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Type and level of production provided by the requestor

Type of production: broiler

Level: husbandry

Keywords: behaviour, health and body condition, housing system, management

Background context provided by the requestor

In the context of organic production of broilers (Gallus gallus) of slow growing strains we have detailed questions on whether lighting can be improved in order to increase the welfare of the birds.

Question raised by the requestor

We would like to know:

a. Does young slow growing broilers such as Ranger Gold/Hubbard (that shall have continuous daytime open air access from as early an age as practically possible and whenever physiological and physical conditions allow), from hatching and the first weeks of their lives have different needs for periods of light and darkness than older birds, and would slow growing broilers welfare benefit from other lighting systems /programmes than the general light programme with 16 hours of light and a continuous nocturnal rest period without artificial light of 8 hours?

b. If a; would resting periods without artificial light of at least 8 hours, divided into shorter periods of resting or by substituting darkness with "dark brooders" the broilers can seek rest under, will be better suitable or if other periods of lighting is needed for the young birds in order to secure their welfare? And how would such a schedule of lighting be at its best including how many hours of darkness in total?

Answer

Two queries have been addressed about lighting and welfare in young poultry: one about pullets (Q2E-2024-003) and one about broilers (Q2E-2024-004). The present answer addresses the two of them together as the information can have interest for both. One question, specific to the query Q2E-2024-003 about the access to natural light in pullets during the first 6 weeks, is treated only in the related answer on pullets.

Needs for Sleep and Rest

All homeothermic vertebrate species intersperse periods of activity with periods of sleep and rest. This cycle often follows a circadian pattern, e.g. diurnal species are mainly active during the day and sleep and rest during the night. The main activity period is often broken up by short periods of rest and, conversely, the main rest period is often interrupted by periods of activity.

Rest may be defined as a prolonged period of inactivity that can clearly be distinguished from other maintenance behaviours, such as foraging, walking or preening (Blokhuis, 1984). Sleep can be defined as a specific state of rest with altered consciousness, reduced responsiveness to external stimuli and homeostatic regulation (Carskadon and Dement, 2005). To measure sleep, one can observe the behaviour when resting. However, it is sometimes impossible to tell whether animals are sleeping or not based on the behaviour, that is why the term resting is more appropriate when using behavioural observations.

Sleep and rest are complex subjects, and they are undoubtedly important for most animal species, most likely serving multiple functions but not yet fully understood. Suggested functions include tissue restoration and growth, energy conservation, neurobehavioral and neurocognitive performance, memory processing and learning as well as increased waste clearance in the brain (reviewed in Forslind, 2023). Quiet rest periods can enhance memory, which is especially important for the young chicks during development learning about their environment and how to interact with other individuals. Physiological recuperation of the body in terms of energy conservation and tissue restoration and growth seem to be a primary function of sleep. During sleep, muscles are relaxed, energy expenditure is low, and hormone secretions are high which, in combination, promote protein anabolism in the tissues (reviewed in Malleau, 2007).

Sleep and rest seem to be particularly important for young animals. Young of all the domesticated species spend more time in sleep than the adults. Young animals do indeed have an increased requirement for sleep compared with adults. Young domestic fowl have been reported to spend approximately 12-16 hours sleeping or resting per day on day 1 post-hatch, compared to 7-8 hours by adult birds (reviewed by Malleau, 2007). These results, coupled with the fact that sleeping and resting occurs daily, suggest that it is an essential activity, especially for the young of a species. Malleau's results (2007) suggest that the need for rest in adult birds is less than the need for rest in young birds, indicating that it serves a different purpose for older birds than for younger birds.

Short sleep, sleep fragmentation, or suboptimal sleep quality define sleep disorders (Jiang et al. 2023). Sleep disruption may affect synchronising daily rhythms of physiological and behavioural processes, reducing feed intake, body weight gain, and immunity in birds (Alaasam et al., 2021). Broiler chickens experience disturbances during resting which obviously decreases their resting quality. **It is very likely that disrupted rest also lead to disrupted sleep and related welfare issues** (Forslind, 2023; Malleau et al., 2007).

<u>Relations between rest/sleep and various factors such as light</u>

An important factor for poultry welfare is light, where the intensity, source, spectrum and schedule all play a role (reviewed in Olanrewaju et al., 2006; Pal et al., 2019). Light is important for sight, help establish rhythmicity (and synchronisation) of essential functions such as body temperature and the metabolism as well as stimulating hormonal secretions that for example control growth and reproduction (Olanrewaju et al., 2006).

Historically, lighting programmes for poultry have been studied in terms of duration and intensity of illumination to optimize growth. The lighting programmes applied to broiler chickens were most often based on a constant day length of close to 23 hours throughout the rearing period. Then, in the poultry industry, when placed in barns post-hatching, chicks are commonly provided with continuous or almost continuous light for the first 3-5 days. For instance, one company recommends providing conventional broiler chicks with 23L at d0-7 and 18-20L after d7 with 4 hours continuously (Aviagen, 2018). Another company recommends exposing pullets to light to promote feed and water ingestion and growth: 22L to 23L d1-3, and then, 22L at d4-7, 20L at d8-14, 18L at d15-21 (Hendrix Genetics B.V. 2021).

The continuous light for the first 3-5 days in commercial farms could disrupt the natural behaviour of chicks regarding sleep. Studies show an increase of disturbances with an increase in stocking density (Hall, 2001; Cornetto et al., 2002; Dawkins et al., 2004; Ventura et al., 2012), however, stocking density in itself does not seem to provide opportunities for undisturbed rest in flocks of broilers (Forlsind 2023). Resting behaviour commonly gets disrupted by physical disturbances by other individuals (Yngvesson et al., 2017). If not synchronised, active broilers are continuously entering and leaving resting groups and areas, disturbing broilers still resting. Indeed, under these conditions, it can be difficult for chicks to get adequate sleep and rest because there will be continual movement to and from feeders and drinkers which will disturb chicks attempting to sleep or rest. **The continuous light commonly given to young chicks may result in sleep deprivation.** Altering the lighting scheme to a more natural like pattern, improves the synchronisation of resting behaviour and reduces physical disturbances which improves the quality of resting (Forslind, 2023).

An understanding of the physiological effects of a circadian rhythm has led to the introduction of night periods in rearing. For instance, night periods allow the production of melatonin by the pineal gland, a hormone involved in numerous metabolic and immune regulations beneficial to the bird (Classen et al, 1991). Remember that in organic production, EU regulation for poultry (2018/848/EC, Annex II, Part II, 1.9.4.4. (l)) indicates that natural light may be supplemented by artificial means to provide a maximum of 16 hours light per day, with a continuous nocturnal rest period without artificial light of at least eight hours.

Under normal conditions, sleep is closely related to the light-dark cycle (Howard, 1972). However, light is not the only factor which controls waking and sleep: hunger, thirst, social competition, hormonal rhythms (such as melatonin) influence the daily organization of sleep-wake cycles. External environmental factors, such as temperature, disturbance and photoperiod, can all affect the quality and quantity of sleep. For instance, several factors, such as sudden loud noises, hunger, large social groups, high temperatures and increased photoperiod, have been shown to be implicated in reducing sleep (reviewed in Malleau, 2004).

Under normal commercial conditions with no equipment failure, hunger, thirst, and temperature are unlikely to be a source of sleep disruption. However, large group sizes have been suggested to possibly reduce sleep time due to constant disturbance (Blokhuis, 1983), even more with continuous lighting. Following Forslind (2023), there are several aspects in broiler production that can affect rest and sleep due to the unnatural circumstances for the birds: high stocking density (more birds occupy the space giving less room to rest undisturbed), large flock sizes (a lot of individuals that can disturb each other), no mother hen, no individual present to induce rest and provide conditions for undisturbed rest for the young chicks, light schedule, if not adapted to the natural resting patterns of young chicks, and barren area (no specific resting places or change to perform motivated resting behaviours such as perching).

To summary, there are two important links between disturbed sleep and animal welfare: animal behaviour and the function of sleep (Figure 1). Firstly, sleep is a highly motivated behaviour, and disturbances of such behaviours could lead to frustration and stress. Secondly, sleep serves vital functions and disturbances of sleep may impair these functions, possibly resulting in impaired health, reduced growth and/or loss of cognitive functioning. **Thus, disturbances of sleep and possible loss of sleep may have detrimental effect on animal welfare, it is relevant to highlight the significance of rest and sleep for the welfare.**

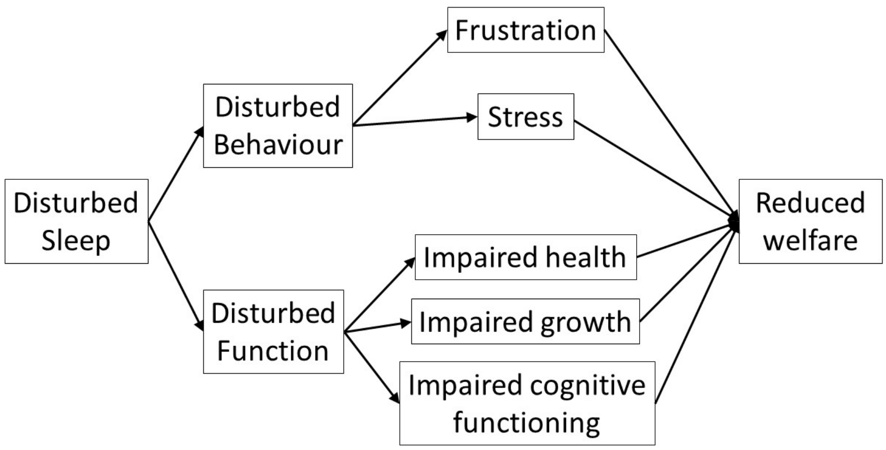

Figure 1: The effect of disturbed sleep on animal welfare. Source: *Forlind, 2023*

Lighting program

As mentioned above, continuous or near-continuous lighting has traditionally been applied with the goal to maximize poultry performance by maximizing access to feed, enhance feed intake, feed conversion ratio and growth rate. Contrary to this assumption, several studies have found that such lighting programs can adversely affect growth performance (Buyse et al., 1996). Furthermore, continuous lighting has been shown in multiple studies to negatively impact poultry welfare.

For example, the photoperiod can impact the **fear response** of laying hens as showed by Campo and Davila (2002). In their study, laying hens housed under 23L:1D lighting regimen showed longer tonic immobility duration than hens housed under 14L:10D photoperiod. This result indicated a negative consequence of continuous light pattern on laying hen welfare in terms of increased fearfulness. Similar results were found in broilers where birds housed under 24 hours of continuous light had higher fear reactions to the same test of tonic immobility in comparison with birds kept under light-dark schedules (Sanotra et al. 2002, Onbasilar et al. 2008). In a study of Onbasilar and colleagues (2008), broilers housed under 16L:8D lighting program also had a **better feather condition** compared to broilers under continuous lighting.

Additionally, in Sanotra and colleagues' study (2002), broilers exposed to continuous lighting (24L:0D) also had more gait problems, worse tibial dyschondroplasia scores, and lower level of activity during the day than those reared on light-dark schedules (2 to 8h daily dark period). These results confirmed previous studies' conclusions: more than 20 hours of light periods per day from four days of broilers' age until slaughter increase the occurrence of skeletal abnormalities (Classen et al. 1991), leg problems (Wilson et al. 1984; Renden et al. 1991), tibial dyschondroplasia scores (Renden et al. 1991), and gait scores at the end of the rearing period in comparison with broilers housed with dark periods superior to 4 hours per day. Light regimes with both light and dark periods may promote bone development via the release of melatonin known to promote bone development, and via the increase of birds' locomotion during light periods (van der Pol et al. 2015). Dark periods in early days of life are therefore essential for **bone development** of broilers.

In addition, near-continuous lighting later in their life has negative consequences on behaviour of broilers. The study by Schwean-Lardner et al. (2012) compared broilers of 27 and 42 days of age housed with different photoperiods. They found that birds housed under near-continuous lighting were less **active** and spend less time on **comfort behaviours**, including preening, stretching and dustbathing. However, when they compared lighting programs with 7 and 10 hours of darkness, they noted no behavioural advantages of the 10 hours of darkness in comparison with 7 hours darkness program. Nevertheless, increasing the length of darkness may have other positive effects on broilers welfare. Recently, Jiang and colleagues (2023) found that broilers housed under 12L and 16L after 15 days of age had improved production performance, leg bone health, and supressed stress reaction compared to birds housed under 18L and 20L. In addition, they found birds in the 12L group to be less fearful according to the touch test and the tonic immobility test. The authors of this study concluded that supplying 12 hours as well as 16 hours of daily light (12L:12D as well as 16L:8D being close to the natural light cycle) improves performance and health while decreasing stress levels in broilers. Lastly, in a recent review, Wu and colleagues (2022) suggested a photoperiod of 16L:8D for the broilers production however recommendations may differ depending on seasons changes and chickens house types.

In 1998, Lewis and colleagues showed with their model that pullets reared on constant 10 hours of daily light will **mature earlier** (first egg earlier) than pullets reared on shorter or longer constant photoperiods. Additionally, exposing pullets to too short photoperiod is deleterious to their **immune response** as shown by Mashaly and colleagues (1988 in Janczak and Riber 2015) who indicated a higher lymphocyte count and a more active lymphocyte response in chicks reared in 16 h of light in comparison with chicks reared in 8 h of light. In a recent review (Du et al. 2022), the authors concluded that pullets could achieve welfare-performance balance if 8 to 10 hours of darkness were guaranteed. As regards adult layers, when the freedom to choose different light intensities is given to laying hens (23 to 30 weeks of age), they choose to spend 10 hours in darkness per day in total distributed intermittently throughout the day (averaging 25 min per hour) (Ma et al. 2016).

A lot of studies (described previously) examined the effect of different lighting programs on broiler chickens and laying hens health, productivity and behaviours. However, these studies mainly focused on lighting exposal during several weeks after the first days of the birds and not on the effects of continuous or near-continuous light during the early period. No study examined the consequences of the photoperiod during the first days of the birds until recently. Two studies on broiler chicks focusing either on the first 7 days (Magee et al. 2023) or the first 14 days of age (Magee et al. 2022) have examine the effects of a longer scotophase (dark hours) of 20L:4D and compared these effects to a near-continuous photoperiod 23L:1D. Magee and colleagues showed no difference in performance (crop fill, body weight, body weight gain, feed intake, feed conversion ratio) in broiler chicks exposed to the shorter photoperiod in comparison with chicks exposed to a near-continuous photoperiod during the first 14 days post-hatch (Magee et al. 2022). Authors concluded that increasing the scotophase length as early as day-of-hatch may be implemented without any compromise in performance. In addition, Magee et al. (2023) have shown an increase of melatonin production in chicks exposed to 20L:4D in the first 7 days of age in comparison with chicks exposed to 23L:1D photoperiod. Additionally, the blood glucose levels of the 20L:4D chicks group stayed consistent throughout the 4 hours of dark period indicating a better glucose regulation, whereas it declined during the 1 hour of dark period in the 23L:1D group. Melatonin having positive effects on the immune system function, stress compensation, growth and development, this study suggest that implementing a longer scotophase to the broiler chicks may improve their health and welfare (Magee et al. 2023).

Intermittent programs

In addition to the duration of dark periods, the distribution of photoperiod (light period) and scotoperiod (dark period) have also been reported to influence growth performance: Duve et al. (2011) found that broilers experiencing a split darkness of 8 h from 8 to 36 days of age (4 h in the first half and 4 h in the last half of the day) had a significantly increased feed intake and weight gain compared to birds with continuous 8 h darkness, although no effect was observed on footpad dermatitis. Additionally, El Sabry et al. (2015) found that broiler chicks from young breeders have improved feed intake and body weight under split darkness from 4 to 35 days of age (14L:4D, 2L:4D) compared to birds exposed to a 16L:8D cycle. However, in this study no welfare indicator was studied.

Furthermore, intermittent light programs impact broilers welfare. Onbasilar et al. (2007) found that broilers housed under continuous lighting (24L:0D) during the first 6 weeks of life showed prolonged TI durations compared to broilers under an intermittent lighting program (1L:3D), indicating higher **fear levels** under continuous light. In the study by Onbasilar et al. (2007), the intermittent lighting regime not only reduced fearfulness but also decreased the feed-to-gain ratio and improved the immune response. However, body weight, carcass traits, tibial dyschondroplasia, and stress parameters were not significantly affected in this study, whereas intermittent lighting affected some of these parameters in other studies. Broilers housed under intermittent light programs (1L: 2D) from 7 days of age have less **leg problems** than birds reared under continuous light photoperiod in a study of Wilson and colleagues (1984). In addition, a study from Nelson and colleagues (2020) showed a higher body weight at 45 days and lower footpad dermatitis and hock burns in broilers reared under an intermittent photoperiod in comparison with broilers reared under increasing photoperiod[1], which have reduced blood indicators of short and long-term **stress** (plasma corticosterone and heterophil/lymphocyte ratio). Nevertheless, another study (Abbas et al. 2008) showed reduced plasma corticosterone and H/L ratio in broilers housed (from 4 days of age, during 6 weeks) under intermittent photoperiod (2L:2D) in comparison with non-intermittent lighting program (12L:12D). However, in Nelson and colleagues' study (2020), the difference of photoperiod was paired with a difference in dawn/dusk duration (1 min in intermittent photoperiod group and 30 min in the non-intermittent photoperiod group) which may impact the result. Indeed, the **dimming period** is essential to allow birds to adjust to the lighting changes and may have reduced stress indicators in broilers reared with non-intermittent photoperiod.

Several studies have investigated the performance of laying hens under different lighting regimes, including intermittent lighting programs. For instance, in 1999, Petersen and Mennicken demonstrated that pullets reared under intermittent lighting were **heavier** at the end of the rearing period in comparison with pullets reared under the same number of light and dark hours but in a non-intermittent program (16 hours of light and 8 hours of darkness), with this weight difference persisting until the end of the laying period. Additionally, intermittent lighting positively influenced the feed conversion ratio based on body weight and the egg production. However, there is a gap of knowledge regarding the effects of intermittent lighting on the welfare of laying hens and pullets. Nonetheless, a recent study by Geng et al.

[1] Intermittent photoperiod: 24L:0D day 0 to 6, 16L:8D day 7 to 13, 12L:4D:2L:6D day 14 to 20, 12L:4D:3L:5D day 21 to 27, 12L:4D:4L:4D day 28 to 41, and 13L:3D:5L:3D day 42 to 45, with a 1 min transition between light and dark periods; increasing photoperiod: 23L:1D day 0 to 7, 16L:8D day 8 to 21, 18L:6D day 22 to 32, and 20L:4D day 33 to 45, with a 1-min light/dark transition period day 0 to 7 and a 30 min transition period day 8 to 45 (Nelson et al. 2020).

(2023) examining pullets reared from 19 weeks old under free-range and different lighting conditions indoor showed that there were higher percentages of birds in the **outdoor area** at 34 and 36 weeks of age in intermittent lighting rearing conditions than in continuous lighting conditions[2] (16.60% vs. 19.95%). The authors hypothesized that hens living under intermittent lighting condition may be more adaptable to the changing outdoor environment. Furthermore, in this study, laying hens raised under intermittent lighting had better **feather coverage** compared to those raised under continuous lighting conditions.

Light intensity

Light intensity should also be taken into consideration. Light intensity needs to be set depending on age and genotype of the bird. Two weeks old layers and broilers prefer high light intensity (200 lux) but this preference had disappeared by 6 weeks of age (Davis et al., 1999). Six weeks old layers and broilers spend more time in the dimmest environment (<10 lux), but this preference was only associated with two behaviours: resting and perching. The light intensity can influence the distribution of the behaviours in broilers (Alvino et al., 2009). In case of lack of distinct light intensity between photophase and scotophase (5 lux photophase and 1 lux scotophase in Alvino and colleagues' study), broilers showed less active behaviours in the photophase and more active behaviours in the scotophase than broilers housed with greater day-night illumination contrast (50 and 200 lux). This study suggested that providing a more distinct light intensity between day and night (even more than the 20-lux indicated in the 2007/43/CE Council Directive) promoted more distinct behavioural rhythms of the broilers and avoided even dispersal of active and inactive behaviours during the entire photoperiod. A too low light intensity may also affect carcass characteristics and health of the broilers. Deep and colleagues (2010) showed that a 1 lux light intensity treatment (from 7 to 35 days of age) in broiler chickens resulted in increased ulcerative footpad lesions and eye size and weight. Du and colleagues (2022) reviewed the effect of management practices on pullet welfare. Regarding light intensity, the studies they reviewed revealed a preference of pullets for different light intensities depending on their activities (feeding, preening, jumping, etc.). Therefore, they suggested in their review providing light intensities varying between 5 and 30 lux at different locations to achieve pullets' welfare–performance balance.

Dark brooders

Dark brooders are artificial replacements of a mother hen, which can be used as a source of heating and resting opportunities for young chickens of domestic fowl (Sirovnik and Riber et al. 2022). Consisting of a horizontal heating element equipped with curtains, dark brooders create a dark area underneath where the birds can rest with reduced disturbance. The effect of dark brooders has mainly been studied in pullets and laying hens. Jensen et al. (2006) compared pens with layer chicks who were either provided with dark brooders or conventional heating lamps under a 14L:10D lighting program. Dark brooders **prevented development of severe feather pecking** in the dark brooder pens, whereas feather pecking in heating lamp pens continued to increase until the termination of the experiment at 23 weeks of age. Mortality was almost non-existent in dark brooder pens and damages to plumage and skin were found to be significantly lower in dark brooder pens. Thus, providing dark brooders effectively reduced the frequency of feather pecking and cannibalism resulting in reduced mortality and an improved condition of skin and plumage. A similar finding was made by Riber and Guzman (2016) who found that layer chicks with dark brooders spent less time on feather pecking compared to control chicks. In addition, their findings suggested that dark brooders reduce fearfulness. Gilani et al. (2012) investigated the effect of dark brooders on commercial farms with layer chicks. They found that farms with dark brooders performed significantly less severe feather pecking behaviour and had a significantly lower percentage of birds with missing feathers compared to control farms. Mortality was not measurably affected by treatment.

Few studies explored dark brooders effects in broiler chickens (only three, to the EURCAW experts' knowledge). The first study on dark brooders in broiler chickens, from Stadig and colleagues (2018), found no effect of dark brooders on the fearfulness, behaviours and free-range use of slow-growing broilers. However, in the second study, dark brooders

[2] 3 photoperiods: 16h, 14 h, 12 h and 6 groups: 16L:8D for group 1; 12L:2D:4L:6D for group 2; 14L:10D for group 3; 10L:2D:4L:8D for group 4; 12L:12D for group 5, and 8L:4D:4L:8D for group 6 (Geng et al. 2023)

had short- and long-term effects (De Jong et al. 2022): broilers reared with dark brooders were **more symmetric** at slaughter age, indicating less stress experienced during rearing, and had **better footpad dermatitis and hock burns scores**. Regarding the behavioural component, birds reared with a dark brooder had a better **social reinstatement** and had more **synchronicity** in their behaviours. De Jong and colleagues indicated that dark brooders stimulate sociality in chickens. An additional study on dark brooders in broiler chickens focused on resting behaviour (Forslind et al. 2022). Their findings revealed that the use of dark brooders resulted in **longer resting bouts and increased activity between bouts**. Moreover, birds in the pens equipped with dark brooders experienced **fewer disturbances during resting bouts** compared to control pens. These disturbances not only shortened the duration of resting bouts but also impacted the activity between bouts, leading to shorter periods of activity following a disturbance compared to uninterrupted activity. Shorter periods of activity may be an indication of increased motivation to continue resting, potentially implying a lower quality of rest when resting bouts were disturbed. Additionally, broilers with access to dark brooders were more likely to **solve a spatial learning task**, although success did not correlate with faster task completion. The study concluded that while dark brooders effectively reduce disturbances, they do not completely eliminate them. The persistent disturbances were attributed to a lack of behavioural synchronization. The authors suggested that alongside dark brooders, implementing intermittent lighting programs could help synchronize behavioural patterns, thereby enhancing resting bouts.

In addition to a darker place, dark brooders provide also a source of heating. Temperature is also an important factor to consider for resting and sleeping. As temperature increases, sleep has been reported to decrease. But the effect of temperature on sleep is probably of greatest significance to the young chicks because they are more sensitive to changes in temperature and air speed (Morrison et al., 1987) than older birds. In commercial practice, young domestic fowl are typically supplied with supplemental heat during the first four weeks of life. Since chicks require an environmental temperature of 30-32°C on day 1, dropping by 2.8-3.9°C per week thereafter (North & Bell, 1990), it is possible that fluctuations outside of this zone coupled with continuous light increasingly hamper adequate rest in young birds. In this way, dark brooders might have a positive influence also on behaviours leading to better resting under dark brooders and increased activity outside of them.

Conclusions

Question A: *Does young slow growing broilers such as Ranger Gold/Hubbard (that shall have continuous daytime open air access from as early an age as practically possible and whenever physiological and physical conditions allow), from hatching and the first weeks of their lives have different needs for periods of light and darkness than older birds, and would slow growing broilers welfare benefit from other lighting systems /programmes than the general light programme with 16 hours of light and a continuous nocturnal rest period without artificial light of 8 hours?*

Young domestic fowl do indeed have an increased requirement for sleep compared with adults. The continuous or almost continuous light for the first 3-5 days in commercial farms could disrupt the natural behaviour of chicks regarding sleep. Additionally, continuous or almost continuous lighting has negative effects on fearfulness of birds (layers and broilers) and impacts negatively the leg health and behaviours of broilers. Broiler chicks should be exposed to at least 4 hours of scotophase for appropriate rest and melatonin production.

In broiler chickens during the rearing period, at least 7 hours of darkness allow good behavioural expression and at least 8 hours of darkness improved the performance, leg health and stress reaction compared to less than 6 hours of nocturnal rest period. In pullets, 8 to 10 hours of darkness promote the welfare-performance balance.

Question B: *would resting periods without artificial light of at least 8 hours, divided into shorter periods of resting or by substituting darkness with "dark brooders" the broilers can seek rest under, will be better suitable or if other periods* *of lighting is needed for the young birds in order to secure their welfare? And how would such a schedule of lighting be at its best including how many hours of darkness in total?*

In broilers, intermittent lighting may increase feed intake and body weight as well as decrease leg issues and contact dermatitis. However, there is a gap of knowledge about intermittent lighting and the welfare of pullets and laying hens. However, one study showed a better feather cover and outdoor range use by laying hens reared under intermittent lighting regime in comparison with birds reared under continuous lighting. There is a gap in knowledge about the effect of intermittent lighting on the welfare of broiler chicks and pullets in their first days of life.

Integrating dark brooders into the housing system for young birds may reduce occurrence of severe feather pecking, reduce fearfulness, promote better resting patterns, enhance positive social interactions, potentially improve cognitive abilities, and provide optimal temperature conditions for rest.

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