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WELFARE OUTCOMES FOR BROILERS

SETTING THRESHOLDS AND TARGETS FOR HIGHER WELFARE BREEDS

THE NEED FOR HIGHER WELFARE BREEDS

There is significant research on welfare issues in conventional (fast-growing) broiler breeds. Fast-growing broilers are birds genetically selected for fast growth and increased muscle mass, with daily weight gains above 55 g/day, and up to 90 g/day (CIWF, 2012). Welfare concerns related to fast growth include physiological issues that can result in ascites and sudden death syndrome (SDS), a higher prevalence of contact dermatitis, and skeletal deformities—which cause chronic pain, impaired locomotion, and leg weakness (Bessei, 2006).

Studies comparing welfare outcomes in fast and slower-growing breeds have found that slower-growing birds in well-managed flocks have a greater potential for better welfare outcomes. For example, studies comparing slower-growing broilers (birds with an average weight gain of 45 g/day) to a fast growing strain (birds with an average weight gain of 63 g/day) found lower mortality, and lower incidences of footpad lesions and hock burn in the slower-growing birds (Cooper et al, 2008). Other welfare outcomes shown to be favorable in slower-growing birds include leg conformation (valgus, varus, and tibial dyschondroplasia), and higher frequencies of welfare-positive behaviors, such as perching (Shim et al, 2012; Wallenbeck et al, 2016). Whereas growth rate is often correlated with positive welfare outcomes, the potential for higher welfare is not only related to the growth rate of the birds, but to an increased robustness and ability to thrive in enriched environments; this is often due to differences in the conformation of birds classified as "slower-growing." As such, we refer to these breeds as higher welfare breeds.

In addition to scientific research on welfare issues in conventional broiler breeds, public concern about the way in which chickens are raised is growing. According to a 2015 survey sponsored by the National Chicken Council (NCC), 70 percent of respondents expressed concern about how chickens are raised. A similar survey conducted by the NCC in 2017 revealed that 43 percent of consumers are specifically concerned about chickens being bred to optimize meat production, with 41 percent and 40 percent reporting concern for how chickens are housed and how they are raised, respectively.

In the US, food businesses have responded to both scientific information and public concerns regarding the welfare of broiler chickens by adopting commitments to: a) transition to strains of birds approved by RSPCA or Global Animal Partnership (GAP) based on measurably improved welfare outcomes.; b) reduce stocking density to a maximum of 6 lbs./sq. foot and prohibit broiler cages; c) provide birds enriched environments including litter, lighting, and enrichment that meets GAP's new standards;

d) process chickens in a manner that avoids pre-stun handling and instead utilizes a multi-step controlled-atmosphere processing system that induces an irreversible stun;
e) demonstrate compliance with the above standards via third party auditing.

This document offers guidance in support of these commitments, especially with regard to the transition to approved breeds with higher welfare outcomes. The main objective of the document is to provide an understanding of the definition and role of welfare outcomes in the overall assessment of animal welfare. To this end, it offers definitions of animal welfare indicators, inputs, and outcomes, and presents a comprehensive list of welfare outcomes commonly used in the assessment of broiler welfare, with suggested thresholds for each outcome specifically for higher welfare breeds.

WELFARE INDICATORS, INPUTS, AND OUTCOMES

DEFINITION AND SCOPE

Animal welfare pertains to the individual and how it perceives its life in terms of avoiding negative physical and mental experiences, as well as having access to what they want and need. Animal welfare is not limited to good health and physical condition, but also includes good mental well-being and the ability to perform behaviors that are characteristic of the animal in question. For chickens, this includes pecking, scratching, wing-flapping, perching, and running. Because it involves all of these aspects, there is no straightforward or simple way to measure welfare. However, we can objectively sense the welfare state of an animal based on two kinds of measures: the first relates to whether the animal has what it needs and wants to experience good welfare **(inputs)**, and the second to if and how the animal is able to use these inputs to observably demonstrate that it has good welfare **(outcomes)**.

INDICATORS

When it is not possible to directly measure these inputs and outcomes, **indicators** are used as an indirect measure or proxy. For example, there is no single way to measure the input “good air quality,” but ammonia levels are often used as a reliable indicator. Indicators act as reference values for performance or outcomes, but are not a measure of welfare, per se. Depending on when these indicators are being measured, they can be considered lag indicators or lead indicators. **Lag indicators** are those recorded at the end of a production cycle (often post-mortem), which can provide feedback on the overall performance of a flock (Manning et al, 2007).

Examples of lag indicators are: mortality, total leg culls, dead-on-arrivals, reject levels, level of contact dermatitis at slaughter (e.g. breast blisters, hock burn, and pododermatitis), and abnormal leg rotation (Grandin, 2005).

Lead indicators, on the other hand, are measured throughout the production cycle, and can be used to proactively change management and practices (Manning et al, 2017). For instance, indicators that look at skin condition, such as hockburn or footpad dermatitis (FPD) assessments can be used as either lag or lead indicators. When assessed during the production cycle, hockburn and FPD indicators can help correct environmental and management factors linked to the development of skin lesions, such as poor litter quality. Indicators should be selected in a way that effectively measures the adequacy of inputs and their effects on welfare outcomes. Additionally, lag and lead indicators should be balanced such that measurements and results can be used to proactively improve welfare during the growth cycle, as well as to fine-tune practices in the long term.

INPUTS

Animal welfare is influenced by intrinsic factors (genetics), and extrinsic factors (environmental provisions). Thus, good welfare requires good care, including good feeding, housing, breeding, health care, and a good overall environment.
In the case of domestic animals, both genetic and environmental factors that are known to influence welfare outcomes are considered **inputs** and should be well managed to ultimately deliver good outcomes (physical, mental, and behavioral).
Relevant inputs include:

- **Good Housing**: No cages, but instead environments with good design features, sufficient space to live (stocking density not to exceed 6 lb/sq ft), and functional areas (for example, separate resting and activity areas).
- **Good Environment**: In addition to the structural elements described above, the environment of the house must provide good ventilation, climate control to maintain comfortable temperature and relative humidity for the animal's type and age, **good litter quality** (with litter covering the entire floor), and an **enriched, stimulating environment** to meaningfully occupy the animal. Examples of acceptable enrichments are: straw bales, scattered grains, perches, edible hanging enrichments, pecking blocks, boxes, ramps, and shelter structures.
- **Good Breeding**: Healthy genetics is perhaps the most important input, as it not only directly impacts important welfare outcomes, but also determines the animal's potential to use the available inputs to further achieve good outcomes.

- **Good Healthcare and Husbandry**: Adequate housing, environment, and breeding are likely to result in better health outcomes for broilers, decreasing the need for non-therapeutic use of antibiotics and other medications often needed to sustain the growth of unhealthy birds in crowded, barren environments. Good husbandry and handling, from placement to slaughter, is key to ensuring that these good outcomes translate to higher-quality products. Adequate handling of broilers during transport and slaughter is essential; chickens must be handled in a manner that **avoids pre-stun handling** and instead utilizes a **multi-step controlled-atmosphere processing system** that induces an irreversible stun.

OUTCOMES

The focus on outcomes to assess and monitor animal welfare is a widely accepted approach, as it stays true to the definition of welfare as an animal-centered measure. However, because outcomes are directly influenced by inputs, their adequacy as a measure of welfare depends on whether these inputs are being provided, and on the availability of suitable indicators.

Additionally, outcomes must not only serve as an assessment tool, but also inform plans to improve welfare and mitigate potential poor welfare situations. Measuring outcomes without considering the various inputs that influence them is unlikely to result in improved welfare for birds. For instance, a welfare policy may include a threshold value for the outcome "walking ability" (for example, 95 percent of birds with gait scores 0, 1, or 2)—but without offering detail on what inputs are being provided to affect the outcome "walking ability," this could result in management practices that ignore or exclude entire categories of inputs known to affect that particular outcome, such as genetics, environmental enrichment, or others. A comprehensive and meaningful welfare plan should give equal importance to inputs, outcomes, and the indicators used to measure them, and make clear connections between what is being provided to the animals, and what is expected in terms of outcomes.

SELECTING THE RIGHT OUTCOMES

Welfare outcomes must be selected according to their potential to accurately portray the welfare state of an individual or flock. An important feature of welfare outcomes is that they provide robust evidence, which for the purposes of animal welfare assessment must be repeatable, valid, and feasible to obtain (Main et al, 2007). Other features of adequate welfare outcomes are:

PRACTICAL:

Outcomes should be reasonably simple to assess on-farm, on a commercial scale, by a trained observer. Gait scoring, although reliable, requires a significant time investment, and can be challenging for commercial scale operations. In such cases, methods may be modified such that reliability is not compromised; for instance, manual gait scoring using a transect method has shown good results in terms of interobserver reliability, as well as time and personnel requirements (Marchewka et al, 2013).

NON-INTRUSIVE:

Preference should be given to outcomes and indicators that can be measured with minimal disturbance to the animal. Additionally, assessments should be conducted such that more intrusive measurements are conducted last (Webster, 2005). For example, optical flow measures use webcam technology to record bird movement patterns, which are then analyzed using image vector analysis. This fully-automated and non-intrusive method has shown potential to substitute manual gait scoring on commercial farms (Dawkins et al, 2009).

ROBUST:

Outcomes should deliver consistent, reliable results despite changes in environmental variables (for instance, seasonal variations in temperature or humidity). Robust outcome measures should also have good inter-observer reliability (Webster, 2005). For an outcome to be robust, it must be tested against other methods and proven to be the most reliable, both in terms of replicability and alignment with the most recent science. For example, whereas systems that automatically monitor broiler activity can be used to assess walking ability, these methods must be tested and validated against the standard method used to assess lameness, which is gait scoring (Silvera et al, 2017).

INTEGRATIVE:

As no one outcome or indicator is able to provide a full picture of animal welfare, they must be selected for their potential to complement other measures to offer a comprehensive assessment of welfare. An integrative outcome is also one that is able to convey information about the historical welfare status of the animal; for example, the presence of severe footpad lesions not only tells us about the welfare of the animal in that moment (pain or discomfort are present), but also about welfare issues leading up to that point (possibly poor quality litter, poor mobility, and susceptible skin) (Webster, 2005).

PROGRESSIVE:

In the context of a comprehensive welfare plan, the role of an outcome measure is twofold: to monitor welfare so it can be maintained at an acceptable level, and to use results to improve welfare based on the welfare potential of the animals in question. To improve welfare, outcome measures must offer the possibility of setting and modifying thresholds in a dynamic way, based on observed results. Any indicator or outcome that is non-binary (0/1, or “present/absent”) has the potential to be used as a progressive outcome, when used together with adequate targets and thresholds. The GAP 5-Step® Animal Welfare Rating Standards for Chickens Raised for Meat are a good example of the use of progressive outcomes. When assessing lameness, systems certified for Steps 2 and 3 should have a score of 15 or less, while Step 4 systems are required to have a score of 5 or less. This correlates directly with the welfare potential of broilers in the different systems; for instance, for Steps 1-3, the maximum growth rate per day is 68 g; while at Step 4, it is 50 g/day. Additionally, Step 4 requires the use of breeds with proven higher welfare outcomes. These thresholds align with research pointing to growth rate, genetics, and body conformation as significant factors in the development of lameness and poor gait scores in broilers (Corr et al, 2003; Knowles et al, 2008).

USING OUTCOMES TO MONITOR AND IMPROVE WELFARE

Regularly scoring relevant outcome measures can identify welfare problems and be used to set **thresholds**, define **targets** for good welfare, and benchmark for **improvements** through an active program—and all of these must be informed by scientific findings. When commercial trials are used, they must be carefully designed such that the treatments, treatment levels, and the measures provide meaningful information about what is deemed acceptable in terms of welfare. Trials should avoid replicating research on issues for which there is already a substantial body of evidence, and should rather aim to provide evidence for outstanding research questions.

When interpreting scientific research to set thresholds and outcomes, it is important to keep in mind that what might be statistically significant is not necessarily significant for welfare from the perspective of the animal (which is what ultimately matters). This is especially important when deciding on thresholds and targets for issues that have not been thoroughly researched, or for which research results remain ambiguous. In these cases, it is useful to consider the correlations between different relevant outcomes, to set targets that will result in improvements for all of the correlated outcomes.

For example, it may be difficult to determine what the target activity level is for higher welfare broiler breeds. From the existing research on activity level in broilers, we can conclude that fast-growing (FG) birds have low activity levels; they have been observed to spend only 5 percent of their time walking at in the first 6 weeks of life, and as little as 1 percent at 8 weeks of age (Weeks, 2000; Bokkers and Koene, 2003). Slower-growing (SG) birds, on the other hand, have been observed to spend 11 percent of their time walking, as well as a significant amount of time perching (34 percent for birds 1-6 weeks of age) and ground-pecking (4 percent at 1-6 weeks of age) (Bokkers and Koene, 2003). Whereas as this research points to a higher potential for activity in slower-growing birds, it does not suggest what the target levels for activity should be. Here, it is important to keep in mind that welfare, from the animal's perspective, involves avoiding negative experiences (pain) as much as enjoying positive ones (walking, perching). As such, looking for correlations between outcomes that focus on avoiding poor welfare (gait scoring or walking ability), with those that focus on welfare-positive states (walking, dustbathing) can offer valuable insights when setting targets for welfare outcomes.

Correlating different outcomes, as well as outcomes and inputs, can help fine-tune thresholds and is important in designing a welfare program focused on the maximization of positive welfare states, rather than just avoiding the worst case scenarios.

Welfare programs designed around the assessment of outcomes should clearly: 1) establish acceptable thresholds (or ranges) for each outcome or indicator; 2) acknowledge correlations between outcomes when setting thresholds (for instance, FPD is known to affect walking ability, so the two should be assessed with this in mind); 3) list the inputs and provisions which are necessary to achieve the desired outcomes; 4) include a list of actions to mitigate poor welfare situations (for instance: "birds with a gait score of 3 or higher shall be humanely euthanized"); and 5) include a timeline for assessments of outcomes (including both lead and lag indicators), mitigation of poor welfare situations, and periodic revision of the program as a whole.

TRANSPARENCY AND ACCOUNTABILITY

Transparency is an additional factor in the use of outcomes to assess and improve welfare. Transparency involves providing clear, sufficient, and timely information to both internal and external stakeholders. From a food business perspective, this includes sharing animal welfare commitments, detailed plans and policies (including inputs and resulting welfare outcomes), as well as progress reports with consumers and investors. Sharing detailed information about animal welfare practices and policy is an important way to foster consumer trust, as labeling often fails to give consumers the information they are seeking with regard to the treatment of animals or other product attributes.

Accountability involves a willingness to have animal welfare commitments publicly scrutinized, and to be responsive to public concerns arising from the disclosure of policies and progress reports. Transparency and accountability are the final link in ensuring continuous progress for farm animal welfare.

OTHER CONSIDERATIONS

- **Seasonal/regional variation:** This should be acknowledged as a factor, but it does not necessarily invalidate outcome measures or assessment tools. Seasonal variation has been shown to affect litter moisture and other environmental factors that may cause variation in welfare outcomes. For example, a study on prevalence of FPD in Dutch broiler flocks found that FPD scores were lower in the warmer months (Jong et al, 2012).
- **Scalability:** For use at farm level, outcomes must be scalable in addition to being meaningful measures of welfare. This can be achieved in a number of ways, including using individual assessment in small samples in combination with transect assessments of whole flocks, and the use of automated monitoring technologies and techniques such as optical flow, vocalization analysis, etc.
- **Inter-observer reliability:** Outcome measures and indicators selected, as well as methods used to collect data must enable inter-observer reliability. Periodic training and assessment against "gold standard" observers are good ways to increase reliability.

SELECTING AND MEASURING WELFARE OUTCOMES FOR HIGHER WELFARE BREEDS

Monitoring welfare outcomes at the farm level, and especially at commercial scale, is a resource-intensive activity. As such, outcome measures should be carefully selected to reflect welfare priorities based on the experiences of the animals themselves (rather than how feasible they are to assess, for example). With regard to breed/genetics, the central question guiding outcome selection should be: which outcome measures are better suited to track the welfare potential of higher welfare breeds in adequate environments? Selection of outcomes must also take into account the following sources of information:

- **Research on outcomes for FG/conventional breeds:** The vast majority of research on broiler welfare outcomes involves the use of conventional breeds in experimental or commercial trials. Whereas results from this research may not be directly applicable to higher welfare breeds, it provides relevant information on what the thresholds may be for these outcomes when only environmental and management conditions are improved. For example, the results of a large-scale study of welfare outcomes in commercial broiler production in varying environmental circumstances helped establish baseline levels for leg straightness, hockburn, pododermatitis, and other outcomes for FG broilers. These values have been referenced to set thresholds in breed assessment protocols (Dawkins et al, 2004; RSPCA, 2013).
- **Research comparing SG to FG breeds:** This research provides insight into if and how much baseline outcome levels may differ in SG breeds when compared to FG breeds. This information may be used to establish outcome thresholds specific to higher welfare breeds, which are likely to present a more reliable picture of the welfare state of birds with a higher welfare potential. For example, a study comparing FG birds to SG birds found that 87.5 percent of SG birds presented no FPD lesions, while only 7.2 percent of the FG birds had no such lesions (with 83 percent presenting "slight" lesions) (Van Middlekoop, 2002). If both of these populations were assessed using a protocol where a "passing score" for FPD was "90 percent of birds with FPD scores 0 (none) or 0.5 (lesion on 25 percent of footpad)", both FG and SG birds would pass, regardless of the SG birds' demonstrated potential for better results for this particular outcome.
- **Research on potential of SG breeds in high welfare environments:** When setting outcome thresholds, it may also be useful to know what outcomes are likely to be for higher welfare birds in optimal welfare situations (e.g. well-managed, pasture-based systems). Research conducted in these conditions may be used to make projections for welfare improvements based on these best-case scenarios. For example, a study comparing two higher welfare breeds with access to an outdoor range with forage reported activity levels between 33 and 46 percent during the finishing period (Almeida et al, 2012).

DEVELOPING THRESHOLDS FOR HIGHER WELFARE BREEDS

In addition to the sources listed above, two important sources of information for selecting outcomes and setting thresholds are the available broiler welfare outcome guidelines, as well as welfare assessment protocols—especially those focused on breed assessment, or that include a breed component. It is important to keep in mind that the former are generally guidelines for conventional breeds in indoor systems, and therefore thresholds may need to be adjusted in accordance with the potential of higher welfare breeds. Examples of each are included below.

1. Welfare Outcome Guidelines: Compassion in World Farming (CIWF) broiler welfare outcomes (with targets adjusted for higher welfare breeds)

OUTCOME OR MEASURE	ASSESSMENT METHOD AND TARGETS FOR HIGHER WELFARE BREEDS
Mortality %	Record the number of deaths and major causes. **Target: ≤ 3-5% throughout the production period.**
Skin lesion scores *(incidence and severity), including foot pad dermatitis, hock scores, breast blisters*	1. Record incidence and severity of ***foot pad dermatitis and hock burn*** of the flock. Can be measured on-farm (50 per house) or more typically at slaughter-house (100 per flock). **Target: ≥ 90-95% of birds with scores 0,1 (majority of those score 0), ≤ 1% score 2.** 2. Breast blister incidence measured at slaughter: Assign score of 0 (no breast blister) or 1 (breast blister or irritation present). **Target: ≥ 90-95% of birds with scores 0.**
Leg health *(lameness/gait scoring/walking ability)*	**Gait score:** 50 birds (0-5 Bristol scale) from five random points in the house, close to maximum stocking density/depopulation. **Target: ≥ 90% score 0-1, ≤ 5% score 2, ≤ 1% score 3 (ideally none), no scores of 4-5.**
Feather cleanliness	Feather cleanliness assessed on farm or at slaughter. Score assigned to breast plumage: 0 (clean) to 3 (very dirty). **Target: >80% score 0; >20% score 1; few scoring 2, none scoring 3.**
Activity level	Activity level should be assessed close to depopulation (ideally within 5 days of slaughter). At least 5 different observation points should be selected per flock. Alternatively, the transect walk method can be used (see Marchewka et al, 2013). Birds will be classified as "active" (standing, walking, running, foraging, and all other social & comfort behaviors) or "inactive" (sitting or lying, including eating while in these positions). **Target: ≥ 40% birds "active."**

2. Protocols and Standards: Royal Society for the Prevention of Cruelty to Animals (RSPCA) outcomes and thresholds for breed welfare assessment and Global Animal Partnership (GAP) standard for meat chickens

HEALTH AND PRODUCTIVITY OUTCOMES

OUTCOME OR MEASURE	RSPCA BREED WELFARE ASSESSMENT PROTOCOL	GAP (VERSION 3.0) STANDARD FOR MEAT CHICKENS
Daily weight gain	Indoor 60 g/day; free-range 52 g/day, calculated at 2.2 kg weight.	Step 3: max 68 g/day; Step 4: max 50 g/day: Step 5: max 43 g/day; Step 5+: max 35 g/day.
Feed consumption/FCR	FCR is calculated at weight of 2.2 kg; no threshold or reference value provided.	Not assessed.
Mortality %	3% (excluding runts, other culls, and 1st week mortality).	Excludes runts and culls. Step 1: max 6%; Steps 2-3: max 5%; Steps 4-5+: max 4%
Cull % and rationale *(legs, runts, sickness, other)*	Leg culls, heart attack, ascites: 1% max each Other dead: 1.5% max Runts and other culls: For information only	Threshold not specified.
Skin lesion scores *(incidence and severity), including foot pad dermatitis, hock scores, breast blisters*	Hock burn scores 0, 0.5 combined ≥ 80% Hock burn score 0.5 max 1% FPD scores 0, 0.5 combined ≥ 90%	FPD: Measured using **0-2 scale**, apply formula to calculate annual score: Step 1: max annual score 20; Steps 2-3: max annual score 15; Steps 4-5: max annual score 5, Step 5+: max annual score 2.
Leg health *(lameness/gait scoring/walking ability)*	**Gait measured using 0-5 scale:** Gait scores 0, 1, 2: combined ≥ 95% Gait score 2: max 60% Gait score 3: max 5%	**Gait measured using 0-2 scale**, apply formula to calculate annual score: Step 1: max annual score 20 Steps 2-3: max annual score 15 Steps 4-5: max annual score 5 Step 5+: max annual score 2
Feathering/Feather cleanliness	Score 1: max 70% Score 2: max 50%	Score 2: max 10%
Morbidity	The impact of illness during the trial must be recorded. If illness results in death, reason for death must be recorded.	Sick animals recorded only if the outcome is euthanasia (reason for culling is recorded as "sick or injured without chance of recovery").

BEHAVIORAL OUTCOMES

OUTCOME OR MEASURE	RSPCA BREED WELFARE ASSESSMENT PROTOCOL	GAP (VERSION 3.0) STANDARD FOR MEAT CHICKENS
Ethogram/activity levels *(e.g., % time feeding/foraging; % time active: % yime sleeping/resting; dust-bathing activity)*	Only walking ability assessed (see "leg health" on previous page for specific thresholds).	Only walking ability assessed (see "leg health" on previous page for specific thresholds).
Ability to perch *at various heights across ages*	Protocol requires that perches be placed in pens, but perching ability not assessed.	Steps 5-5+ require that birds must be able to perch through end of growth period. Assessment method & thresholds not specified.

PROCESSING/QUALITY OUTCOMES

OUTCOME OR MEASURE	RSPCA BREED WELFARE ASSESSMENT PROTOCOL	GAP (VERSION 3.0) STANDARD FOR MEAT CHICKENS
Slaughter outcomes	Any slaughter data that is available must be recorded, including percentages of: DOAs, factory rejects, downgrades, breast blisters, scratches, and grade A's.	At least 99% of the chickens must be properly stunned (in a sample of 300); no more than 1% broken or dislocated wings. If hung live, both legs must be shackled (1 mis-shackling in 500 is considered a failure), with no broken legs (1 broken leg in 500 is considered a failure). No more than 1% bruised thighs and drumsticks. No live chickens entering the scalder.
Flock uniformity	Not assessed.	Not assessed.
Processing yields *(breast, thigh meat)*	Not assessed.	Not assessed.
Muscle integrity *(incidence of white striping, woody breast, or other abnormalities)*	Not assessed.	Not assessed.
Meat texture	Not assessed.	Not assessed.
Skin condition (*thickness, color)*	Scratches and breast blisters recorded at slaughter, if data is available. No other skin parameters assessed.	Not specified.
Fat *(color and %)*	Not assessed.	Not assessed.

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We believe in collaboration and a solutions-led approach, developing relationships that are based on trust, mutual benefit, and recognizing progress.

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