70th Annual Meeting of the European Federation of Animal Science,
City of Ghent (Belgium), 26 - 30 Aug 2019

Efficient waterlines cleaning protocols in post-weaning rooms: a new way to reduce antibiotic consumption?

Mily LEBLANC-MARIDOR[1]
Sophie BRILLAND[2], Catherine BELLOC[1], Patrick GAMBADE[3]

[1]BIOEPAR, INRA, Oniris, 44307 Nantes, France
[2]CEVA Santé Animale, 53 000 Laval, France
[3]UNIVET Santé Elevage, 22600 Loudéac, Brittany, France.

Context

- Drinking water

  an essential nutrient for animals

  - Solvent and reagent
  - Transport vehicle
  - Osmotic balance
  - Thermal exchanges

- **Correct and safe water supply**,

  in terms of both quality and quantity,

  allows **optimization** of **animal performances**

  while maintening their health

Context

- **Performances can decrease**

  and/or **diseases** may appear

  when the physiological animal's requirements

  are not satisfied

Gogny and Debrueker, 1999

- **Health disorders**,

  like digestive disorders,

  can also be **linked with a poor water quality**

Context

- To guarantee
  the best quality of water
  from the source to the animal troughs

Formation of biofilms
in distribution systems

- Persistent reservoir for **potentially pathogenic bacteria**
- May clog waterpipe and filter **thus restrict water flow**
- Make disinfection difficult
- Can **decrease efficacy of oral treatments**

Wingender and Flemming, 2011

Fairchild and Ritz, 2009

Chazarenc, 2010

Context

- On field, **waterlines cleaning protocols** appear more frequent in poultry farms than in pig farms…

Are poultry farmers

more aware of water quality

than pig producers ?

Context

A previous survey underlined that **the control of water management is more established in poultry farming** compare to pig industry

⇨ **The main differences concern**

- The monitoring of water consumption
- The waterpipe maintenance (systematic cleaning)

70th EAAP Annual Meeting

POSTER 37.18

Water quality: differences of perception and management between poultry and pig producers

C.BELLOC[1], S.BRILLAND[2], P.GAMBADE[3], M.LEBLANC-MARIDOR[1]

[1]BIOEPAR, INRA, 44 307 Nantes, France
[2]CEVA Santé Animale, 53000 Laval, France
[3]UNIVET Santé Elevage, 22600 Loudéac, Brittany, France

Weaning

⇨ **Critical management period**

- Social, environmental and nutritional changes
- Digestive disorders frequent

+/- use of antibiotics

The improvement of water management could help to prevent digestive disorders in weaners and/or to reduce antibiotic consumption during this period

Aim of the study

To evaluate in pig farms during the weaning period
the effects of different mechanical and chemical
waterlines cleaning protocols,
similar to those used in poultry farms

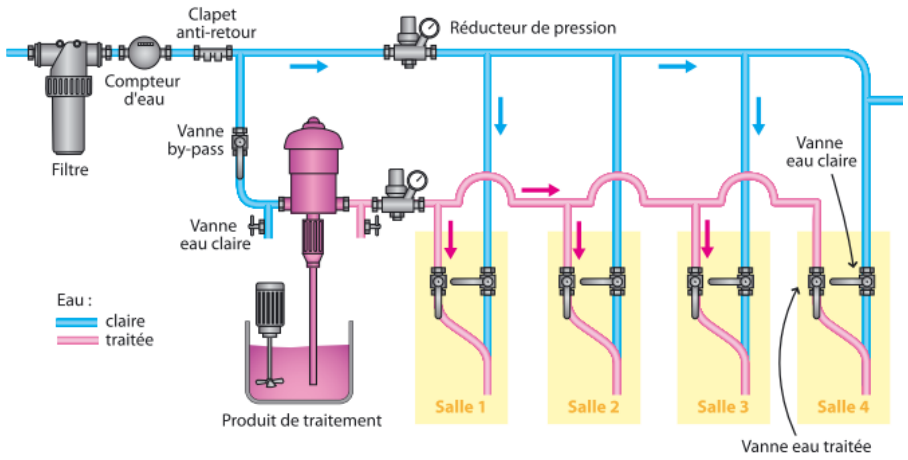
Material and Methods

- *Selection of farms*

➔ Inclusion's criteria (in post-weaning)

- Recurrent problem of digestive disorders
- Two post-weaning rooms
- Specific system for waterlines

Dual water circuit
with a treated water circuit
connected to a metering pump
and a clean water circuit



Material and Methods

- *Selection of farms*

  ➔ three farrow-to-finish farms

    - Located in the West Region in France
    - From one production company

- *Experimental design*

  ➔ two waterlines cleaning protocols set up

    - at the same time in two post-weaning rooms
    - the day before the entrance of the piglets

Material and Methods

- *Waterlines cleaning protocols* (used in poultry farms)

Protocole 1: Post-weaning room 1	Protocole 2: Post-weaning room 2
Mechanical action: line flushing	
Alkaline detergent (Sanolin®: potassium hydroxide) **45 minutes at 1%**	**Enzymatic detergent** (Sanozym®: protease, amylase) **45 minutes at 1%**
Mechanical action: line flushing	
Acid (Sanocidex®: peracetic acid 5%, hydrogen peroxide 14.5%) **1 hour at 2%**	
Mechanical action: line flushing	

Material and Methods

- *Procedure of line flushing (4 steps)*

➔ Mechanical action = water under pressure!

1. Adjusting the pressure reducer to reach 3 bars
2. Opening the drain valve to purge one volume of water
3. Closing the drain valve
4. Opening all the water troughs to purge one volume of water

Material and Methods

- *Mechanical action: flushing water under pressure*

➔ Necessary to pull off the biofilm

- Increase the efficiency of disinfection

Prior to set up the experiment :

- **A terminal drain valve** has been added at the end of each water pipeline of each post-weaning room
- **The pressure regulator of the waterline** system was set at **3 bars** in order to have an efficient mechanical action

Material and Methods

- *Sampling and bacteriological analyses*

➔ To follow the bacteriological water quality

- Enumeration of mesophilic/aerobic flora
- 500mL sterilized collection bottles

Total flora at 37°C and 22°C (CFU/ml)			
Water analysis (CFU/ml)			
Before the metering pump	Water at watering place (troughs)		
	Before protocol	After mechanical action	After protocol

Material and Methods

- *Sampling and bacteriological analyses*

➔ To evaluate the cleanliness of the pipes

- Enumeration of mesophilic/aerobic flora
- Cotton swabs (or sterile nylon swabs)

Total flora at 37°C and 22°C (CFU/ml)	
Cleanliness of the pipelines (CFU/swab)	
Cotton swabs in the water pipes of the troughs	
Before protocol	After protocol

Results and Discussion

- Initial water quality (before the metering pump)

Water quality ?	Total flora at 37°C (CFU/ml)	Total flora at 22°C (CFU/ml)
Farm A	**>100**	**77**
Farm B	<10	<10
Farm C	10	16

⇨ **Recommendations of OIE for animal drinking water quality: 10 CFU/mL**

Results and Discussion

- Water quality on the water line system ?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

Results and Discussion

- Water quality on the water line system ?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

Results and Discussion

- Water quality on the water line system ?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

Results and Discussion

- Water quality on the water line system ?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

⇨ **Bacterial concentrations in water increase along the pipeline**

Results and Discussion

- Potential effect of the mechanical action?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

Results and Discussion

- Potential effect of the mechanical action?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

⇨ **Bacterial concentration can increase after line flushing**

Results and Discussion

- Efficiency of the protocols on water quality?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

Results and Discussion

- Efficiency of the protocols on water quality?

		Total flora at 37°C/22°C (CFU/ml)			
		Water analysis (CFU/ml)			
		Before the metering pump	Water at watering place (troughs)		
			Before protocol	After mechanical action	After protocol
Farm A	*PW1*	>100/77	356/548	19/116	29/34
	PW2		312/95	412/456	9/5
Farm B	*PW1*	<10/<10	17 000/27 000	63 000/380 000	1 000/3 000
	PW2		13 000/110 000	340 000/780 000	800/160
Farm C	*PW1*	10/16	6 000/6 100	410/450	110/92
	PW2		60 000/150 000	180/990	7/3

⇨ **Both protocols reduced total flora, improved water quality**

Results and Discussion

- Efficiency of the protocols to clean the pipes?

		Total flora at 37°C/22°C (CFU/ml)	
		Cleanliness of the pipelines (CFU/swab)	
		Cotton swabs in the water pipes of the troughs	
		Before protocol	**After protocol**
Farm A	*PW1*	660/360	<100/<100
	PW2	60/70	<100/<100
Farm B	*PW1*	2 800/2 500	10/10
	PW2	20 000/20 000	180/20
Farm C	*PW1*	540 000/10 000	60/10
	PW2	5 300/2 300	30/<10

Results and Discussion

- Efficiency of the protocols to clean the pipes?

		Total flora at 37°C/22°C (CFU/ml)	
		Cleanliness of the pipelines (CFU/swab)	
		Cotton swabs in the water pipes of the troughs	
		Before protocol	After protocol
Farm A	*PW1*	660/360	<100/<100
	PW2	60/70	<100/<100
Farm B	*PW1*	2 800/2 500	10/10
	PW2	20 000/20 000	180/20
Farm C	*PW1*	540 000/10 000	60/10
	PW2	5 300/2 300	30/<10

Results and Discussion

- Efficiency of the protocols to clean the pipes?

		Total flora at 37°C/22°C (CFU/ml)	
		Cleanliness of the pipelines (CFU/swab)	
		Cotton swabs in the water pipes of the troughs	
		Before protocol	**After protocol**
Farm A	*PW1*	660/360	<100/<100
	PW2	60/70	<100/<100
Farm B	*PW1*	2 800/2 500	10/10
	PW2	20 000/20 000	180/20
Farm C	*PW1*	540 000/10 000	60/10
	PW2	5 300/2 300	30/<10

⇨ **Both protocols improved cleanliness of pipes**

Conclusions

This study confirmed that **waterlines cleaning protocols** used in poultry farms **can be transferred easily in post-weaning rooms**

⇨ **The setting up of the protocols requires**

- A **drain valve** and a **pressure reducer** (line flushing)
- The add of a **metering pump** (common now in farms)

By **reducing water's total flora** and the **formation of biofilms**, these waterlines cleaning protocols could be part of the **health prevention measures**

Perspectives

The **improvement of water management** could be also **used to reduce antibiotic consumption** especially during this sensitive period

⇨ **It would be interesting**

- To measure the recontamination of water
- To adapt protocols (frequency, type) mixing
  - optimization of water quality for animals
  - convenience for farmers
- To study the potential impact on digestive disorders and/or reduction of antibiotics' use

Thank you for your attention

Efficient waterlines cleaning protocols in post-weaning rooms:
a new way to reduce antibiotic consumption?

Oniris
Nantes-Atlantic National College of Veterinary Medicine, Food Science and Engineering

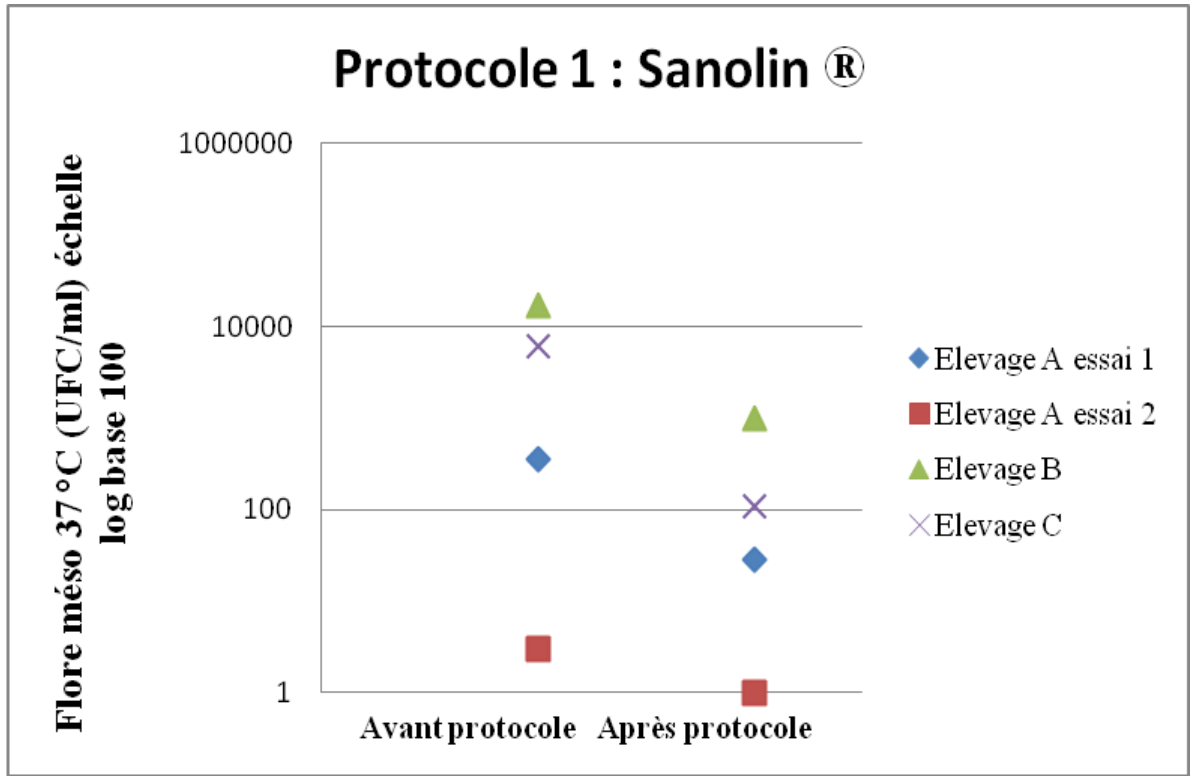
INRA
SCIENCE & IMPACT

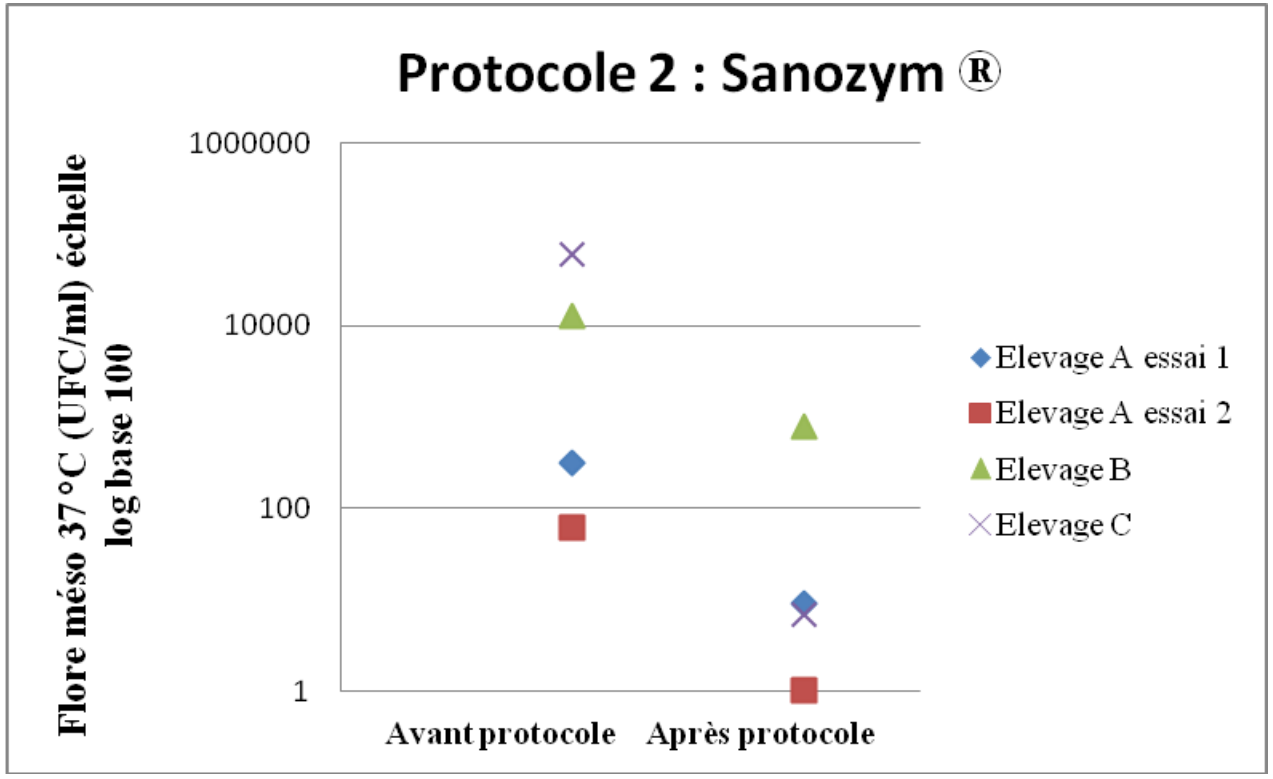
SANDERS
Nourrir nous engage

UNIVET
Santé Élevage

Comparison of the protocols

Evolution of the total flora in water samples





Protocol 2: Higher decrease of total flora in the waterline system

Other measures at the start of the study

	Farm A	Farm B	Farm C
Dureté (°F)	12,5	**7**	**8,2**
pH	**4,75**	**5,14**	7,75
POR (mV)	**274**	**325**	**413**

In bold: value above the standard reference for water quality for human consumption

- Three different biochemical profiles
- Really high level of Manganese
  - x5 to x170 the standard value recommended for human consumption