



## Type and level of production provided by the requestor

Type of production: broiler

Level: husbandry, transportation

Keywords: physiology, management



## Background context provided by the requestor

To meet market weight specification, free-range broiler producers reduce feeding frequency to once daily for weeks. What is the optimum feeding frequency and also the maximum time intervals between feeds to prevent hunger?

Related to this query, slaughterhouses sometimes require that broilers, free-range and non-free range, are feed restricted for >16 hours pre-slaughter to ensure an empty gut. What are the welfare issues with this practice?



## Question raised by the requestor

In order to meet market specification for weight, free-range broiler producers sometimes reduce feeding frequency in the last few weeks of production to once every 24hrs. What is the optimum feeding frequency for broilers and also what is the maximum time intervals between feeds in order to prevent hunger and other welfare consequence?



## Answer

### 1. Reduced feeding frequency as a feed restriction method

In commercial broiler production, feed is normally allocated several times a day. The amount in each feeding is usually adjusted according to the broilers' daily intake. The goal is generally to provide feed ad libitum. The daily requirement is thereby met by distributing the total daily ration across multiple feeding times.

If a broiler flock is allocated feed several times during the day, the amount per feeding is reduced to avoid waste. However, if the number of feeding times is suddenly reduced without increasing the amount of feed allocated per time, the total daily ration will drop. If this is the scenario, then reducing the feeding frequency will become a method of feed restriction.

It is therefore important to notice that a producer can allocate feed just once a day without it being feed restriction, as long as the broilers are provided with a total daily ration allowing ad libitum access to feed during that single feeding, i.e., the feed trough is never empty. Such feeding programs are particularly found in extensive broiler production without complex feeding systems.

This answer will assume that the query addresses the cases where the sum of feed provided is reduced along with the reduced feeding frequency, i.e. the reduced feeding frequency is a method of feed restriction. Feed restriction is a much more common practice in broiler breeder production compared to broiler production. Scientific knowledge on feed restriction in broilers is very limited. Some parts of the current answer are therefore based on knowledge from feed restricted broiler breeders. However, there are, to the knowledge of the authors, only few studies on the effects of feed restriction by means of reducing the feeding frequency in broilers or broiler breeders. The section on welfare consequences of feed restriction is therefore mainly based on feed restriction methods other than reducing feeding frequency.

### 2. Effects on broiler welfare of reduced feeding frequency as a method of feed restriction

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Broiler breeder chicks with a high growth potential are typically fed ad libitum during the first 7-10 days before feed restriction is implemented. Usually feed restriction is introduced by meal feeding, where the number of meals is reduced over some days, while the total amount of feed is less than what the birds would ingest if having ad libitum access. A study of the behaviour of broiler breeder pullets during the rearing period (Ross 308) showed that the age that differed the most from the others was week 2, which corresponded to the transition period from ad libitum access to feed to feed restriction and meal feeding (Riber et al., 2021). At this age the birds spent less time resting and standing but more time foraging and walking. The authors suggested that the high level of food-seeking behaviour and low level of resting behaviour observed when feed restriction was initiated by meal feeding may have been a response to the commencement of feed restriction, i.e. a sign of frustration. During the following weeks, the activity of the birds changed back to less foraging and walking and more resting, which could indicate some degree of habituation to the feed restriction. Similarly, Nielsen et al. (2003), who compared feed restricted broilers (meal fed twice a day) with broilers fed ad libitum, found a higher general activity level of the broilers that were feed restricted, starting from the day the feed restriction commenced and lasting throughout the period of feed restriction.

### 3. Maximum time intervals between feedings/duration of fasting periods

Regarding the query on maximum time interval between feedings when feed restricted, the answer is that there is no established optimal interval. A higher feeding frequency, but same total daily feed ration, has not been shown to result in improved welfare when broiler breeders are feed restricted (Zuidhof, 2018, Girard et al., 2017, Mens et al., 2022). Zuidhof (2018) found that feed restricted broiler breeders allowed small rations 10 times a day still on average visited the empty feed station additional 51 times per day, indicating that distributing feed over 10 feedings did not provide satiety. From this it can be concluded, that if the same restricted amount of feed is given, the interval between feedings within 24 h will most likely not have an effect on the sensation of hunger.

Supporting this, Lindholm and Altimiras (2023) found that the behaviour and physiological traits of 29 days old Ross 308 broilers was much more affected by feed restriction (30% or 60% of daily ration) than reduced feeding frequency (every day or alternate day) when combining both. Broilers can compensate for fasting periods by increasing feed intake in the periods with feed ad libitum by filling up the crop (Svihus, 2014).

A study on the effect of fasting young broilers for 2, 4, 6 and 8 h daily from 7 to 19 days of age found that fast-growing broilers (Ross 308) fasting for 4 h daily or more showed anticipatory feeding behaviour (Fondevila et al., 2020). The 2-h fasting had no effect compared to the non-fasting control group. Fasting for 6 and 8 h daily resulted in lowered weight gain. Thus, according to this study, changes in the broilers' behaviour, indicating a negative affective state, occurred in the interval 2-4 h after fasting was initiated. Consequently, according to this study, fasting fast-growing broilers for up to 2 h does not cause a negative affective state. However, it should be noted that the broilers were given ad libitum access to feed outside the periods of fasting.

The scenario explained in the query is that the broilers experience a sudden restriction in access to feed without having the possibility of compensatory feed intake. Therefore, the behavioural effect of being subjected to fasting up to slaughter may be more similar to the scenario explained in the query. Pereira et al. (2013) compared the behaviour at 6, 9, 12 and 15 h of fasting pre-slaughter for 42-days old fast-growing Cobb broilers. The birds stood and sat less with increasing fasting period, and at the 12 h fasting point panting and feather pecking occurred, which had been absent at 6 and 9 h fasting. Additionally, there was a linear increase in chirping and distressed behaviour; the latter characterised by birds frequently changing positions. As there was no control (i.e. 0 h of fasting), it cannot be deduced whether 6 h of fasting affected welfare. However, the



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increase in distressed behaviour at 9 h and the feather pecking at 12 h compared to 6 h indicates that fasting for 9 h or more resulted in a negative affective state.

#### 4. Welfare effect of feed restriction on broiler welfare

As limited research is available on the welfare consequences of feed restricting broilers, this section also includes studies on feed restriction in the parents of broilers, i.e. the broiler breeders.

Broilers, including their parents, are selected for growth parameters. The selection has caused an increased appetite due to modulation of mechanisms of hunger regulation (Denbow, 1989; Siegel and Wolford, 2003).

Shusha et al. (2021) found a higher activity level for Sasso broilers experiencing fasting from days 14 to 60. The treatment group that had ad libitum access for 12 h daily and no access to feed for the following 12 h was more active than the ad libitum fed control group, showing both more exploration and less resting. Likewise, Trocino et al. (2020) found more ground pecking and less standing for Ross 308 and 708 broilers receiving 80% of their expected ad libitum intake at days 13-21 compared to the broilers fed ad libitum. Yan et al. (2021) showed a difference in behaviour as a reaction to feed restriction from days 30 to 60 of age when comparing fast- and slow-growing broilers. The explorative behaviour increased for both hybrids when given a diet of 70% of the expected ad libitum feed intake compared to those fed ad libitum, but the increase was significantly higher for the slow-growing hybrid. Feed restriction resulted in decreased resting behaviour and increased drinking behaviour in both hybrids. There was no effect on perching or preening behaviour (Yan et al., 2021).

A few studies have also investigated the effect of feed restriction, used as a method to manipulate growth rate, on other welfare indicators than those related to hunger in broilers. In an older study of fast-growing broilers, the incidence of cardiac arrhythmia reached up to 27% (Olkowski and Classen, 1998). However, when their growth is slowed down by restricting their feed intake to about 60% of what they would normally consume, the incidence of arrhythmia drops to below 2% (Olkowski, 2007). Kuttappan et al. (2013) found that reducing the growth rate of broilers of the Cobb 500 genotype from 55 to 50 g/day using feed restriction resulted in a reduced prevalence of severe white striping, a type of muscle disorder, in the breast fillets. Similarly, Zhou et al. (2024) found that reducing the growth rate of the Cobb 700 genotype from 66 to 48 g/day using feed restriction resulted in an increased activity index, improved walking ability and increased bone strength. However, these findings may be caused by the hunger experienced by the feed restricted birds, resulting in restlessness and increased time spent locomoting and foraging in the search for food. It is important to emphasize that while feed restriction seems to improve some physical health parameters, it also leads to hunger and related welfare issues. Choosing a broiler genotype with slower growth potential, which does not require feed restriction, could likely achieve similar welfare improvements without these negative effects (Riber and Wurtz, 2024).

Finally, studies of the effects of feed restricting the parents of the broilers, i.e. the broiler breeders, have repeatedly been shown feed restriction to negatively impact animal welfare due to hunger and the resulting physiological and psychological stress (de Jong and Guemene, 2011, Riber, 2020). Chronic hunger can lead to abnormal behaviours such as increased aggression, injurious pecking, and cannibalism, as well as immunosuppression and changes in physiological stress measures (D'Eath et al., 2009). Compensatory feed intake (de Jong et al., 2003) and physiological measures like blood heterophil to lymphocyte ratios, corticosterone, and dopamine levels (Najafi et al., 2015) change in proportion to the severity of feed restriction, indicating that the higher the level of feed restriction, the more negatively the welfare is impacted.

#### 5. How to spot restrictive feeding



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As mentioned in Section 1, reducing the feeding frequency does not equal restrictive feeding. This, combined with studies suggesting that feeding frequency per se has little to no effect on welfare, means that the focus when inspecting a production should be on the amount of standard feed provided, regardless of the feeding frequency.

Ways of identifying restrictive feeding through management-based indicators in broiler production are proposed below:

- a. Check the amount of feed being used for the specific flock inspected.  
The daily feed allocation should not decline during the lifetime of a flock unless the broilers are sick. If it does, it causes feed restriction.
- b. Check the number of feedings per day and the amount provided per feeding.  
A reduction in feeding frequency without a corresponding simultaneous increase in feed amount per feeding causes feed restriction.
- c. Check the feed troughs for feed content. If empty, check when the next scheduled feeding will occur.  
No feed in the trough combined with more than 2 h until next feeding may indicate that feed restriction is practiced. This is based on the results of Fondevila et al. (2020) who found that fasting resulted in the broilers experiencing negative welfare consequences, starting in the interval 2-4 h after fasting was initiated.



## Conclusions


Reducing the number of feedings without increasing the amount per feeding can lead to a lower total daily ration, causing feed restriction. Feed restriction can result in increased activity and food-seeking behaviour, indicating hunger and a negative affective state among broilers and broiler breeders. Prolonged fasting for more than 2 h can lead to anticipatory behaviour, with extended fasting pre-slaughter increasing distressed behaviour and feather pecking.

If the broilers are not fed ad libitum in between fasting periods, feeding frequency will have little effect on their welfare as the persisting hunger reduces welfare regardless of feeding frequency. The daily amount of feed should therefore be the main concern. Thus, the amount of feed provided daily should be checked rather than the feeding frequency when visiting a broiler producer.



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