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Effects of a combination of feed dilution and roughage on home pen behaviour in Ross 308 broiler breeder cockerels

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ABSTRACT

Restricted feeding during the rearing phase is an ongoing welfare challenge in the broiler breeder industry, and there is especially a knowledge gap regarding potential effects of alternative feeding strategies for broiler breeder cockerels. The aim of this study was to investigate the effect of a qualitative feed restriction using diluted feed with insoluble fibres combined with roughage on the home pen behaviour of broiler breeder cockerels. A total of 200 Ross 308 broiler breeder cockerels were housed in 12 pens (6 pens/treatment), 17 birds/pen from 5 to 10 weeks of age. The treatments were standard feed (Control) and feed diluted with 20 % insoluble oat hulls and 150 g of lucerne roughage daily/pen (D+R). The D+R birds received 20 % more feed per day. Observation of home pen behaviours were performed in week 6, 8 and 10 during three different periods of the day relative to feeding time: 1 h prior to feeding, 1 h during feeding and 4 h after feeding. There were no differences between treatments with regards to time spent standing, foraging, locomotion, oral behaviours or aggression. Differences between treatments with regards to drinking and comfort behaviour were found, but the direction of these effects were not consistent across age or time of day. In conclusion, limited effects of diluted feed on home pen behaviour in Ross 308 broiler breeder cockerels were found.

1. Introduction

To ensure good health and reproduction in the adult broiler breeders, modern strains of fast-growing broiler breeders must be fed quantitatively restricted rations during the rearing period, where the amount of feed is about 25 % of what they would eat ad lib (Carney et al., 2022). This leads to a prolonged sensation of hunger and chronic stress (Van Krimpen and De Jong, 2014) and the practice is considered a major welfare issue in the broiler industry (Nielsen et al., 2023). Several studies report that restrictively fed broiler breeders show behaviours indicative of high feeding motivation and frustration, including increased activity levels (Puterflam et al., 2006), with more time spent on locomotion and less time on resting and comfort behaviour (De Jong et al., 2003; Riber et al., 2021). Furthermore, restrictive feeding may lead to behavioural disturbances such as oral stereotypic behaviour, including stereotypic pecking at drinker nipples, the interior or on conspecifics (Nielsen et al., 2011). Another negative effect of prolonged feed restriction is greater levels of aggression between birds (Shea et al., 1990) which is observed both in skip-a-day-fed birds and precision-fed birds (Girard et al., 2017).

Several studies on breeder pullets have tried to mitigate these welfare challenges by providing qualitative feed restriction methods rather than the standard quantitative restriction. With this alternative strategy, fibres of non or low nutritional content are used to dilute the concentrated feed. Providing birds with more fibre and quantitively more feed increases the gut fill and feed passage time and results in more time spent searching for feed and eating (e.g. Sandilands et al., 2006). However, the reported success of this feed strategy varies, with some studies pointing to minimal effects of feed dilution on behaviour and physiological stress responses in broiler breeders (Mench, 2002; Mens et al., 2022; Van Krimpen and De Jong, 2014). Other studies report some positive effects, including reduced corticosterone levels and more comfort behaviours in breeder pullets provided with insoluble fibres (Nielsen et al., 2011, Moradi et al., 2013). A study by Riber et al. (2021) provided broiler breeder pullets (Ross 308) with different feed dilutions with either soluble fibres, insoluble fibres, a mix of soluble and insoluble or roughage, and found that mixed fibres birds were less likely to forage and walk when observed in their home pen. Furthermore, the roughage birds showed clinical signs of improved welfare, including better plumage, less vent pasting, and better footpads compared to the other

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treatments (Tahamtani et al., 2020). Thus, a combination of diluted feed together with roughage is a promising approach for improving satiety and potentially reduce behavioural signs of frustration and hunger.

Until recently, all published studies on alternative feed strategies in the rearing phase have been done with pullets and little is known about the effects of a qualitative feed restriction in broiler breeder cockerels. In general, adult male broiler breeders display higher levels of aggression towards males and females compared to males from laying strains (Millman and Duncan, 2000), but levels of different behaviours in broiler breeder cockerels during the rearing phase has not been reported in detail. Observations of home pen behaviour are therefore needed in order to investigate whether a qualitative feeding restriction can positively affect the behaviour and welfare of cockerels during the rearing phase.

The aim of this study was to investigate the effect of a qualitative feed restriction using diluted feed with insoluble fibres (20 % oat hulls, D) combined with roughage (lucerne, R) on the home pen behaviour of Ross 308 broiler breeder cockerels. We expected that D+R birds, who received 20 % more feed in addition to roughage, but with similar total energy level would be less hungry and show less locomotion, less stereotypic pecking, less aggression, more resting and more comfort behaviour compared to the control birds, especially 4 h after feeding, due to expected increased satiety and gut fill. This study was part of a larger study, comparing the effects of a diluted feed and roughage on a range of parameters including health (Kittelsen et al., 2023) and indicators of stress, fear and motivation to explore (Tahamtani et al., 2024).

2. Methods and materials

2.1. Ethical approval

This study was conducted at the Norwegian University of Life Sciences' research facility. The study was approved by the Ethical Board of the Norwegian Food Safety Authority, license number 30003.

2.2. Birds and housing

The Ross 308 cockerels were hatched at a commercial broiler breeder hatchery and transported as day olds to a commercial rearing farm in southeast Norway, where they stayed until 5 weeks of age (WOA). None of the birds were beak trimmed but they were toe clipped at the hatchery. The rearing barn consisted of 8200 pullets and 1100 cockerels, housed in sex separated compartments in the barn. The barn was fully insulated with mechanical ventilation and concrete floor with wood shavings. Management during rearing followed the recommendations of the breeding company and Norwegian regulations (Landbruks-og Matdepartementet, 2006) with regards to feed, water, ventilation, litter and lighting. The cockerels were fed pelleted feed using a spin-feeder once per day. When they were 5 weeks old, 200 cockerels were selected based on a live weight close to the Ross breeding manual's weight recommendation at the age.

The selected birds were manually caught, crated in pullet transport containers and transported two h in a climate-controlled truck to the animal husbandry experimental research facility, Senter for Husdyrforsøk, at the Norwegian University of Life Sciences. At the experimental facilities, the cockerels were randomly allocated to one of 12 elevated pens with solid floors, with 16–17 birds per pen. All pens were situated in the same room. The pens measured 296 × 60 x 71 cm (length x height x depth). While Aviagen recommends a stocking density of 3–4 birds/m2 for males during rearing (Aviagen, 2023), Norwegian law allows for up to 15 birds/m2 (Landbruks- og Matdepartementet, 2006). Therefore, in our study, we used a mean density of 8 birds/m2, which is commonly used in practice in Norwegian rearing farms. All pens were covered with fresh wood shavings. Water was provided ad libitum from nipple drinker lines (4 nipples per pen). In the ceiling of each pen there was hanged a 70 cm jute rope (ø: 20 mm) in the middle of the pen (i.e. two tail ends side by side) as environmental enrichment. Ventilation, humidity, temperature, and lighting were according to the Ross breeding manual and consistent across treatments. The light period was 8 h, starting at 0730 h, with a light intensity of 10 lux. The cockerels had 3 days of habituation period in the experimental facilities before the start of the study, where all cockerels received the same feed as they had received in the rearing farm (starter control, described in Table 1).

2.3. Experimental treatments

The two treatments in the study were Control and Dilution + Roughage (D+R), both formulated as pelleted feed (2.50 mm). The control diet was formulated according to nutritional specifications of a commercial rearing diet. Raw material composition was optimised as similar as possible between control and diluted diet to avoid raw material effects. The D+R diet was diluted with 20 % oat hulls, reducing metabolisable energy (ME) and digestible amino acids content by one fifth, resulting in 20 % more feed allowance per bird and day (Table 1). The two treatments were dispersed equally across the 12 pens, resulting in six replicates per treatment. There were 4 rows of pens with 3 pens in each row, and the control and trial pens alternated throughout the room so both treatments were represented in all rows and parts of the room.

The pelleted feed was given once per day, scattered manually on the floor of the pen at 09:00 AM. Feed amounts allocated per bird in the control group were based on Norwegian growth curves for Ross 308 broiler breeder cockerels and recommendations of the breeding company (Aviagen). In addition to the pelleted feed, the D+R diet received a total of 150 g lucerne roughage/pen/day provided 15 min after the pellets in metal hay feeders attached to the side of the pen.

2.4. Data collection

Home pen behaviour was observed per pen by video recordings (Sony Handycam HDR-CX 405, Zaventem, Belgium) 1 h before feeding (0800–0900 h), 1 h from start of feeding (0900–1000 h) and 4 h after feeding (1300–1400 h) once weekly at 6, 8 and 10 weeks of age. The videos were scored with the event-logging software BORIS (Friard and Gamba, 2016). From the video recordings, focal animal sampling was performed using continuous sampling for 2 min with 10-minute intervals. To avoid harmful pecking, the birds were not marked. Focal animals were chosen by pausing the video at the start of each observation period, and a random bird was chosen using a random number generator on the internet (Random number generator, calculator.net) and counting from the left side of the pen to the bird matching the random number. The behaviour of that focal bird was then recorded for the next two min using continuous recording and scoring the behaviours presented in Table 2. Thus, a new random focal bird was selected at 0800, 0810, 0820, 0830, 0840 and 0850 h, and the same was done in the other two observation periods for all ages. All the behaviour observations were done by the same observer.

2.5. Statistical analyses

Statistical analyses were performed using the software SAS 9.4 (SAS Institute Inc., Cary, NC). Due to the low occurrence of certain behaviours, the following variables were created by merging a number of behaviours. Pecking object, pecking tail, and pecking body were merged into the variable "Oral behaviour". The variable "Aggression" was created by merging aggressive pecks and other aggressive behaviour. In addition, comfort behaviour and dustbathing were also merged and analysed together as "Comfort behaviour". Finally, as resting behaviour had extremely low occurrence and was only detected in 2 % of the scans, it was not statistically analysed. Therefore, the final roster of behaviours analysed were Standing, Foraging, Drinking, Locomotion, Comfort behaviour, Oral behaviour and Aggression.

Table 1
Diet composition information for the experimental diets provided.

	Age (wk)	ME (MJ/kg)	Protein (g/kg)	Crude fibre (%)	Soluble NSP[a] (%)	Nonsoluble NSP[a] (%)	Daily amount of feed g/bird/day[b]
Starter							
Control	5	11.8	165	5.18	2.92	14.4	49
Grower							
Control	6 – 10	11.2	135	6.2	2.98	18.09	50–60
Diluted	6–10	9.0	110	11.6	2.74	30.71	60–72
Lucerne	6–10	3.6	168	27.1	Total NSP 55 %		ca. 8–9

[a] Non-Starch Polysaccharide.
[b] The daily amount increased according to the weight of the birds. This shows the increase from the first week to the last week.

Table 2
Ethogram for home pen behaviour recordings (based on Riber et al., 2021).

Behaviour	Description
Foraging	Pecking and scratching at the litter.
Drinking	Pecking at water nipple.
Standing	Standing without performing other behaviour
Resting	Sitting or lying without performing other behaviour.
Locomotion	Horizontal or vertical movement of the body, including walking, running and jumping.
Dustbathing	Rubbing the head and body against the ground, vertical wing shaking, pecking and scratching the ground with beak or body while lying on the side, shaking off dirt from the plumage.
Comfort	Body shake, wing flapping, stretching wings or legs, preening, feather ruffling (outside the context of dustbathing).
Feather pecking	Pecking the feather of other birds, with or without feathers pulled out
Stereotypic pecking	Repeated pecking at object or pen wall, with several uniform pecks without moving its body
Aggression	Forcefully pecking another bird/hopping towards/threatening, resulting in a reaction in the recipient
Other	Behaviour other than described above

Each of these behavioural variables were analysed using the mixed procedure with models including diet treatment, week of age, period of the day and their interactions as fixed factors while pen was included as a random factor. Backward stepwise reduction of the models was performed for all behaviours. The data for Locomotion, Oral behaviour and Aggression were log transformed to fit the model assumptions (i.e. normal distribution of the residuals). Post hoc pairwise comparisons were performed with Tukey's test (Tukey's HSD test). The critical alpha value was set to 0.05.

3. Results

There was no effect of the diet on the time spent standing in the home pen (LS means ± SE: Control = 31.9 ± 1.6 s; D+R = 31.7 ± 1.6 s; $F_{1,9} = 0.01$; $P = 0.91$). There was, however, a significant effect of the interaction between week of age and period of the day ($F_{4604} = 8.65$; $P < 0.0001$). Standing (without eating) was performed less during feeding compared to the other periods of the day at every age ($P < 0.05$). The birds spent more time standing before feeding compared to 4 h after feeding at week 8 and 10 weeks of age, but not at 6 weeks ($P = 0.58$; Fig. 1A).

There was no effect of diet treatment on foraging behaviour ($F_{1,\ 9} = 0.02$; $P = 0.88$) as each treatment spent on average 54.61 ± 45.03 s (Mean ± Std Dev) per scan on this behaviour. There was, however, an effect of the interaction between week and period of the day ($F_{4604} = 2.41$; $P = 0.048$), where foraging was performed significantly more during the h of feeding compared to the h before and 4 h after feeding ($P < 0.0001$; Fig. 1B).

There was a 3-way interaction between diet treatment, week of age and period of the day on the time spent drinking ($F_{8,\ 594} = 2.55$; $P = 0.01$). As can be seen in Fig. 2A, at 6 weeks of age, birds receiving the D+R diet spent more time drinking 4 h after feeding than they did in the periods before or directly after feeding ($P = 0.02$ and $P < 0.0001$ respectively). In contrast, there was no significant difference in drinking behaviour for the control birds at this age ($P > 0.05$). Furthermore, D+R birds spent more time drinking in the observation period 4 h after feeding at 6 weeks of age compared to the same period of the day at 8 and 10 weeks of age (P 0.002 and $P < 0.0001$, respectively). This difference was not observed in the control birds ($P > 0.05$). However, the control birds showed a significant variation in time spent drinking across the periods of the day at 8 weeks of age. At this age, the control birds drank more 4 h after feeding compared to before or immediately after feeding ($P = 0.002$ and $P = 0.001$). In contrast, there was no difference in the time spent drinking for the D+R birds at this age ($P > 0.05$). Any further significant differences were lost during *post hoc* analysis.

There was no effect of diet treatment on the time spent on locomotion ($F_{1,8} = 0.79$; $P = 0.4$). There was, however, an interaction between week of age and period of the day ($F_{4441} = 3.58$; $P = 0.007$). At 10 weeks of age, the birds from both treatments spent more time on this behaviour in the h before feeding than in the other two periods assessed ($P < 0.02$, Fig. 3A). In addition, locomotion during the h immediately after feeding was lowest at 10 weeks of age compared to at 6 and 8 weeks of age ($P = 0.002$ and $P = 0.02$, respectively). No other significant differences were observed.

There was a 3-way interaction between the diet treatment, week of age and the period of the day on the performance of comfort behaviours ($F_{8595} = 2.19$; $P = 0.03$). At 6 weeks of age, while the control birds performed more comfort behaviours 4 h after feeding than in the h immediately after feeding ($P = 0.007$; Fig. 2B), this apparent difference in the D+R birds was lost during post hoc analysis ($P = 0.39$). At 8 weeks of age and 4 h after feeding, the D+R birds performed more comfort behaviour than the control birds ($P = 0.03$). However, both treatment groups performed more of these behaviours 4 h after feeding compared to during feeding (Control $P = 0.02$; D+R $P < 0.0001$). Furthermore, while 8-week-old D+R birds also performed more comfort behaviours in the period before feeding compared to during feeding ($P = 0.008$), there was no such difference in the Control birds at this age ($P = 1.0$). Similarly, at 10 weeks of age, D+R birds performed more comfort behaviour 4 h after feeding compared to before or during feeding ($P < 0.0001$ in both cases). In contrast, there was no significant difference in the performance of comfort behaviours by the Control birds at any period of the day at this age ($P > 0.22$).

There was no effect of diet treatment on the performance of oral behaviours ($F_{1,11} = 2.15$; $P = 0.17$). For both treatment groups, these behaviours were relatively rare and only observed in 22 % of scans (Mean ± Std Dev: Control = 2.5 ± 6.0 s; D+R: 1.3 ± 5.1 s). Independent of diet treatment, there was an effect of the interaction between week of age and period of the day ($F_{3127} = 3.22$; $P = 0.02$). As can be seen in Fig. 3B, at 6 weeks of age, more oral behaviour was performed 4 h after feeding compared to before feeding ($P = 0.03$). However, the performance of oral behaviours decreased with age, and the birds performed significantly less oral behaviour 4 h after feeding at 10 weeks of age compared to the same period of the day in week 6 ($P = 0.03$).

Aggression was also quite rare, with only 15 % of scans detecting this type of behaviour. Thus, there was no significant effect of any of the

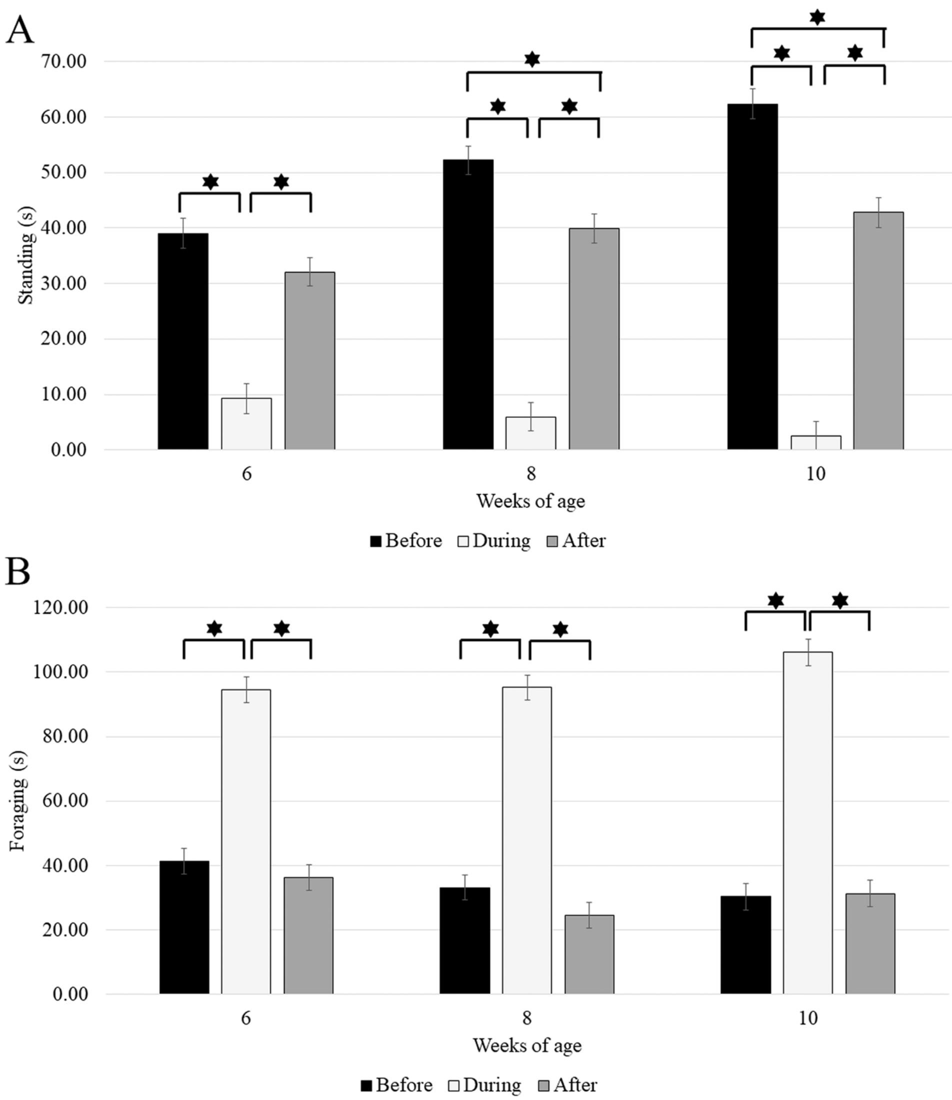

Fig. 1. Time (LS means ± SE) spent standing (A) and foraging (B) per week of age and period of day. *Pairwise comparisons statistically different (P < 0.05).

main factors diet treatment ($F_{1,8} = 0.84$, $P = 0.38$), week of age ($F_{2,13} = 0.30$; $P = 0.74$) or period of the day ($F_{2,11} = 0.8$; $P = 0.47$) on the performance of this behaviour. The control birds seemed to spend more time on this behaviour (Means ± Std Dev = 1.33 ± 5.8 s) compared to the D+R birds (0.39 ± 1.2 s), however both treatments had high variation and thus they did not differ significantly.

4. Discussion

The present study aimed to investigate the effect of a qualitative feed restriction using diluted feed with insoluble fibres combined with roughage on home pen behaviour in Ross 308 broiler breeder cockerels. Only limited treatment effects on the birds' home pen behaviours were found. We hypothesised that the treatment birds would experience a higher level of satiety as they were allocated 20 % more feed per bird, in combination with roughage, and would thus show less locomotion and more resting and comfort behaviours, especially 4 h after feeding. However, across the treatments, ages and time of day, resting was only observed in 2 % of the scans. This is far lower than reported for broiler breeder pullets in Riber et al. (2021), where birds were observed resting in 17 % of the observation periods. A higher level of resting is generally considered an indicator of reduced stress and hunger (De Jong et al., 2003; Puterflam et al., 2006). However, as the time budget of breeder cockerels during the rearing period is relatively unknown, we do not know if males in general spend less time resting compared to pullets at the same age, and how alternative feeding strategies may affect this behaviour. Furthermore, to fully understand the effects of a restrictive diet on the behaviour of cockerels during the rearing period, a study comparing ad lib fed birds, standard feed restriction and an alternative diet is needed, similar to what has been investigated for breeder pullets (Merlet et al., 2005; Puterflam et al., 2006).

Standing (without eating) was one of the most commonly observed behaviour across ages, with no differences between treatments. The birds spent more time standing before feeding compared to after feeding at 8 and 10 weeks of age, which is similar to reported for pullets (Riber et al., 2021) and could be due to an expectation in the birds that feeding time was approaching, during which they would typically show a mix of locomotory behaviour and standing with their heads oriented towards the door. The cockerels spent most of their time foraging in the litter at all ages, especially in the first h after feeding. We expected an increased amount of feed per bird to increase the satiety in the treatment birds and thus reduce the amount of foraging 4 h after feeding, but there were no observed differences between treatments. This is consistent with previous results on feed dilution, where minimal effects on behaviours, including foraging behaviours have been found (Mens et al., 2022; Van Krimpen and De Jong, 2014).

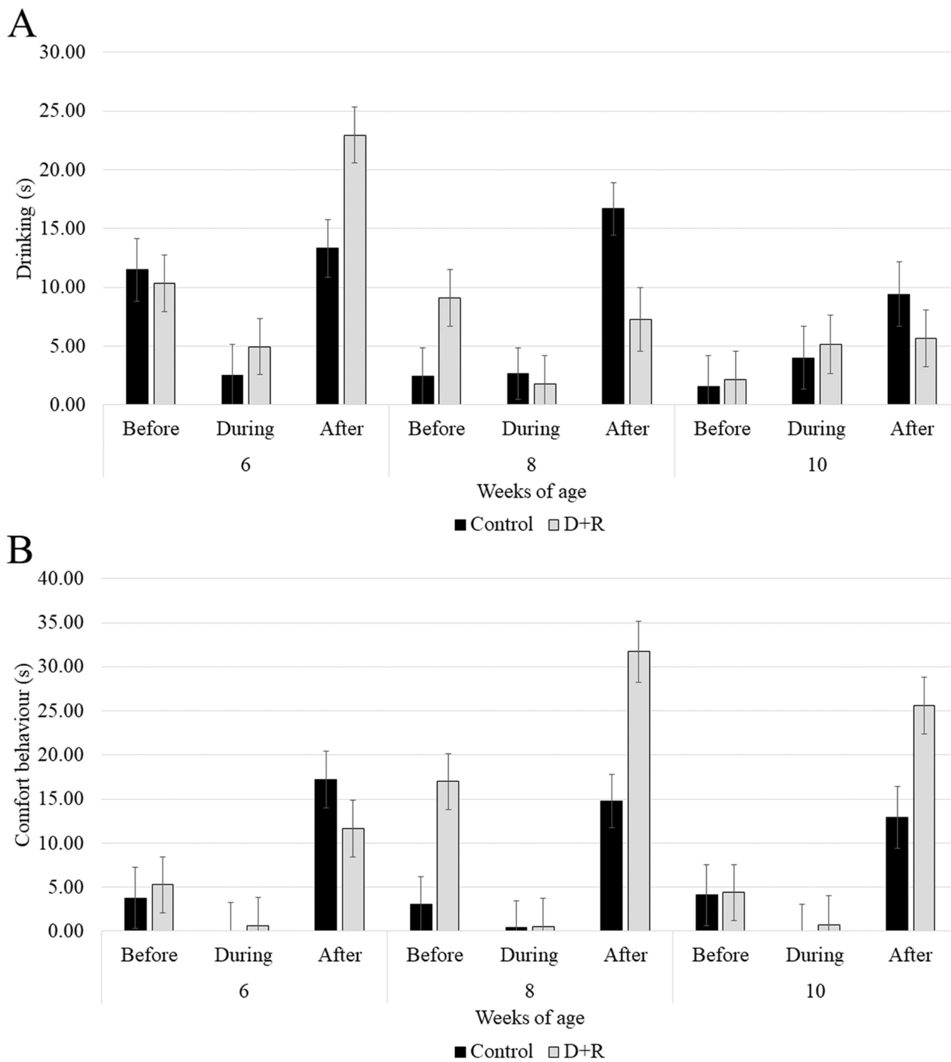

Fig. 2. Time (LS means ± SE) spent drinking (A) and performing comfort behaviours (B) for Control and D+R birds across week of age and period of day. *Pairwise comparisons statistically different ($P < 0.05$).

In general, the cockerels spent relatively little of their time drinking, measured as pecking at the water nipples, during all weeks, and far less than pullets of the same hybrid at the same age (Riber et al., 2021). Whether this is a random result or a difference due to genders should be further investigated. More time spent drinking and pecking at the water nipple could be indicative of frustration and hunger and could thus be expected to be higher in the control birds with a lower food intake (Puterflam et al., 2006). Although there were differences in drinking behaviour between treatments, these were not consistent across time of day and age.

A high amount of locomotion has often been observed in restrictively fed pullets (Puterflam et al., 2006), and we therefore expected the time spent on locomotory behaviours such as walking and running to be reduced in the treatment birds, especially after feeding. However, no differences between treatments were observed. Locomotion was reduced overall with age, but in week 10, birds in both treatments spent more time on locomotion before feeding compared to during and after feeding. Interestingly, as with drinking, this result is quite different than reported for pullets of the same hybrid at the same age, which spent more time walking after feeding at all ages (Riber et al., 2021).

Increased time spent on comfort behaviours, such as preening, wing stretching and dust bathing are positive welfare indicators and were expected to be higher in the treatment birds, especially after feeding. Pullets provided insoluble fibres (ISF), such as the oat hulls used in this study, have shown more comfort behaviour in some studies (Nielsen et al., 2011), while not in others (Riber et al., 2021). In the present study, the treatment effects were not consistent across week of age. However, birds in both treatments showed more comfort behaviours after feeding compared to before or during feeding, which is as expected. The lack of systematic treatment effects could be due to the level of ISF in the cockerels' diet, as we used a similar level as Riber et al. (2021) (20 %), while Nielsen et al. (2011) found increased comfort behaviours in the treatment birds using up to 89 % ISF. As this study hoped to find an alternative feed strategy that could be implemented in practice, an increase in feed quantity of 80 % or more per bird was not considered realistic.

Oral behaviours, which included pecking at objects in the pen, or at the tail or body of another bird, were relatively rare in both treatments and showed no treatment effects. Oral behaviour was observed in 22 % of the observation periods, which fits well with Riber et al. (2021) who found oral behaviours performed by pullets in 19 % of their observation periods. More oral behaviour was performed after feeding compared to before feeding in both treatments, which is also reported in several other studies on broiler breeders (Mason and Mendl, 1997; Puterflam et al., 2006; Riber et al., 2021). However, the level of oral behaviour in the present study was slightly reduced with age, which is contrary to other studies that point to these types of stereotypic behaviour to develop over time (Mason, 1993; Riber et al., 2021). Aggression was another

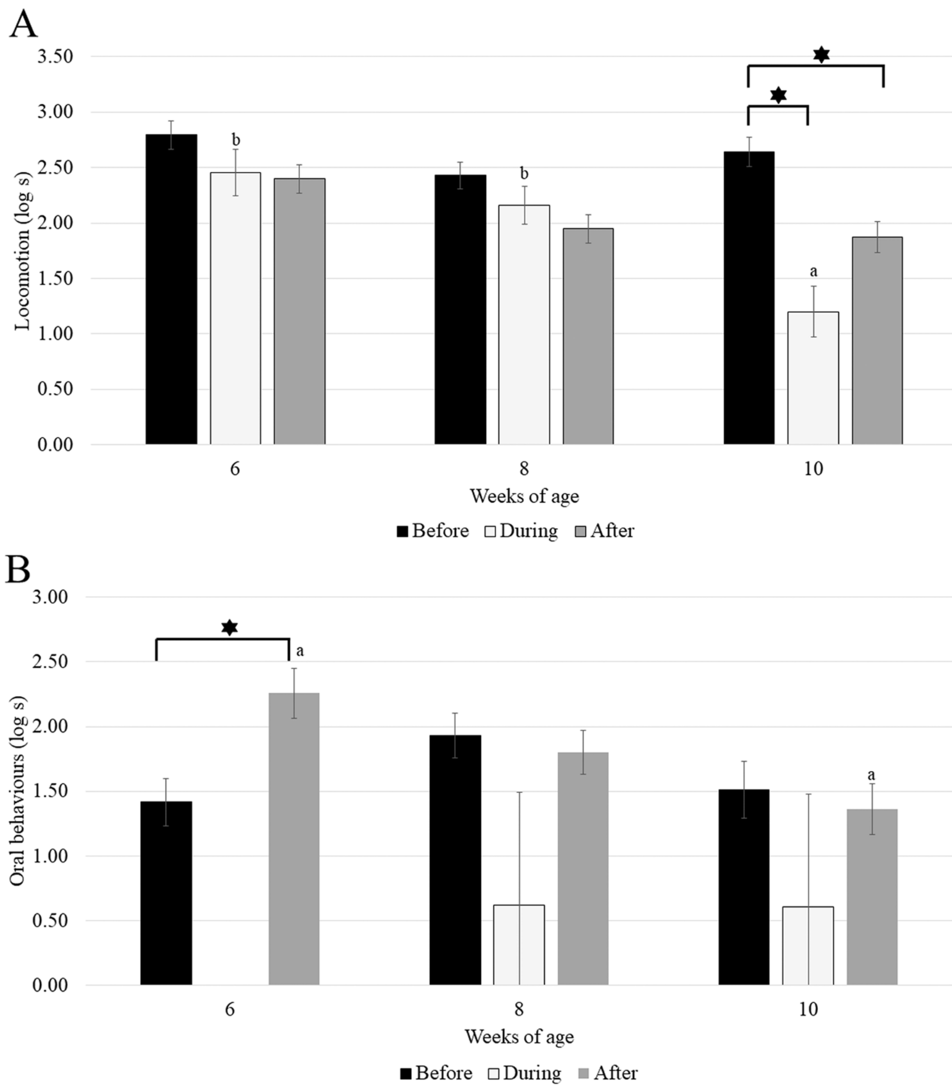

Fig. 3. Time (LS means ± SE) spent performing locomotion (A) and oral behaviours (B) per week of age and period of day. Data are presented in the log scale. *Pairwise comparisons statistically different ($P < 0.05$).

behaviour rarely observed, with only 15 % of scans detecting this type of behaviour, and with no difference between treatments, time of day or age.

Overall, the cockerels spent a majority of their time standing and foraging, followed by comfort behaviours, with minor differences between treatments. Birds in both treatments showed higher levels of standing and walking before feeding including standing and walking, which is in accordance with previous studies (Puterflam et al., 2006; Riber et al., 2021). This study was part of a larger project to assess effects of diluted feed on a wide range of health- and welfare indicators in cockerels. Kittelsen et al. (2023) focused on health parameters in the same birds as the present study and reported that control birds tended to have a lower weight compared to treatment birds, but found no effects on weight uniformity, footpad dermatitis, litter quality, weight of organs or number of wounds, indicating that the treatment had no adverse nor positive health effects in the broiler breeder cockerels. Furthermore, Tahamtani et al. (2024) investigated the differences between treatments on level of stress, fear and motivation to explore, and found that treatment birds were slower to approach a novel object, had a shorter duration of tonic immobility and showed lower levels of frustration in the thwarted feeding test, indicating a positive effect of the diluted feed treatment on welfare. Thus, when combining all these results for the Ross 308 breeder cockerels, there are small but positive effects of a qualitative feed restriction on cockerel welfare, but only minor and inconsistent effects on their home pen behaviour.

Importantly, the present study has several limitations, the largest being the study design with relatively small pens and group sizes, which results in a low total area available for the birds compared to a commercial rearing house. This could have affected the time spent on different behaviours, and future studies where the diluted feed is provided on a commercial farm are warranted, especially as knowledge of the time budget of broiler breeder cockerels at different ages is currently lacking.

In conclusion, only limited effects of a diluted feed on home pen behaviour in Ross 308 broiler breeder cockerels were found, and our hypotheses that a diluted feed would affect behaviours indicative of hunger, such as locomotion and resting was not confirmed. This support existing literature suggesting that small adjustments in the feeding regime such as the ones tested here are not sufficient to alleviate the negative effects of restrictive feeding. Further studies on the behaviour and time budget of cockerels fed ad libitum and under commercial settings are needed to increase our understanding of the differences seen between pullets and cockerels at the same ages, and to further explore the possibilities of improving cockerel welfare using alternative feeding strategies.

CRediT authorship contribution statement

Ingrid C de Jong: Writing – review & editing, Methodology, Investigation, Conceptualization. **Fernanda Tahamtani:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Guro Vasdal:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Kathe Elise Kittelsen:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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