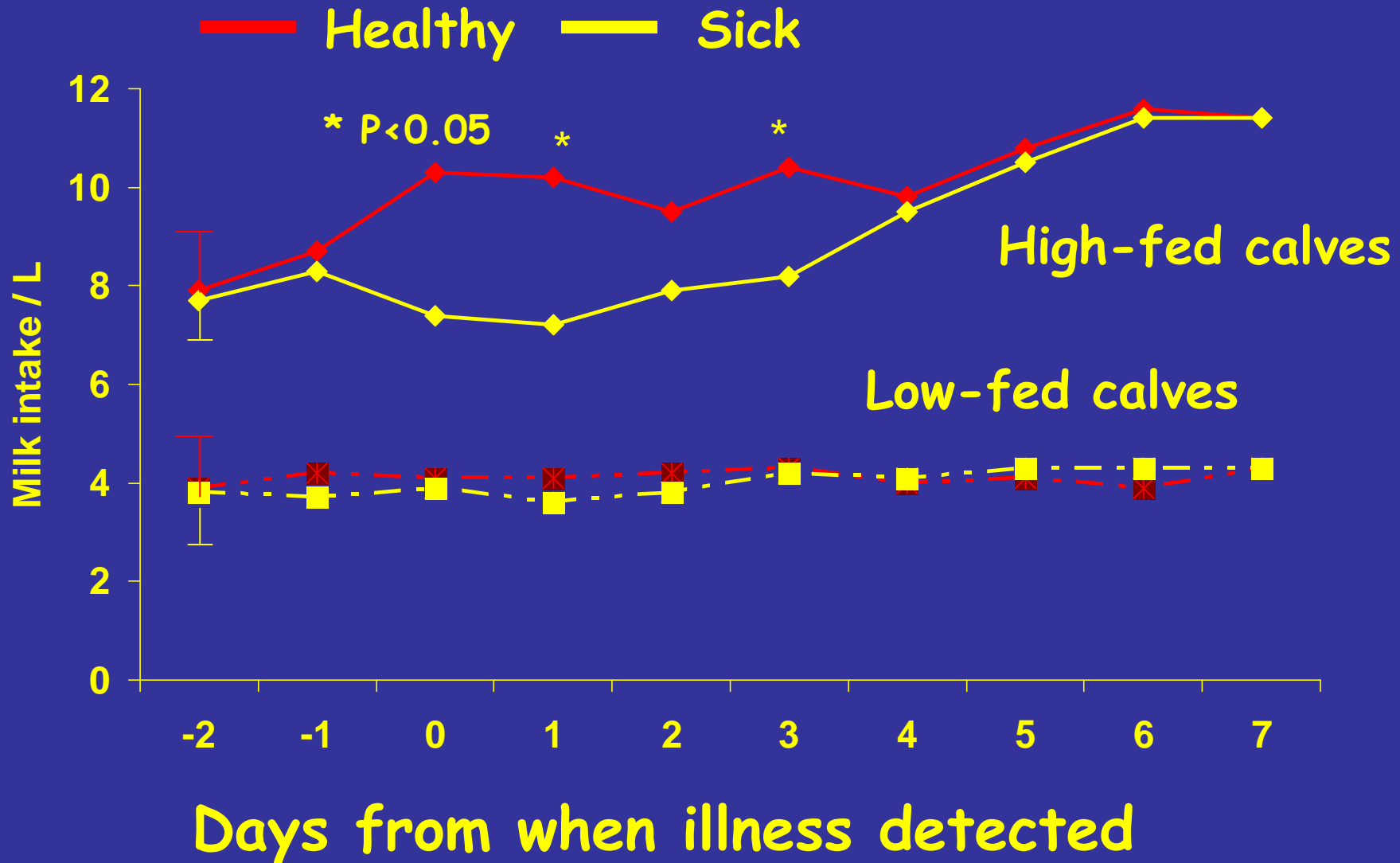
Nasal/ocular discharge

Coughing / Lung sounds

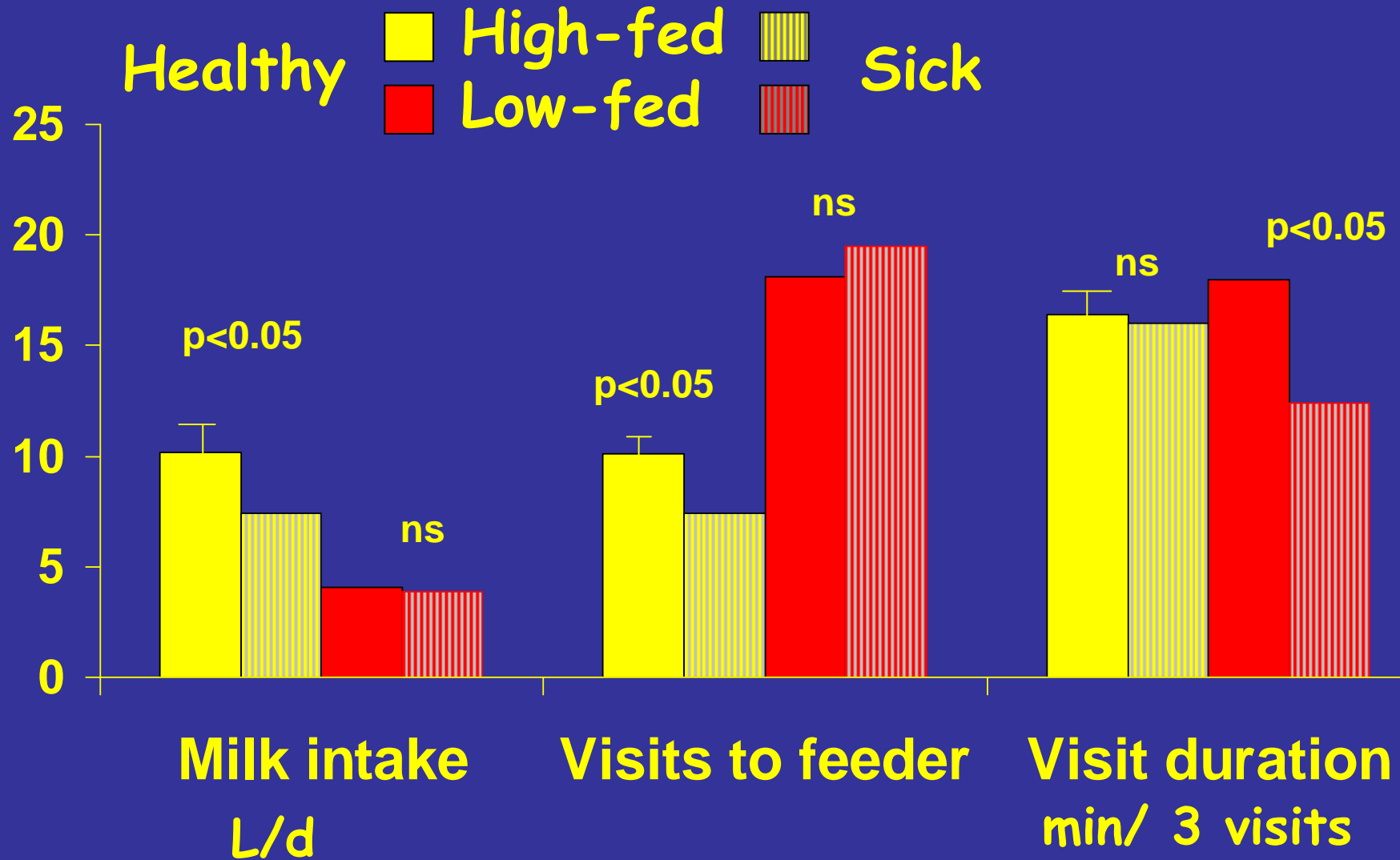
Hair

Muzzle humidity

# Illness reduced milk intake only of calves fed high amounts of milk



# Effects of illness on feeding behaviour depends on feeding motivation



# Improving heifer welfare on farms

- A survey
- An intervention tool





# 1. Problems areas identified in the survey:

Calving management

Pre weaning mortality

Colostrum management

Pain control during dehorning

Milk feeding and Weaning

Despite frequent recommendations, many dairy producers use management practices that increase the health and welfare risks of milk-fed calves.

In particular, inadequate health monitoring and colostrum management practices need to be improved.

## 2. On-farm intervention tool to improve rearing practices

Tested on 30 farms in Quebec

New approach of on-farm management and health data collection

A tool to improve calf and heifers rearing practices

## Intervention has 2 parts:

1. Farmers' part:  
takes samples and records

2. A half-day visit:

An interview to document management practices

a check-list in the barn on housing and other environment measures

→ Observer assigns "marks" and provides recommendations on the 10 key elements of rearing practices

# Farmers' part:

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Farmers take samples (colostrum and blood) and records (mortality and morbidity) during a 6-months period

Farmers tests for colostrum quality and IG transfer level in blood

# Producers measure colostrum quality

We provide colostrometer



# Producers measure blood Ig levels

We provide  
kits

Producers  
take blood  
samples



# Report and discussion

