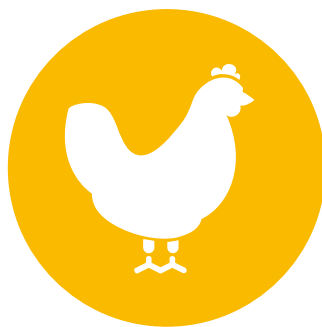




Review

Behavioural Indicators Used to Assess Welfare of Broiler Chickens On-Farm



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1 Executive Summary

Behavioural assessments can be used to indicate the welfare of broiler chickens. The occurrence or frequency of certain behaviours associated with negative emotional states (e.g., fear) or inappropriate environment (i.e., thermal stress) can indicate poor welfare. On farm assessments can include fear or human-animal relationship tests, as well as behaviours like panting, piling, and huddling. Conversely, the occurrence or frequency of behaviours associated with positive emotional states or suitable environments can indicate improved welfare. In this case, the most common are assessing play behaviour, comfort behaviours, and exploratory behaviours. Some assessments include a Qualitative Behavioural Assessment (QBA) to gauge the overall emotional state of the animals. Behavioural indicators provide an important complement to other animal-based measures. However, it is important to remember that any behaviour test that relies on movement may be difficult to interpret in heavier or older broilers who are not able to move as well.

2 Introduction

Behavioural indicators of welfare are an important complement to other animal-based measures. Behaviour can provide insight into emotion or affective state, as well as indicate if the environment is meeting the broiler's needs through the expression (or lack of expression) of natural and motivated behaviours. Changes in bird behaviour may provide an early warning of a developing pathology or could provide evidence that some pathologies are more painful than others (Abeyesinghe et al., 2021). There are numerous behaviours and behavioural tests that can be used as welfare indicators, each with their own benefits and limitations. There are limited behavioural measures included in formal welfare assessments such as the Welfare Quality® protocol. However, there are many different behavioural measures being applied in research settings that could be used as on-farm welfare indicators.

Broadly, these behavioural measures can be grouped into positive or negative welfare indicators. The frequency of expression of motivated behaviours like dust bathing, or the occurrence of behaviours associated with positive emotions like play, can result in a positive interpretation of welfare. Conversely, the absence of these behaviours can indicate negative welfare. On the other hand, increased frequency of behaviours that are associated with negative emotions like fear or stress can also be used to indicate that the flock may be experiencing negative welfare.

The main way of assessing behaviour is through its frequency and/or its duration. Behavioural welfare indicators are often assessed by observing the proportion of time dedicated to different behaviours thought to indicate either positive or negative welfare. Alternatively, one can assess the frequency of certain behaviours (i.e., number of animals per unit time) (EFSA, 2023). Behavioural assessments require training to perform and can be labour intensive depending on the scale of production and complexity of the behaviour (EFSA, 2023). There are numerous methodological techniques that can be used when assessing animal behaviour and describing all of them is outside the scope of this review. Behavioural assessments are typically conducted in real-time by trained observers or by watching and assessing video recordings. For on-farm assessment of broiler welfare, live observation is more common, however, the increasing digitization of broiler systems is making video observations and assessments more feasible. The measurement approach chosen is often dictated by flock size and very fine detailed measurements are not always practical in large flocks. Furthermore, it also depends on the type of behaviour being assessed where some behaviours that are longer in duration (i.e., standing, perching) may be better suited to a different type of sampling compared to behaviours of very short duration (i.e., feather pecking).

The purpose of this review is to illustrate the different behavioural measures that exist for on-farm welfare assessment of broilers and provide a brief description of the connection between these behaviours and broiler welfare.

3 Methods

A literature search was conducted in September 2024 using the Web of Science database without any temporal or language restrictions. Search terms included:

Search 1: broiler* AND welfare AND behavio*r AND indicator

Search 2: broiler* AND welfare AND positive affective state AND indicator

The obtained literature was screened for relevant references using the snowball method. Technical documents, such as those from animal welfare audit organizations were obtained using Google. For each publication, information regarding the behavioural measures used to indicate welfare was collected.

4 Results

For detailed information about behavioural sampling methods, the reader is encouraged to visit the scientific articles referenced in each section.

Welfare assessment protocols for broilers

Several welfare assessment protocols have been developed for the on-farm welfare assessment of broilers. Some are available in mobile application form such as the French tool EBENE (Warin et al., 2018), the i-WatchBroiler app (Marchewka et al., 2015; Marchewka et al., 2013), and the TIBENA app (Michel et al., 2017). There are also welfare assessment guidelines such as the KBTL guidelines (Knierim et al., 2020), the RSPCA Broiler Breed Welfare Assessment Protocol (RSPCA, 2017), and the Welfare Quality® protocol (WelfareQuality®, 2009). While some of these protocols include animal-based measures, they do not include behavioural welfare indicators and are therefore not discussed (i.e., KBTL, RSPCA).

The WelfareQuality® protocol (2009) includes behavioural measures to indicate spatial distribution (i.e., cover on the range, free range use), a good human-animal relationship (i.e., avoidance distance test), and positive emotions (i.e., Qualitative Behaviour Assessment). The poultry WelfareQuality® protocol also includes a section for assessing the expression of social behaviours but no measure has been developed for this criterion regarding broilers. For laying hens, this section includes aggressive behaviour and associated injuries, but this has not been validated for broilers in this protocol.

The i-WatchBroiler app is based on an adaptation of the transect walk methodology (Marchewka et al., 2015; Marchewka et al., 2013). In this method, the poultry house is divided into transects (typically spaces between feeder and drinker lines). The observer slowly walks down each transect, scans the birds in their path, and records the frequency of welfare indicators indicated in the WelfareQuality® protocol (Figure 1) (BenSassi et al., 2019; WelfareQuality®, 2009).



Figure 1. Observer conducting a transect walk between the feeder and drinker lines in a broiler barn.

The EBENE app includes behavioural measures such as the number of birds dustbathing, grooming/preening, exploring, stretching or wing flapping, aggressive pecking, and interacting with each other. The observer records the number of times these behaviours are observed in a 5-minute interval, repeated in several areas throughout the barn.

Negative behaviours

It is most common to consider the expression of behaviours associated with negative stimuli/emotional states when conducting welfare assessments. These behaviours with typically negative connotations can include fear response, panting, uneven spatial distribution, severe feather pecking and cannibalism (Lourenço da Silva et al., 2021).

Fear response

Fear is defined as a response to the perception of actual danger (Boissy, 1998) and while it can be adaptive, overly fearful animals are more likely to be chronically stressed, injure themselves, and have a more negative welfare (Rushen et al., 1999). Several behavioural tests and indicators exist to assess the fear response in poultry and many of these measures have been applied in on-farm assessments of broilers. Humans can be a fear inducing stimulus that negatively affects broiler welfare (Rushen et al., 1999), and so several behavioural tests of the fear response involve the reaction of the birds to a human in their environment (i.e., avoidance distance test, touch test, stationary person test). Additionally, if birds are generally fearful, they may present higher levels of neophobia which means they are afraid of unfamiliar objects in their environment. Some tests, therefore, exist to test the reaction of the birds to an unknown object (i.e., novel object test). Generally, these tests assume that if the birds are fearful of the human or object they will move away (greater distance) and if they are not fearful they will move closer (shorter distance) (Rasmussen et al., 2024).

Avoidance distance test (ADT)

The ADT is considered a validated method in broilers to assess human-animal relationship and general fearfulness (Vasdal et al., 2018; WelfareQuality®, 2009). The ADT is included in some on-farm broiler welfare assessment protocols (WelfareQuality®, 2009). This test assesses the reaction of an animal to a human observer. The observer goes to several different locations in the barn and assumes a non-threatening position (i.e., squatting) and counts the number of birds within arms distance (1 m) after 10 s (WelfareQuality®, 2009). If more birds are within arm's reach, this is thought to indicate a better human-animal relationship and consequently better welfare in that flock compared to a flock with fewer birds within arm's reach.

Stationary person test (SPT)

The stationary person test is another behavioural test that can be used to assess broiler chicken fearfulness of humans (Brantsæter et al., 2017). To conduct this test, an observer slowly enters the house and stands stationary with their back against the door and faces the inside of the house. The area in front of the observer is monitored for typically two minutes and the number of chickens within half a square meter of the person are counted every 10 seconds. Similar to the other fear tests, if more birds approach the observer, it is assumed that they are less fearful and consequently have better welfare. If this test is to be repeated multiple times in the same flock of birds (i.e., over different days, weeks), sometimes the appearance of the observer is changed (i.e., different coloured clothing, different person) to avoid habituation of the birds to a specific observer.

Touch test (TT)

The touch test is similar in its principle to the ADT and SPT. It aims to assess human-animal relationship and general fearfulness (Vasdal et al., 2018). In this test, the observer approaches a flock of birds, squats for 10 s, and then counts the number of birds within arm's length (1 m or less) (Vasdal et al., 2018). The observer then counts the number of birds they can actually touch. This test is repeated up to 21 times in a flock, however, if no birds are within arm's length in the first 12 trials, the touch test is terminated. This test assumes that the fewer birds that can be touched, the more fearful the birds are and perhaps worse in terms of welfare. Similar to the other tests, if more birds are able to be touched, this is indicative of better human-animal relationships and better welfare. More information on conducting the TT can be found in the corresponding Factsheet (EURCAW-Poultry-SFA, 2024).

Novel object test (NOT)

The NOT is considered a validated method in poultry to assess neophobia and general fearfulness (WelfareQuality®, 2009). Although this test is included in the WelfareQuality® for laying hens, it is not included in the protocol for broilers (WelfareQuality®, 2009). This test is conducted by presenting the animals with an unknown object and observing the subsequent reaction. Like the ADT, this test is conducted at several different locations in the barn by placing the object and counting the number of animals within a bird-length radius of the object, usually over a couple minutes. By using the bird length as the radius, it allows for adjustment over time as the birds grow. It is important to use a different object every time this test is conducted to avoid habituation

of the birds to the object. Similar to the other fear tests, it assumes that the closer the birds are to the novel object the lower the fear and consequently better welfare.

Piling

In addition to the behavioural tests, the occurrence of certain behaviours can be used to indicate fear. Piling is a behaviour defined as the gathering of birds in densities that are higher than expected (Gray et al., 2020). Several types of piling have been defined across poultry species including nest box piling, creeping/recurring piling, and fear/panic induced (Bright & Johnson, 2011). Fear/panic piling is a type of piling that could be used as a behavioural indicator of welfare in broilers. In all cases, piling can lead to smothering (death due to suffocation) (Winter et al., 2021). Several definitions of piling for behavioural observation exist. It can be defined as three or more mostly immobile hens in close proximity to each other with most hens facing the same direction (Winter et al., 2021) or at least 10 birds pressed together for at least one min (Campbell et al., 2016). In laying hens, piling bouts that last longer than 4.5 minutes can be reliably detected by trained observers (Winter et al., 2021). These piles form mostly at the end of aisles or in corners. However, other studies have argued that a more practical definition of piling for on-farm assessment is more than thirty tightly packed birds such that only the head and neck are visible, for more than 30 minutes (Herbert et al., 2021). Fear piling can be used as a behavioural indicator of welfare because it has been associated with nervousness, social pressure, and pain in poultry (Hansen, 1976).

Thermal stress

Broilers experience negative welfare when they are subject to temperatures that are too hot or too cold. Behavioural indicators of thermal stress can be recorded as part of an on-farm broiler welfare assessment. These behaviours are natural responses to temperatures outside the thermal comfort zone. However, a large number of birds exhibiting behaviours associated with heat stress (i.e., panting) or cold stress (i.e., huddling) for prolonged periods likely indicates that adjustments need to be made in their environment. It should also be kept in mind that the frequency of these behaviours can vary with the housing system, and birds may be more susceptible to different kinds of thermal stress depending on their age.

Panting

Panting is associated with heat stress which is a prominent welfare concern in broilers. Panting is observable as short fast breaths with the beak open (WelfareQuality®, 2009). The birds pant in an effort to increase respiratory heat loss. The higher frequency of panting observed indicates a higher welfare risk from heat stress. Birds experiencing heat stress may also hold their wings farther away from their body to try to dissipate additional heat.

Huddling

Huddling is a behaviour observed in broilers that can be used to indicate cold stress. Huddling involves the clustering together of birds possibly with space in between individual clusters. This appears differently to the normal loose grouping distribution that broilers often display when resting. The birds huddle in this way to minimize heat loss when their environment is too cold.

The more huddling behaviour observed indicates a greater severity of cold stress (WelfareQuality®, 2009). This is different than the behaviour called piling discussed above. In young chicks, huddling is often associated with distress calls which could be used to help distinguish between the two behaviours.

Injurious behaviours

Injurious behaviours refer to those with the potential to cause injury. The injurious behaviours that tend to be used as welfare indicators in broilers mainly involve aggression. The WelfareQuality® protocol considers aggression under the expression of social behaviour criterion, and as of the latest edition (WelfareQuality®, 2009) there is no measure developed for this criterion for broilers. In laying hens, the measures in this criterion include aggressive behaviour, plumage damage, and comb pecking wounds (WelfareQuality®, 2009). Aggression is more commonly reported in broiler breeders; however, some studies have developed measures for aggressive behaviour in broilers. Pettit-Ryley et al. (2002) developed an ethogram to assess broiler aggression which included behaviours such as chasing, fighting (with or without pecking), leaping, pecking, stand-offs, and threats. The most common aggressive behaviour observed in the broilers was threats which was defined as an encounter in which a birds stands with an erect neck and feathers raised in front of another bird (Pettit-Riley et al., 2002). Behaviours with the potential to cause injury (i.e., fighting, pecking) occurred very rarely in conventional broilers (although they may be more frequent in slow-growing or broiler breeders) which may illustrate why these behaviours are not often included in broiler welfare assessments. Furthermore, at young ages, it is difficult to distinguish between true aggression and play fighting. Therefore, caution should be taken when attempting to assess and interpret aggression in broilers as part of a welfare assessment. It should also be noted that these behaviours are not always easy to observe during live observations due to their short duration. Typically, they are assessed using focal sampling or video recording which is not necessarily feasible during on-farm welfare assessments. Alternatively, body lesions (outcomes of the injurious behaviours) can be used as a proxy for the level of injurious behaviour in a flock with a greater occurrence of lesions indicating more injurious behaviour and consequently poorer welfare.

Table 1: Ethogram of behavioural indicators of negative welfare in broilers. For some behaviours, multiple ethogram definitions are presented.

Behaviour	Definition	Reference
Piling	A minimum of 10 birds pressed against each other for at least 1 min, their heads facing the same direction and not performing any other discernible behaviour	(Campbell et al., 2016)
Panting	Bird sitting upright with an open beak making rapid visible respiratory movements.	(WelfareQuality®, 2009)
Huddling	Birds grouped together in tight clumps with areas of empty space between, distinct from the loose grouping that birds show when resting.	(WelfareQuality®, 2009)
Aggression	Aggressive and vigorous pecking and/or kicking the legs where the aggressor makes contact with another bird in a rapid and forceful manner. Aggressive pecking is usually directed at the head of the receiving bird. The receiving bird will take action to immediately avoid the aggressor or will respond with aggressive pecking and/or	(Baxter et al., 2019)

	kicking. There is usually a clear winner and loser, such that a pecking order could be interpreted. A bout begins when a bird makes forceful contact with another bird and ends when the bird resumes another activity.	
Chasing	One bird runs at least three steps after another bird.	(Pettit-Riley et al., 2002)
Fighting (no pecks)	Two birds are standing in front of one another with their heads and necks raised at the same level. Bird is delivering more than two vigorous kicks at the opponent, but no pecks are observed.	(Pettit-Riley et al., 2002)
Fighting (with pecks)	All criteria for fighting above with one bird delivering at least one peck to the opponent.	(Pettit-Riley et al., 2002)
Stand-off	Two birds stand facing one another with their heads at the same level for more than 2 seconds.	(Pettit-Riley et al., 2002)
Threat	A bird stands with its neck erect and feathers raised while facing a second bird which usually has its head at a lower level.	(Pettit-Riley et al., 2002)

Positive behaviours

Positive animal welfare examines and assesses valued resources, positive emotions, and motivated natural behaviours. The increased frequency and/or duration of positive behaviours is believed to indicate better welfare. Some positive behaviours examined in on-farm broiler welfare assessments include worm running, play fighting, wing flapping, jumping, running, ground scratching, and vertical wing shaking (Rayner et al., 2020).

Comfort behaviours

Comfort behaviours can be defined as those involved in body maintenance (Rayner et al., 2020). Comfort behaviours include preening, dust bathing, wing flapping, and leg stretching (Nicol, 2015). These behaviours are performed to keep the feather cover in good condition and develops in chicks as early as 1 week of age (Baxter et al., 2019). It has been suggested that these behaviours are associated with a positive emotional state (Zimmerman et al., 2011). The inability to perform comfort behaviours is considered a prominent welfare consequence for broilers (EFSA, 2023). Comfort behaviours are not included in some on-farm welfare assessment protocols like WelfareQuality®, while some of these behaviours (i.e., preening, stretching, and dustbathing) are included in assessment applications like EBENE.

Preening

Preening involves the bird using its beak to clean and realign its plumage (EFSA, 2023). This can be through pecking, combing, nibbling, or rotating movements that distribute oils from the preen gland throughout the plumage. Preening is important for maintaining plumage quality which has important implications for welfare. However, excessive preening behaviour may indicate frustration and therefore could also be used as an indicator of negative welfare.

Dust bathing

Dust bathing is a body maintenance behaviour that is an organised sequence of behavioural patterns where the bird covers the feathers in substrate and distributes it amongst the feather cover. Dust bathing ends with feather shaking to dislodge the dust from the feathers. In addition

to the body maintenance function, dustbathing is believed to be associated with relaxation and can occur with behaviours like stretching and wing flapping (Zimmerman et al., 2011).

Stretching

Stretching involves the spreading of one or both legs and/or wings sideward or backward and downward (Li et al., 2021). A low frequency of stretching indicates there is a lack of space to perform the behaviour which can negatively affect welfare. If this is the case, sometimes birds attempting to stretch can be observed but they are unable to reach full extension due to limited space (Buijs et al., 2011).

Play and high-energy behaviours

High-energy behaviours are often used as welfare indicators since their occurrence tends to decrease when the animals or conditions are poor. Some of these behaviours include high-energy activities like running, jumping, and wing-assisted incline running (WAIR). It is also relatively common to use a high-energy behaviour like play as a positive welfare indicator in animals including broiler chickens. Play behaviour is defined as behaviours that are spontaneous, energy-demanding, and often self-handicapping (intentionally inhibiting strength or skill), that are performed in non-threatening conditions (Spinka et al., 2001). Play is considered an opportunity behaviour that tends to decline when conditions are poor. Playing can involve locomotion (i.e., running and jumping), objects (i.e., interacting with items/toys/structures), and/or other animals (i.e., play fighting). Play behaviours are more common in juvenile animals and their frequency typically declines with age. The occurrence of play behaviours is believed to indicate positive affective states because animals find it rewarding and the frequency of play is often reduced when animals are stressed or ill (Held & Špinka, 2011). Some examples of high-energy behaviours included in on-farm welfare assessments of broilers are described below.

Worm (food) running

Worm (also known as food) running occurs when a bird picks up a piece of food or object and runs with it, while other birds chase the running bird and try to grab the item (Cloutier et al., 2004). When food is provided ad libitum, this behaviour meets the criteria for play because it is not associated with social dominance, and it does not have an immediate benefit for survival (especially when non-food items are used). The natural occurrence of worm running can be observed as a welfare indicator, or a “worm running test” can be conducted by providing the chickens with a worm-like object (i.e., piece of paper, pipe cleaner) and observing how they interact with it (Liu et al., 2020).

Play fighting

Play fighting (or sparring) is a type of play behaviour typically defined as birds displaying some elements of normal fighting like jumping and physical contact, but without aggressive pecking and injuries (Baxter et al., 2019). Bouts of play fighting may begin with jumps and kicks that make little to no contact with another bird. Threats or stand-offs may also occur. Play fighting can typically be distinguished from aggression because the actions are not overly forceful and do not

cause a strong avoidance response from the receiver (Baxter et al., 2019). The receiver may reciprocate and participate in playing or ignore the acting bird.

Frolicking

Frolicking is defined as spontaneous and repeated running with raised or flapping wings (Dawson & Siegel, 1967). This behaviour is socially contagious in flocks, meaning other birds in the flock will often mimic the behaviour (Dawson & Siegel, 1967). Sometimes frolicking may lead to play fighting. Wing flapping can also occur when the bird is not moving and is often associated with frolicking and sparring in young chickens. Wing flapping performed without running can also be interpreted as a comfort behaviour (WelfareQuality®, 2009).

Foraging and exploratory behaviours

The inability to perform foraging and exploratory behaviours has negative implications for broiler welfare (EFSA, 2023). Exploratory behaviours are defined as those involved in finding or revealing aspects of the physical environment (Rayner et al., 2020). Exploring is defined as the gathering of environmental information through active moving (including pecking) whereas foraging specifically refers to the exploratory search for food (EFSA, 2023). Although there is consistent provision of food in broiler houses, a large proportion of their time is spent exploring and foraging. The amount of time spent, or frequency of these behaviours, can be used as welfare indicators due to their inverse relationship with fear and environment quality. Fearful birds will explore and forage less, and foraging will decline when litter condition is poor. Because these are motivated behaviours, the inability to explore and forage may result in frustration and boredom which has negative welfare implications. Foraging and exploration occur through the production cycle of a broiler chicken, however, many factors can influence the expression of this behaviour like stocking density, body weight, environmental complexity, and personality (EFSA, 2023).

Exploratory behaviour is defined for assessment as bouts of walking and/or pecking or scratching at the floor, wall, structures or objects. These actions are often repeated several times. This does not include regular consumption of food or pecking at other birds. Exploratory behaviour can also be tested using the novel object test described earlier (Tahamtani & Riber, 2020).

Table 2: Ethogram of behavioural indicators of positive welfare in broilers. For some behaviours, multiple ethogram definitions are presented.

Behaviour	Definition	Reference
Comfort		
Dust bathing	Broilers are lying and performing head rubbing, vertical wing-shakes, leg scratching, and/or raking the substrate closer to them with their beak. Broilers clearly covered in substrate and lying without clearly performing other behaviours are categorised as dustbathing because the end of a dustbathing bout is typically signified by a body-shake which removes excess substrate. Broilers preening while covered in substrate are classified as dustbathing. Broilers not covered in substrate and performing preening without any additional dustbathing behaviours are classified as preening.	(Baxter et al., 2019)

Preening	The bird runs their beak through their feathers in a seated or standing position.	(Baxter et al., 2019)
Stretching	A bird extends both one wing and one leg or only one leg when stretching.	(Li et al., 2021)
	Stretching one leg often together with the wing of the same side, but also may be stretched alone while sitting or standing.	(Pichova et al., 2016)
Play and high-energy		
Play fighting	Bird runs or jumps directly towards the head of another standing bird which may simultaneously rapidly approach. If both birds face each other and stare while in close proximity, both birds are counted. If one bird approaches and stares at another standing bird which does not respond, only that bird is counted. If playful movements and sudden stops are not directed to any particular bird, it is not recorded as play fight.	(Rayner et al., 2020)
	A bird simulates fighting behaviour with no obvious aggression or injurious contact. The following behaviours may begin a bout and occur during a bout: jumps with light kicking that make little or no contact with the receiver; stand-offs (threats) in which birds will face up to one another briefly, stepping close to one another and raising their necks to stand practically beak-to-beak (with or without a difference in head height); raising feathers around the neck, usually during a stand-off; stand-off with wing-flapping; stand-off with light pecks at the neck, head or beak of the receiving bird.	(Baxter et al., 2019)
Worm (food) running	While walking or running excitedly, bird carries a small object projecting from the beak, such as a large piece of wood shaving or peat, piece of paper or plastic, or a feather. The bird makes rapid changes of direction and normally attracts other birds to follow.	(Rayner et al., 2020)
	A bird follows and chases (runs at least two paces after another bird to begin the bout) a bird that has picked up or obtained a large object that projects from their beak. This bird has run from conspecifics but may make rapid and counter-intuitive direction changes towards conspecifics. There are conspicuous peeping noises that typically accompany this behaviour. The bout ends when the chasing bird loses interest and begins another behaviour, for example, sits down or begins feeding	(Baxter et al., 2019)
Frolicking	Spontaneous and rapid running and/or jumping and wing-flapping with no obvious intention, often with rapid direction changes. Running without wing-flapping is not classified as frolicking. A frolicking bout ends when the bird sits down or resumes another activity. Birds displaying frolicking directly leading to sparring are categorised as sparring, to avoid misinterpretation of their movements.	(Baxter et al., 2019)
Wing flapping	While active and not lying down, bird raises and rapidly lowers both wings simultaneously, usually several times in rapid succession. Usually occurs when running or jumping, aiding in propelling the body. Does not include slow stretching of wings, holding wings out but not flapping, or body shaking.	(Rayner et al., 2020)

Running	While active and not lying down, bird takes at least three rapid steps forward with one foot after the other, with both feet briefly lifted off the substrate during strides, resulting in moving the body rapidly from one location to another.	(Rayner et al., 2020)
Jumping	While active and not lying down, bird moves both feet off substrate simultaneously; may jump up off the floor (e.g. up into the air).	(Rayner et al., 2020)
Foraging and exploratory behaviours		
Foraging	Scratching and pecking at the ground (from a standing or walking position)	(Baxter et al., 2019)
	Bird stands in upright position with both feet on the ground, uses both feet alternatively to paw at the ground, and/or lowers its head from time to time to peck at or move litter material in search of food	(Lourenço da Silva et al., 2021)
Ground scratching	While active and not lying down, bird rakes the substrate with the toes and claws using a rapid backward kicking movement of the leg and foot.	(Rayner et al., 2020)

Qualitative behaviour assessment (QBA)

The Qualitative Behaviour Assessment (QBA) is one of the behavioural welfare indicators in the Welfare Quality® protocol and is also used in other research settings. The QBA considers the broilers' "body language" and describes how the animals behave and interact with conspecifics and the environment. During the QBA, an observer evaluates a group of animals based on a number of adjectives (*Figure 2*).

To conduct the QBA, an observer selects between one and eight observation points depending on the size of the barn. The selected points should be distributed among the different areas of the farm and the total observation time should not be greater than 20 minutes, therefore this time should be distributed as evenly as possible at all the selected points. After the 20 minutes of observation, the observer should score the 20 descriptors using a visual analog scale. This scoring should not be done during the observations and only one assessment should be made of the farm. A statistical method called a Principal Component Analysis (PCA) is often used to analyse the scores given to these adjectives to summarize the scores into two factors, one factor that runs from positive to negative welfare and another factor that runs from activity to passivity (Keeling et al., 2013). If a less complicated analysis is desired, the WelfareQuality® protocol also gives instruction for how to calculate a flock score using these data (WelfareQuality®, 2009).

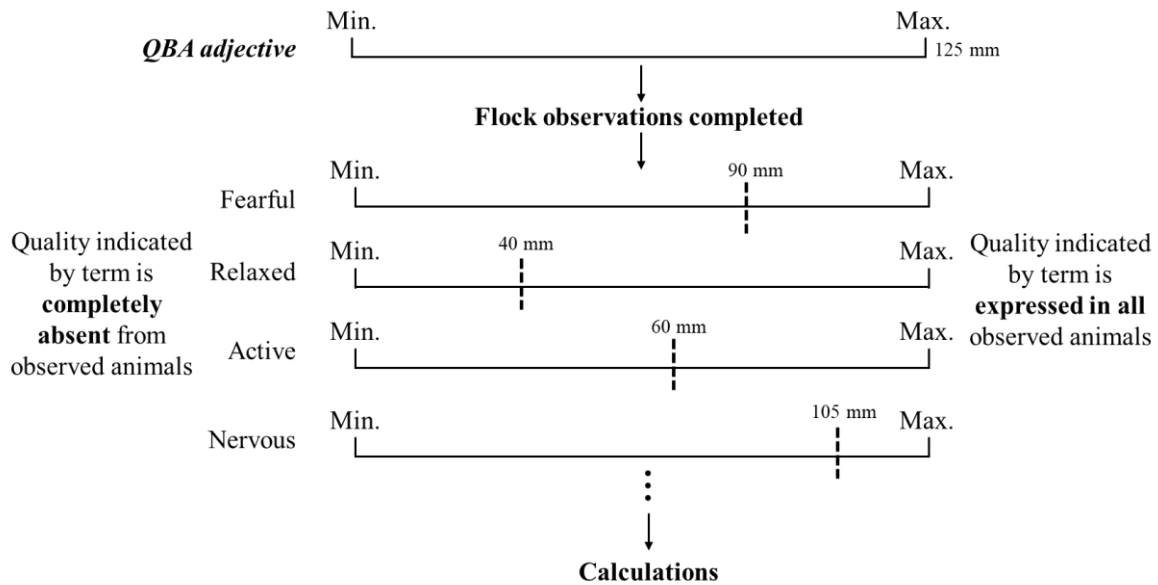


Figure 2. Example of the qualitative behaviour assessment (QBA) workflow.

Challenges with broiler behavioural indicators

Broilers may have problems effectively expressing their motivations due to a poor physical ability to perform (Averós et al., 2022). For example, several studies report a reduced expression of positive behaviours in fast growing broilers compared to slow growing (Averós et al., 2022). However, higher stocking densities of fast-growing broilers may contribute to this reduced expression and may not be due to fast growth alone. For example, the incidence of play behaviours has been reported to be affected by stocking density in broilers with lower frequency of play happening at higher densities (van der Eijk et al., 2022).

Behavioural expression is also influenced by location in the house possibly related to changes in density. There tends to be a lower performance of positive behaviours closer to the house walls which may be due to higher densities or the higher prevalence of injured or sick birds in these areas (Averós et al., 2022). Therefore, in commercial settings, the results of any movement dependent test (i.e., NOT, stationary person, touch test) may need to be interpreted with caution (Vasdal et al., 2018). Stocking density and physical ability of the broilers may influence their ability to distance themselves from the observer.

5 Conclusions

There are numerous behavioural measures that could be used as indicators of broiler welfare. The time spent (or lack of time spent) or frequency of these behaviours can indicate positive or negative welfare. Some measures like the QBA can indicate overall emotional state. It is important to interpret any behavioural measure that relies on movement of the birds with caution, especially in older broilers, as their weight and stocking density may impair their ability to move and consequently their welfare.

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About EURCAW-Poultry-SFA

EURCAW-Poultry-SFA is one of the four European Union Reference Centres for Animal Welfare. It focuses on poultry and other small farmed animals welfare and legislation, and covers the entire life cycle from hatch/birth to the end of life. EURCAW-Poultry-SFA's main objective is to scientifically and technically support the European Commission and Member States for implementation of welfare legislation. This includes:

- Directive 98/58/EC concerning the protection of animals kept on farms;
- Regulations 1/2005/EC and 1099/2009/EC concerning their protection during transport and slaughter;
- Directive 1999/74/EC laying down minimum standards for the protection of laying hens;
- Directive 2007/43/EC laying down minimum rules for the protection of chickens kept for meat production.

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Activities of EURCAW-Poultry-SFA

- Coordinated Assistance
Providing support, networking and Questions to EURCAW;
- Welfare indicators, Assessment & Good Practices
Identifying animal welfare indicators, including animal based, management based and resource-based indicators, that can be used to verify compliance with the EU legislation;
- Scientific and technical studies
Preparing Scientific Reviews of knowledge on welfare topics, identify research needs and perform scientific and technical studies to fill the gaps of knowledge;
- Training
Reviewing existing training activities and developing new training materials, webinars and knowledge pills for official inspectors and competent authorities;
- Communication and Dissemination
Increasing awareness of our outputs via the website, and newsletter.

Website and contact

EURCAW-Poultry-SFA's website offers relevant and actual information to support enforcement of poultry and other small farmed animals' welfare legislation.

We offer a 'Questions to EURCAW' service for official inspectors, policy workers, and other personnel providing advice or support for official controls of poultry and other small farmed animals welfare in the EU. For more information go to the Q2E webform available online [here](#) or <https://survey.anses.fr/SurveyServer/s/DSL/Questionnaire>. All Q2E answers are available [online](#).