Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Economic Affairs,
Education and Research EAER

Agroscope

Roughage and type of dispensers: what consequences on horses' feeding behaviour?

M. Roig-Pons, S. Tomozyk, L. Gardes, S. Briefer

Swiss national Stud Farm SNSTF

Agroscope

www.harasnational.ch

UNIVERSITÄT BERN

EAAP • WAAP • INTERBULL • 2023 • LYON • FRANCE
74th

28.08.2023

Introduction – Natural feeding behaviour

16 hours of foraging and food ingestion per day

Voluntary breaks < 4 hours

Particular posture with a lowered head

75,000 chews/day - Satiety hypothetically induced by the fatigue of the masticatory muscles

Waring et al., 2003 – Harris et al., 2005 – Zeitler-Feicht et al., 2012
Weinert et al., 2019 – Meyer and Coenen, 2014

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Introduction – Feeding under domestic conditions

- Two to three meals a day = 6 to 9 hours of feeding
- Fasting periods > 4 hours
- Few movement, use of dispensers
- Gastric issues + Behavioral disorders

Bell et al., 2007 – Lesimple et al., 2016
Henderson, 2007 – Benz et al., 2014

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Introduction - Slowfeeders

«Dispensers that mechanically slow down hay ingestion»

- ↓ **Speed of ingestion** = allow greater forage availability without gain weight
- Modification of the **feeding behavior**
- Modification of the **horse's posture**

Rochais et al., 2017 – Ellis et al., 2015
Speight et al., 2019 – Raspa et al., 2021

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

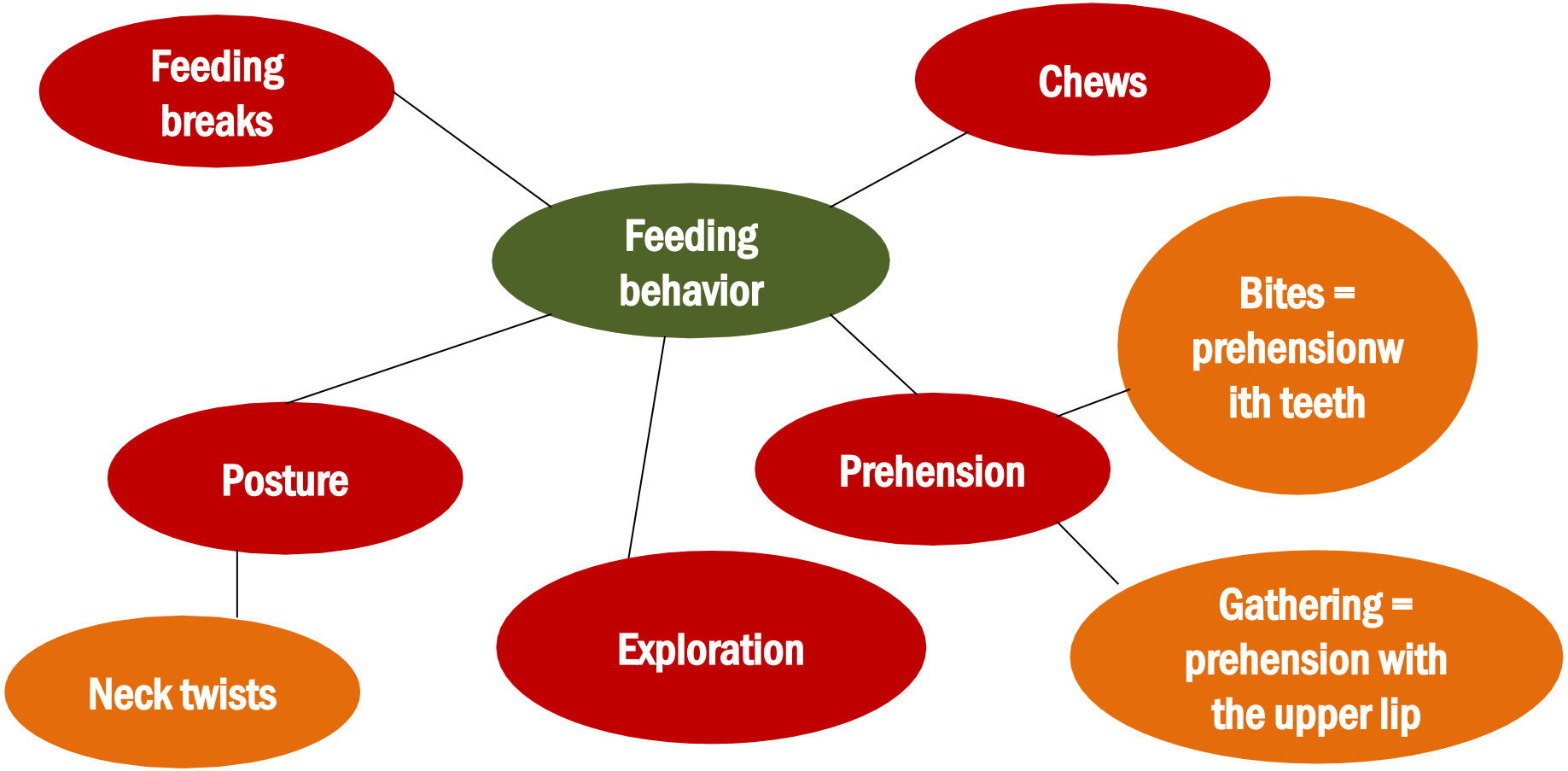
Aim & Hypotheses

→ Compare **feeding behaviour** of horses with **loose hay, grass** and hay in **haynets**

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

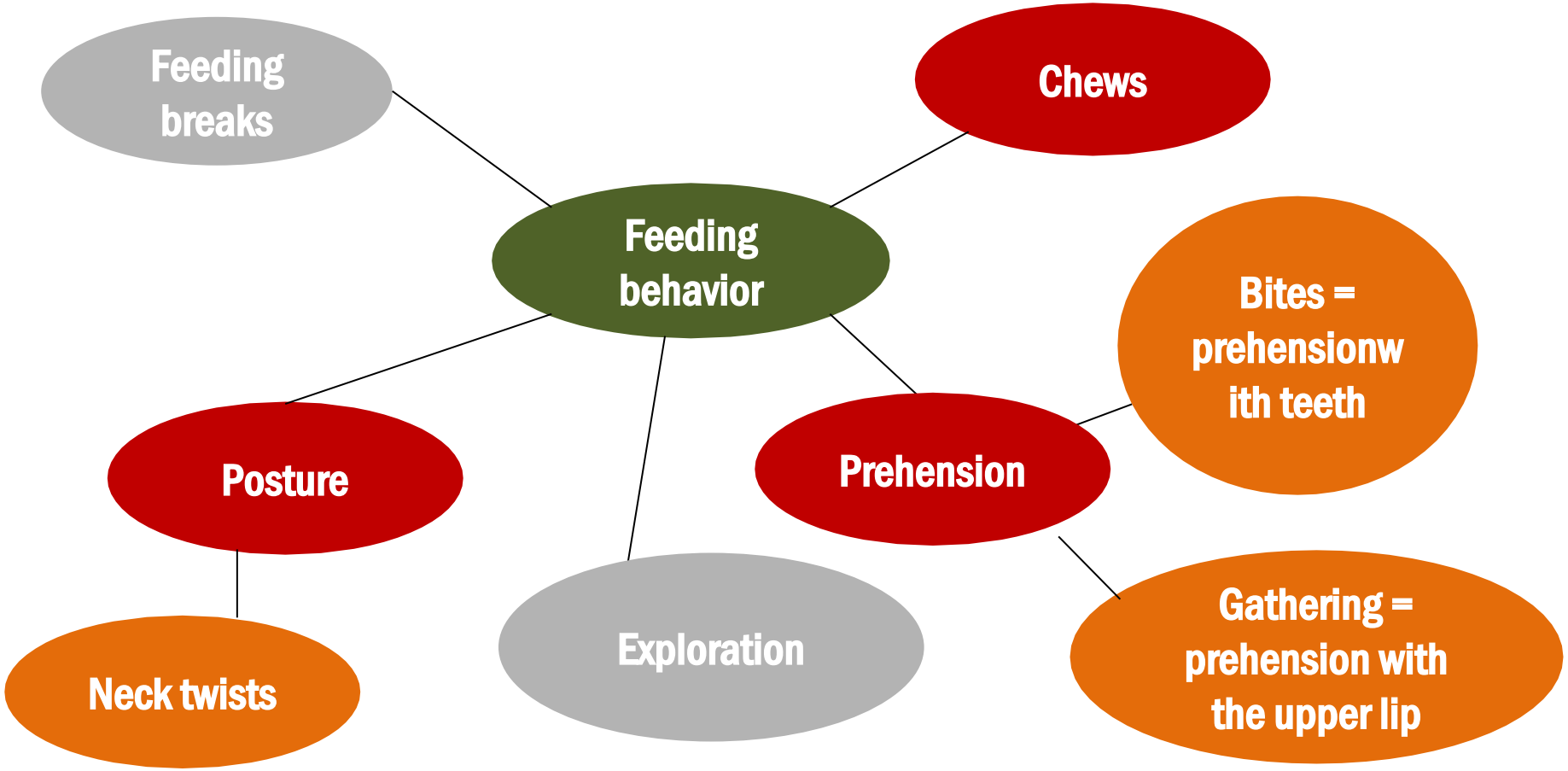
Peyrille and Roche., 2015 – Roig-Pons and Gardes, 2022
Ellis et al., 2015 – Neveux, 2012

Feeding parameters



Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Feeding parameters



Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Aim & Hypotheses

→ Compare **feeding behaviour** of horses with **loose hay, grass** and hay in **haynets**

1. • Nets allow a **number of chews closer to the one obtained for grazing** than for loose hay
2. • **Haynets ↑ prehensive bites** and ↓ **intake with the upper lip**
   → more similar to the grass than the loose hay is
3. • The **use of haynets induces neck twists** but less than suspended slowfeeders

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Peyrille and Roche., 2015 – Roig-Pons and Gardes, 2022
Ellis et al., 2015 – Neveux, 2012

Animals & Treatments

- **Power analysis :** 12 horses and at least 18 videos per horses
- **2 locations:** the Swiss Institute of Equine Medicine (ISME) and a swiss private stable
- Swiss sport horses / 13 years ± 4.8 years
- **Horses accustomed to haynets!**
- **Treatments:**

Short grass (x< 2cm)

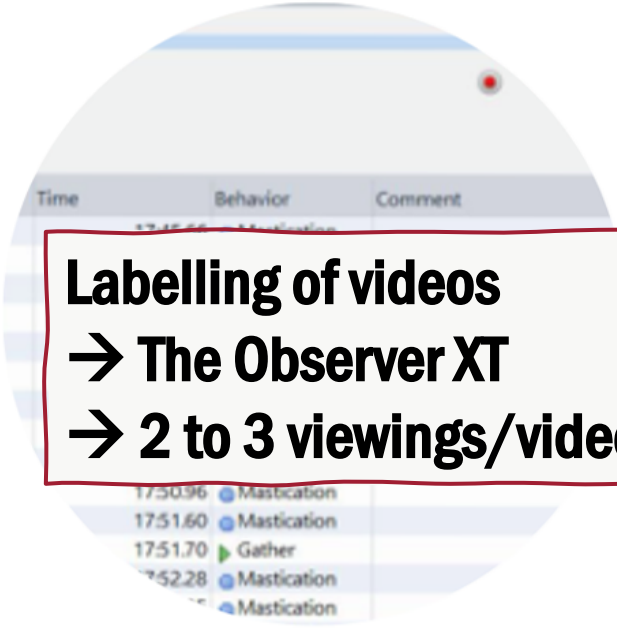
Medium grass (4<x< 10cm)

Long grass (> 15 cm)

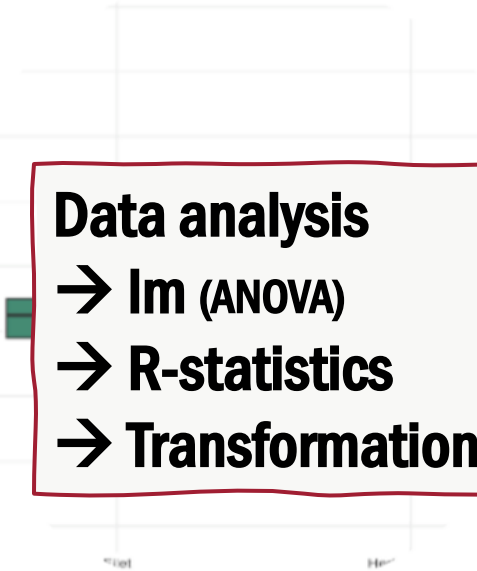
Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Data collection and data processing

15-min videos, 6 videos per treatment
→ **260 videos**



Labelling of videos
→ **The Observer XT**
→ **2 to 3 viewings/video**



Data analysis
→ **lm (ANOVA)**
→ **R-statistics**
→ **Transformation**

Phase 1
Videos of horses feeding

Phase 2
Quantification of feeding behavior parameters

Phase 3
Impact of feeding mode on feeding behaviour

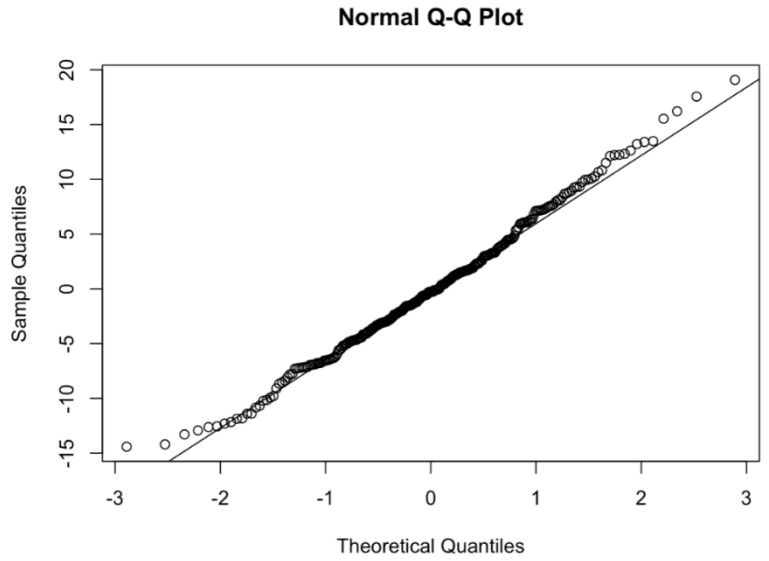
64.5 HOURS!

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results – General process

1) **Model selection using AIC criteria (stepAIC, {mass}) --> select best model**
2) **Check of p-value and assumptions**
3) **Tukey post-hoc test**

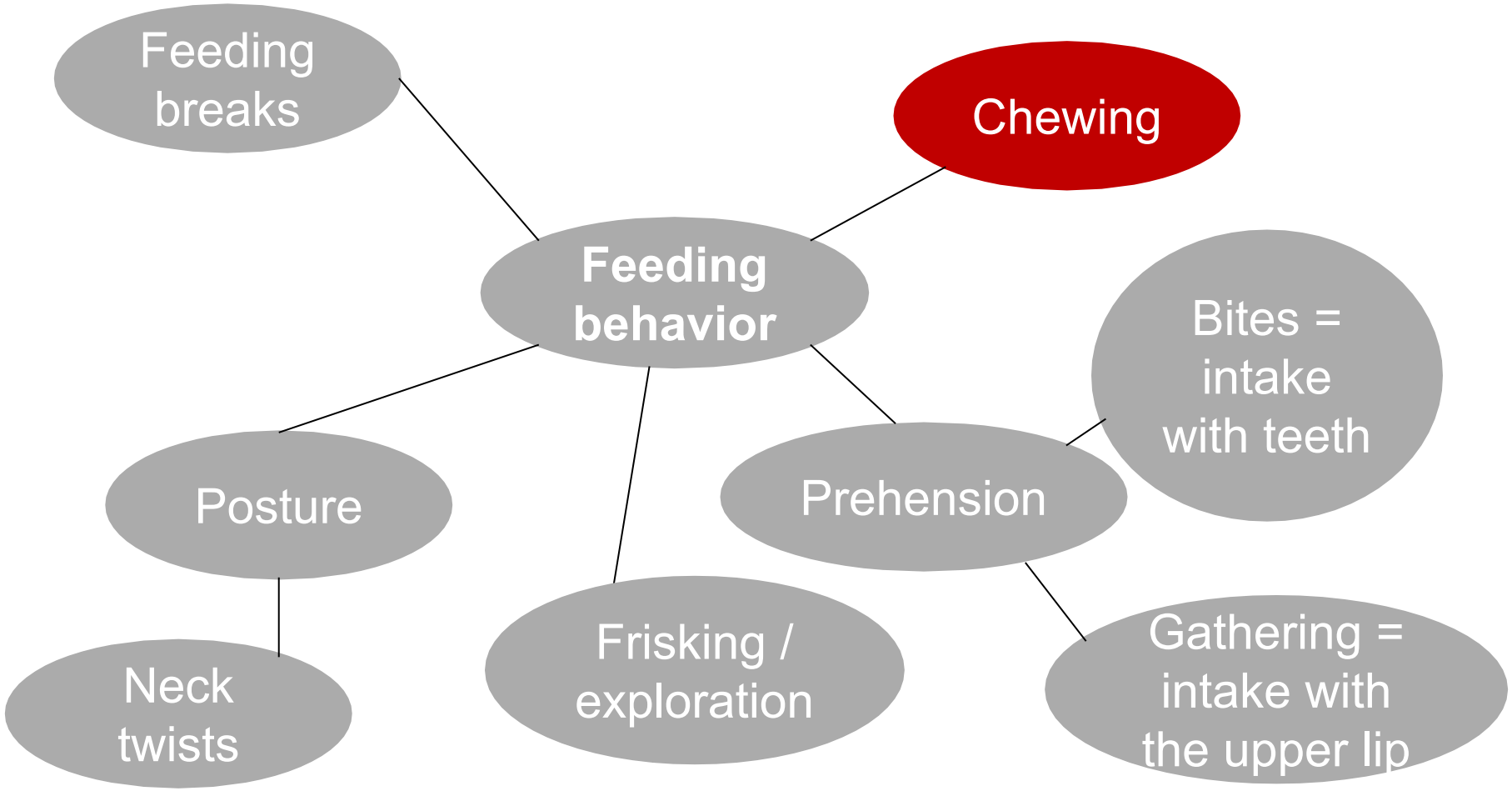
```
Call:
lm(formula = Masti_par_min ~ Systeme + Cheval, data = FinalDataComportement)

Residuals:
     Min       1Q   Median       3Q      Max
-14.4121  -4.4591  -0.2749   3.9319  19.0737

Coefficients:
                      Estimate Std. Error t value Pr(>|t|)
(Intercept)           86.28984    1.64951  52.312  < 2e-16 ***
SystemeFilet         -47.04678    1.38975 -33.853  < 2e-16 ***
SystemeFoin Vrac     -16.40860    1.37449 -11.938  < 2e-16 ***
SystemeHerbe courte  -71.42329    1.46043 -48.906  < 2e-16 ***
SystemeHerbe medium  -56.27581    1.91711 -29.355  < 2e-16 ***
ChevalAlpha            8.55996    2.16708   3.950 0.000102 ***
ChevalChimoko          2.59355    2.13417   1.215 0.225445
ChevalDenver           2.55385    2.16708   1.178 0.239755
ChevalForever          2.82048    2.13417   1.322 0.187547
ChevalHazola          -9.01211    1.88873  -4.772 3.15e-06 ***
ChevalKalinka          0.77212    1.90838   0.405 0.686128
ChevalKenya           -0.43713    1.90838  -0.229 0.819015
ChevalKita            -4.62125    1.92949  -2.395 0.017373 *
ChevalUsem             6.63864    2.18817   3.034 0.002675 **
ChevalVoronja         -0.42014    1.90838  -0.220 0.825932
ChevalWega             0.03115    1.92838   0.016 0.987127
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 6.608 on 244 degrees of freedom
Multiple R-squared:  0.9356,    Adjusted R-squared:  0.9317
F-statistic: 236.4 on 15 and 244 DF,  p-value: < 2.2e-16
```



Shapiro : p-value = 0.2529
Bartlett : p-value = 0.09

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results



Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

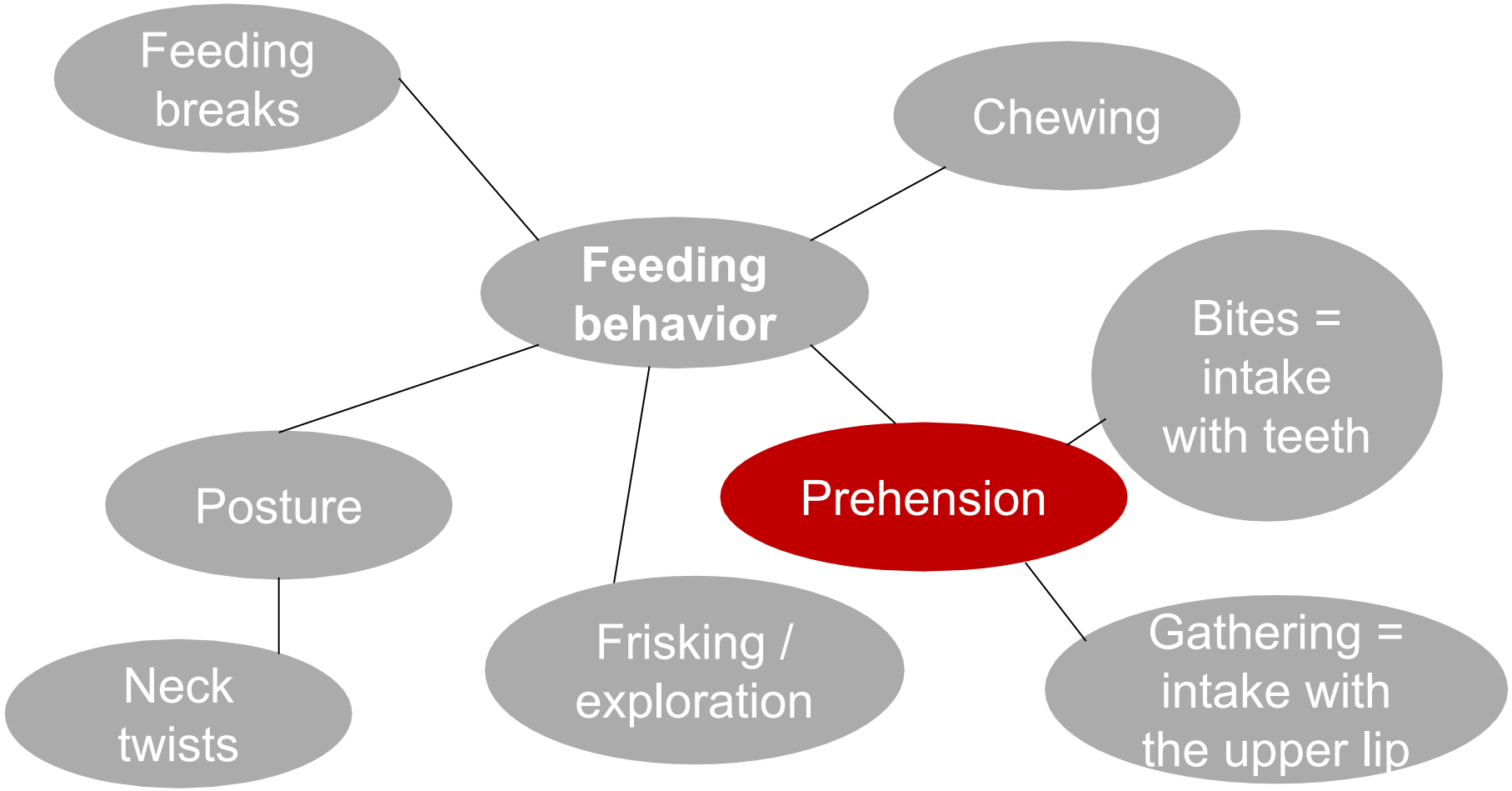
Results – Chews

- Chews ~ System + Horse : $R^2 = 0.93$
- Model Chews ~ System : $R^2 = 0.91$ VS Model Chews ~Horse : $R^2 = 0.015$

- **All systems significantly different** (p-value < 0.05)
- Loose hay : decrease of **16 %** compared to long grass
- Haynet : decrease of **52%** compared to long grass (but similar to medium grass)

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results



Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results – Prehensive bites (incisors)

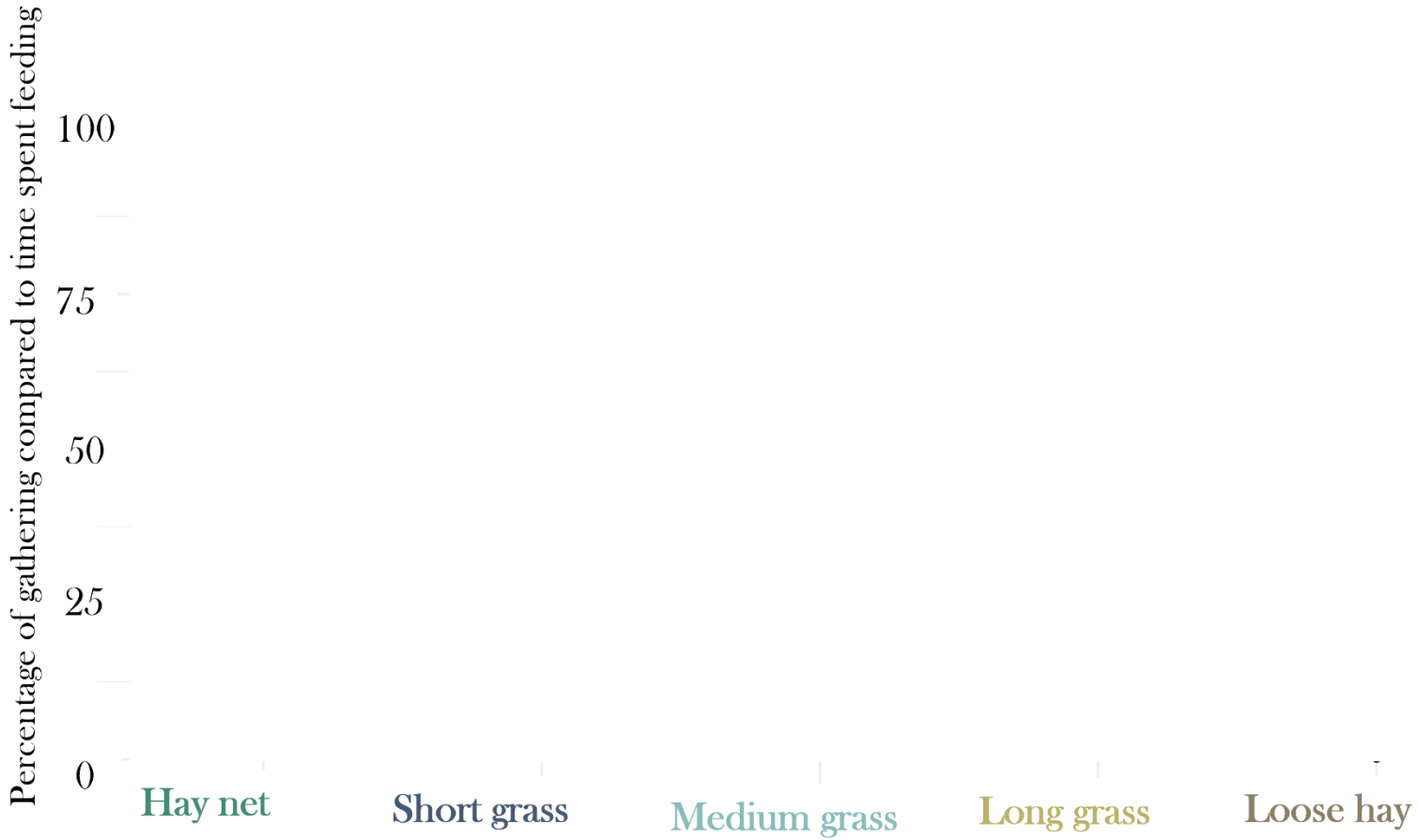
- Bites ~ System + Horse : $R^2 = 0.96$
- Model Bites ~ System : $R^2 = 0.93$ VS Bites ~ Horse : $R^2 = 0.03$

- **Long grass and Haynet not significantly different** (p- value > 0.05)
- **Loose hay** : decrease of **93%** compared to **long grass**

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results – Prehensive gathering (upper lip)

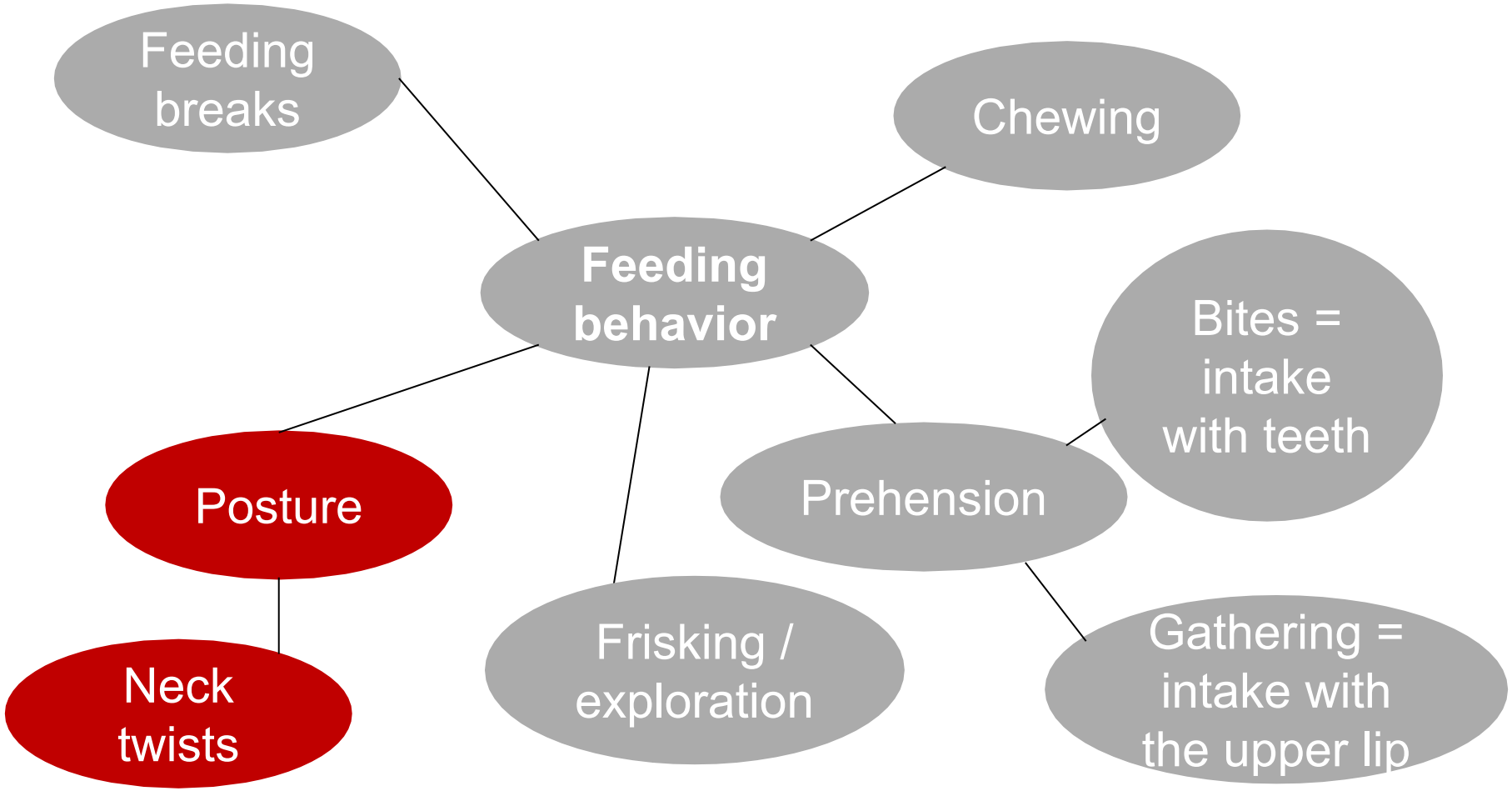
- Gather ~ System + Horse : $R^2 = 0.90$
- Model Gather ~ System : $R^2 = 0.89$ VS Gather ~ Horse : $R^2 = 0.01$



- **Long grass and Haynet not significantly different** (p-value > 0.05)
- % of gathering of haynet = % of gathering of grass
- Loose hay : increase of **130%** compared to long grass

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results

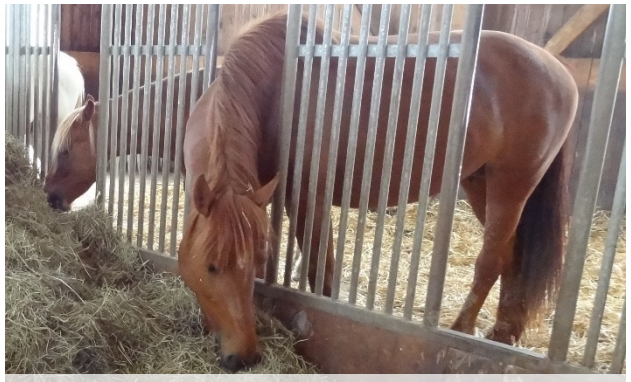


Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Results – Posture (Neck twist)

No linear model

Haynet : Mean duration of a neck twist **= 4.88±6.97 sec**



Lateral flexion

Neck torsion

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Discussion

1. Nets allow a **number of chews closer to the one obtained for grazing** than for loose hay

2. **Haynets ↑ prehensive bites** and ↓ **intakes with the upper lip**
   → more similar to the grass than the loose hay is

3. The **use of haynets induces neck twists** but less than suspended slowfeeders

Agroscope Swiss national Stud Farm SNSTF

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Discussion

1. Nets allow a **number of chews closer to the one obtained for grazing** than for loose hay

2. **Haynets ↑ prehensive bites** and ↓ **intakes with the upper lip**
   → more similar to the grass than the loose hay is

3. The **use of haynets induces neck twists** but less than suspended slowfeeders

1. **Loose hay was the more similar to long grass** but haynets were similar to medium grass

   - Long grass : **26cm± 9cm** VS fodder : **15 cm ± 5cm** (and medium grass **[5:10]**)
     → Impact length of strands ?
   - Rebound effect for long grass ?

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Discussion

1. • Nets allow a **number of chews closer to the one obtained for grazing** than for loose hay

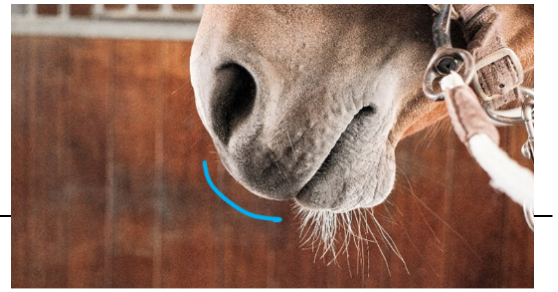
2. • **Haynets ↑ prehensive bites** and ↓ **intakes with the upper lip**
   → more similar to the grass than the loose hay is

3. • The **use of haynets induces neck twists** but less than suspended slowfeeders

2. • **Haynet = only treatment not significantly different from long grass** (both bites and gather)

   • **Gathering for long grass ≠ Gathering for haynet**
   = "nuzzle behavior«

   → Effect on vibrissae wear ?



Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Discussion

1. Nets allow a **number of chews closer to the one obtained for grazing** than for loose hay

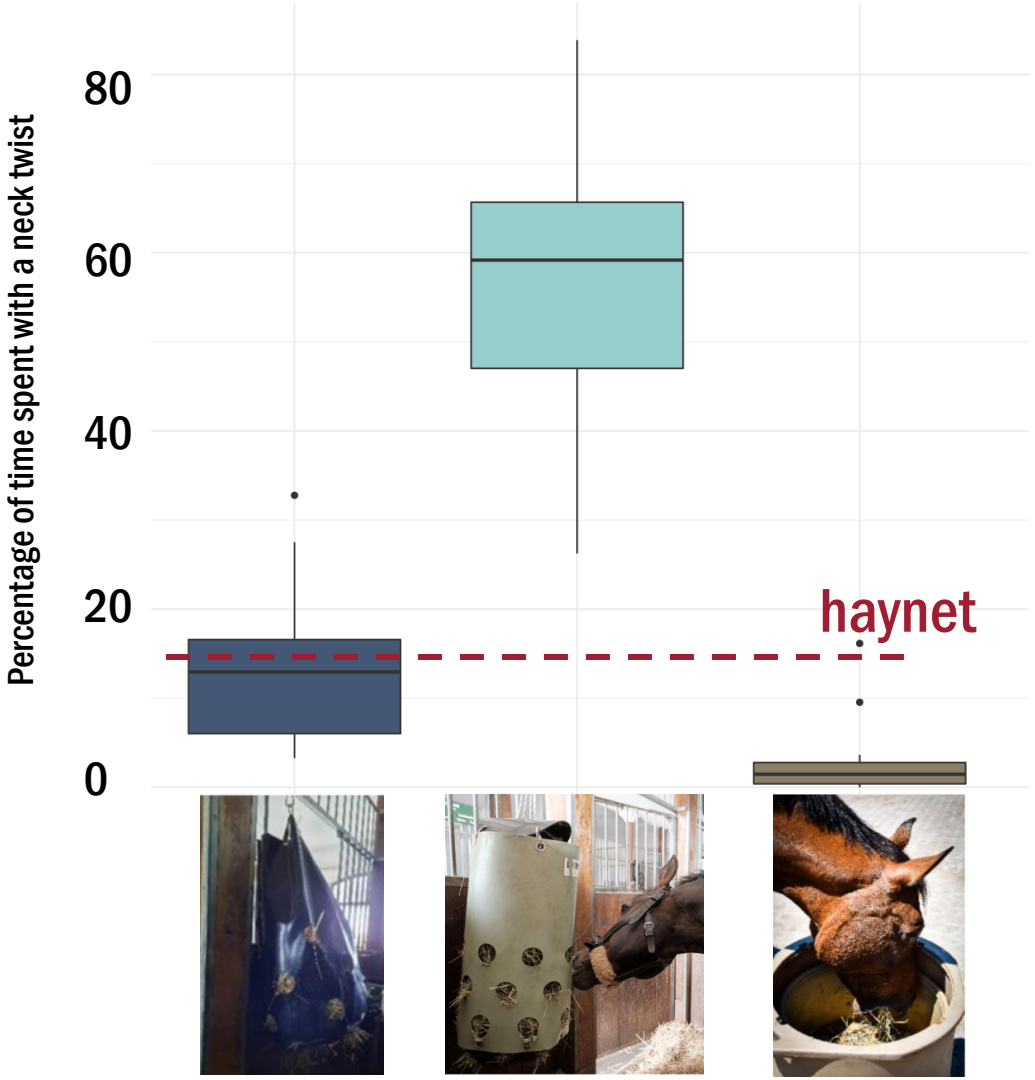
2. **Haynets ↑ prehensive bites** and ↓ **intakes with the upper lip**
   → more similar to the grass than the loose hay is

3. The **use of haynets induces neck twists** but less than suspended slowfeeders

3.
- **Haynet induces a neck twis** (~15% of feeding time)
  → Long-term effect ?
- Mean duration bouts ~ 5 sec : no difference in musculoskeletal health (epidemiological study)
- % neck twist → depends on system

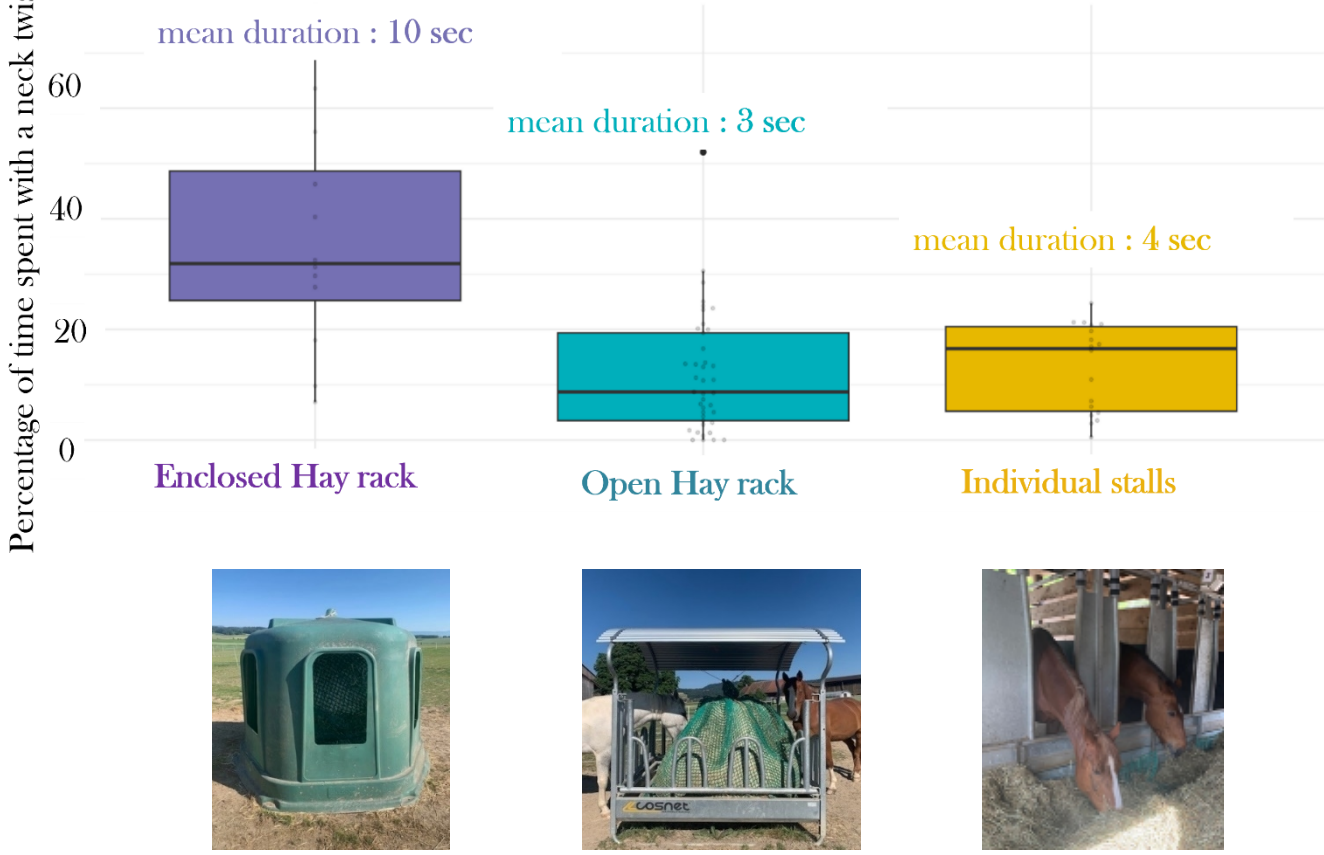
Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Discussion – Effect of dispenser



Model Neck twist ~ Hay Racks Type : $R^2 = 0.20$

Enclosed ≠ From the two other hay racks



Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Discussion

1. Nets allow a **number of chews closer to the one obtained for grazing** than for loose hay

2. **Haynets ↑ prehensive bites** and ↓ **intake with the upper lip**
   → more similar to the grass than the loose hay is

3. The **use of haynets induces neck twists** but less than suspended slowfeeders

3.
- **Haynet induces a neck twist** (~15% of feeding time)
  → Long-term effect ?
- Mean duration bouts ~ 5 sec : no difference in musculoskeletal health (epidemiological study)
- % neck twist → depends on system

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Take-home message

- Except for bites (to investigate), **haynets promote a feeding behaviour more similar to the natural feeding behaviour** (with grass) than loose hay
- **Haynets induce neck twists but long-term effect do not appear alarming**
- **Our results question the use of loose hay, not only as a reference in studies, but also as daily fodder)**, as it modifies the feeding behaviour of horses
- **More research is needed on the long-term effects** of a modified feeding behaviour → O'Neill *et al.*, 2010

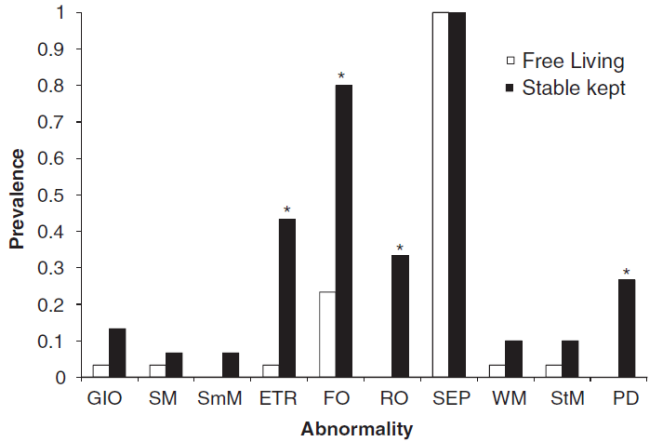


Figure 1 The prevalence of each dental abnormality; asterisk indicates a significant difference (χ^2) between groups ($P < 0.01$).

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch

Thank you for your attention ! Any questions ?

Marie Roig-Pons – marie.roig-pons@agroscope.admin.ch