The Welfare of Poultry: Review of Recent Literature

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Introduction

Poultry production represents a very large and diverse. There are many facets of production, and hence many areas that are potential concern for the welfare of the animals involved. These areas may include, among others, housing of laying hens, beak trimming, toe clipping, spent hen disposal, molting of laying hens, feed restriction, lighting programs, growth rates and resulting effects of chicken and turkey broilers, transportation, pre-slaughter management, slaughter, and handling (Mench and Siegel, 1997). While research is actively being conducted in methods to improve welfare in most if not all of these areas, recommendations for present management schemes is to have producers ensure they are making the most of the research that has already been completed, using the best management practices that are possible.

Light

Light is an important tool in the management practices for poultry. It can be manipulated in four areas that may be helpful, including source, intensity, wavelength, and photoperiod (Manser, 1996). Vision, however, is important to birds. Hence, altering these light factors may play a part in the welfare of the poultry.

Light sources

Typically, incandescent bulbs were common in poultry houses. However, there has recently been a trend towards the use of fluorescent bulbs or high pressure sodium discharge lights because of their longer livability and lower costs. The type of light source used generally does not affect production parameters such as growth rates, feed efficiency or mortality in broilers (Lewis and Morris, 1998). Light source does not affect egg production, hatchability or growth rates in broiler breeders (Manser, 1996). Recent research has indicated that light source may have an effect on leg disorders, with the use of fluorescent bulbs causing a lower incidence of the problem as compared to incandescent bulbs (Lewis and Morris, 1998). As well, sexual maturity of laying hens, but not broiler breeders, may be delayed when incandescent bulbs are used in the barn (Lewis and Morris, 1998).

Turkeys are visually sensitive birds, and may have the ability for vision in ultraviolet light (Moinard and Sherwin, 1999). Furthermore, UV light may actually play a part in behavioral development, including such actions as foraging behaviour. Incandescent and fluorescent light, both common in usage in poultry houses, has minimal UV content, which may represent a problem if exposure to UV light is important (Moinard and Sherwin, 1999). Preference tests indicate that birds prefer UV light to fluorescent (Moinard and Sherwin, 1999). When given the choice between fluorescent and incandescent light, turkeys will choose the fluorescent. This may be because fluorescent light actually mimics daylight (Sherwin, 1999). The use of
fluorescent light, which is more efficient and less expensive than incandescent, does not impair the welfare of turkeys.

**Light Intensity**

Aggressive pecking and cannibalism can and does occur in a number of poultry species, including laying hens and turkeys. Managers can attempt to control this by the use of beak trimming. While trimming the beaks improves welfare of the birds by lowering the frequency of aggressive acts, the procedure itself may be a welfare concern (discussed further in the beak trimming section). Another tool that may be used is to lower light intensity. Once again, welfare may be improved by lowered aggression (Nixey, 1994), but the level of light can be a cause a concern in itself. Very low light intensities used in the broiler or turkey production cycle may lower body weights by altering behavioral patterns causing active time to decrease (thereby resulting in the bird laying on the litter for longer times, possibly increasing the levels of skin blemishes due to ammonia contact). It can also cause eye damage, increased mortality, and result in physiological changes in the birds (Buyse et al, 1996; Sherwin, 1998). Preference tests have shown that turkeys may find light intensities of less than 1 lux aversive (Sherwin, 1998).

Aggressiveness in birds is a problem, and research into the management procedures used to control this should continue, as welfare of the birds can be reduced by the use of beak trimming in low light intensities (Sherwin, 1998).

Excessively high light intensities may also be detrimental to birds. Reduced weight gains and increased aggression can result in broilers at light intensities of more than 150 lux (Buyse et al, 1996).

**Wavelength**

Light wavelength via colored light may also be altered to reduce aggression in birds. Activity levels in turkeys are reduced when exposed to blue light versus white, green or red light (Manser, 1996). Broiler aggression is highest in red light, and lowest in blue (Manser, 1996).

**Photoperiod**

Photoperiod manipulation is likely the most important aspect of light in poultry production. In the past, many producers have used constant light in broiler and turkey production flocks in the belief that by allowing continuous light, birds can eat 24 hr per day, and grow faster. However, there are many disadvantages to constant lighting programs. Birds are less active, leg disorders are much more common, and eye damage may occur (Manser, 1996). Metabolic problems are common (Buyse et al, 1996). Sleep for the birds is disturbed, and physiological stress results (Gordon, 1994). Lighting programs are very important for broilers, but may even be more so for turkeys since their life span is longer (Nixey, 1994). Use of constant light in turkeys also results in a higher incidence of leg disorders and metabolic diseases (Classen et al, 1994).

Research has now indicated that providing birds a photoperiod which involves an extended dark period may be beneficial. Use of increasing programs, which have a long dark period early in the life of the bird, results in slower growth and reduced feed intake during the early production
period, and compensatory growth at the end of the production cycle. The result is a bird that weighs the same as those raised on constant light, but with significantly lower leg disorders and metabolic diseases. There is also increased bird activity, lower electrical costs for the producer and improved feed efficiency (Gordon, 1994). Turkeys have fewer breast blisters and cleaner feather cover when raised on increasing versus constant light (Newberry, 1992). This is believed to occur partially because of the reduced early growth rate, but also results from metabolic changes within the bird when given access to a dark period (Gordon, 1994). Intermittent light programs, which involve short periods of light and dark throughout the day, are also effective in reducing these problems (Buyse et al, 1996). However, birds raised on intermittent programs tend to have variable meat and fat pad yield (Buyse et al, 1996), and may actually result in more leg disorders if the program is used throughout the entire growing cycle of turkeys (Nixey, 1994). Overall, the use of either an increasing or intermittent lighting program will improved the welfare of either turkeys or broilers over those birds raised on constant light photoperiods.

Beak Trimming

Beak trimming has become a very controversial management tool. Trimming beaks involves removing a portion of the beak. Beak trimming effectively reduces feather pecking, aggressive pecking and cannibalism in laying hens and turkeys (Cunningham, 1992). As a result, it can be stated that the welfare of beak trimmed birds is improved over full-beaked birds, which are faced with the pain and resulting fear of being pecked or cannibalized. This will result in reduced stress in the trimmed birds (Struwe et al, 1992). However, the procedure itself does cause pain, either acute or chronic, which reduces the welfare of the bird. Further confounding this issue is that of housing systems for laying hens. Because battery cages are facing so much criticism in terms of welfare, housing systems involving larger groups of birds are being used in some areas. When bird group sized increase, so does the frequency of cannibalism. If beak trimming is not allowed on welfare grounds, then there is no current effective method to stop the cannibalism once it begins.

The age that birds are beak trimmed has an immense effect on the duration of pain and healing level of the beak (Hughes and Gentle, 1995). When chicks are beak trimmed at either 1 or 10 days of age, pain results in the first week following the procedure, but symptoms do not appear after that time (Gentle et al, 1997). Birds trimmed at 28 days of age showed signs of pain for three weeks post trimming (Craig and Lee, 1990). The beak itself regrows, but will not regain the afferent nervous system or the sensory receptors in the tip (Gentle et al, 1995; Gentles et al, 1997). Turkeys trimmed at 21 days of age also did not appear to be in lasting pain due to the procedure, and the anatomy of the healed beak appeared similar to a chicken beak (Gentle et al, 1995; Grigor et al, 1995). However, birds trimmed at 16 weeks of age did appear to be in chronic pain (Gentle et al, 1990). It is possible that when older birds are trimmed, neuromas form in the beak stump. These neuromas may have rapid and spontaneous firing, resulting in pain for the birds (Hughes and Gentle, 1995). Because sensory nerve endings do not regenerate in the beak stump, the birds may be deprived of sensory input (Hughes and Gentle, 1995). This would partially explain the reduction in pecking.

There are different types of equipment that can be used to trim the beaks of turkeys or chickens. These also appears to have a relationship with the damage to the beak and the pain that ensues. Hot trimming, with the use of a hot cauterizing blade, may result in chronic pain
Beak trimming does reduce aggression and cannibalism in broilers and turkeys (Gentle et al, 1995). However, the procedure can be traumatic for the birds. If it is to be performed, it should be done very early in life, as this appears to have a less drastic pain effect. The type of system used is also important, as is the amount of beak removed.

**Transportation and Slaughter**

The transportation procedure can be very traumatic for birds. The pre-slaughter procedure, including the handling and removal from the farm, crating, transportation, unloading, and shackling, is a very stressful time for birds, and one in which welfare can be severely compromised. The stress that results from these procedures can lead to visible signs of poor welfare, including dead-on-arrivals (DOA). These can result from injury, thermal discomfort, physiological stress, dehydration, exhaustion, or poor health in general (Nicol and Scott, 1990; Gregory, 1994). The most common causes of DOA's in broilers include congestive heart failure (47%) and trauma often resulting from poor handling (35%) (Gregory, 1994).

**Pre-slaughter management**

Before birds are transported to slaughter, they are exposed to a number of stressful areas. Broilers are feed restricted to clear the intestinal tract prior to slaughter (Nicol and Scott, 1990), possibly resulting in exhaustion before the trip is over (Sherwin et al, 1993). Dehydration is also a concern as water is removed prior to transportation (Nicol and Scott, 1990). This is particularly true if weather is hot and the trip is to be lengthy. Poor handling can result in pain for the birds, and 40% of bruising found after slaughter is believed to occur during catching of the broilers (Knowles and Broom, 1990). Catching the birds, either manually or by machine, causes heart rates to increase, indicating stress. However, this rate declines more rapidly when the catching is automated, indicating bird welfare is improved when machine catching is used (Nicol and Scott, 1990). It should be noted that this may not be the case if any mechanical failures occur or the procedure is not performed correctly (Knowles and Broom, 1990).

The welfare of laying hens may be even more compromised during removal from the barns. When laying hens are housed in battery cages, their bones become particularly fragile. If handled poorly upon removal from these cages, breaks in the bones occur (Knowles and Wilkins, 1998). The level of birds with broken bones at the slaughter plant can reach as high as 29%, most occurring at the points of cage removal and shackling (Knowles and Broom, 1990; Gregory, 1994). Proper handling could reduce this percentage. Removing birds from cages individually by two legs rather than a number at a time by one leg resulted in freshly broken bones being reduced from 13.8% to 4.6% (Knowles, 1994). The handling procedure results in stress and fear responses in the birds (Mills and Nicol, 1990).

The next transport procedure is when birds are loaded into crates. This involves dropping the birds into the crate, confinement, and mixing with unknown birds, all of which are stressful
Management again plays a major part in the level of stress during these processes. Dropping birds into crates causes a number of physiological changes indicative of stress, and the further the birds are dropped, the greater the stress (Knowles and Broom, 1990). The crating system used on the trucks is important, as it is believed that some crating systems are more welfare friendly than others (Mills and Nicol, 1990). In general, the crating experience is aversive to birds, and once crated, birds have a longer latency to approach crates than those never before crated (Nicol and Scott, 1990).

**Transportation**

There are a number of factors involved with transportation of poultry that cause a reduction in welfare for the birds. However, it is of interest to note that poor handling has more of a negative effect on the welfare of the birds than does the transportation itself (Knowles and Broom, 1990).

Motion, vibration, starting and stopping are stressful for birds (Nicol and Scott, 1990; Mitchell and Kettlewell, 1994). Microclimates exist in many types of truck units, which can result in temperature and air variability within the unit. This makes control of air quality parameters very difficult (Mitchell and Kettlewell, 1994). Transportation results in exhaustion for the birds (Sherwin et al, 1993). Broilers loose weight during the trips, with the amount of loss correlated strongly with length and duration of the trip (Knowles and Broom, 1990). There is also a correlation with length and duration of trip along with time spent waiting at the plant, and fear level (Knowles and Broom, 1990; Nicol and Scott, 1990).

Work is continuing on into how to improve factors associated with transportation. Mapping of microclimates within the unit will help to understand air movement within the trailers, and should lead to better quality management (Mitchell and Kettlewell, 1994). Mobile killing units for on-farm kills, which would eliminate this step entirely, are also being examined (Nicol and Scott, 1990).

**Shackling**

Shackling of birds at the processing plant (as well as other times such as weighing and veterinarian examinations) can result in reduced welfare for birds (Gregory, 1994). Birds often struggle violently at this point, which can result in bruising, broken bones and ineffective stunning (Jones et al, 1998). Pressure is placed on the hock of the bird (Satterlee et al, 2000). Since males are heavier than females and have larger hock circumferences, more struggling occurs (Satterlee et al, 2000). Designing a shackle that fits birds better may improve welfare by increasing comfort (Satterlee et al, 2000).

Placing a hood over the head of the bird prior to shackling results in less violent struggling for a shorter period of time (Jones and Satterlee, 1997). This is likely through visual impairment as well as the physical properties of the hood (Jones, Hagedorn and Satterlee, 1998). Many slaughter plants use low light intensity to attempt to reduce struggling. While no differences were found at light intensities between 2 and 50 lux, birds may struggle more at high intensities such as 200 lux (Jones, Satterlee and Cadd, 1998), although the results are inconclusive (Jones, Hagedorn and Satterlee, 1998). This dictates that processing plants do not have to be
in near darkness in the shackling bay, which may improve working conditions for the workers and result in better welfare for the birds.

**Stunning**

The most common form of stunning of poultry at processing plants is water bath - electrical stunning. The current used is very important when examining welfare. Typically, 105 mA are used. However, when examining the brain waves of birds stunned with this current, it is not conclusive that immediate unconsciousness occurs (Raj, 2000). A minimum of 120 mA must be used to ensure unconsciousness (Raj, 2000). Increasing currents result in reduction of the quality of meat (Hoen and Lankhaar, 1999), hence other alternatives for stunning are being examined (Fletcher, 2000).

Studies are being conducted into captive bolt stunning. However, there are still concerns that this method does not lead to immediate unconsciousness (Raj, 2000). Air-pressure captive bolt systems are also being examined (Fletcher, 2000). Head only electrical stunning leads to violent wing flapping, which can lead to injury (Raj, 2000). Passing a current from a hand-held pair of tongs may be one of the most humane methods of stunning, and since it is performed on birds in the sitting position, would eliminate the need for shackling (Raj, 2000).

The method that seems to hold the most interest as a replacement for electrical stunning is gas stunning for both chickens and turkeys. This method actually results in death of the bird (Fletcher, 2000). While care must be taken as to the composition of gases used, proper methods of this process may improve welfare over water bath electrical stunned birds (Hoen and Lankhaar, 1999). Gases used include oxygen and carbon dioxide mixtures, carbon dioxide and nitrogen combinations (Hoen and Lankhaar, 1999), and argon-based gases (Fletcher, 2000). Use of carbon dioxide alone results in birds showing signs of respiratory distress, so are not appropriate for welfare reasons (Raj and Gregory, 1994). Increasing levels of carbon dioxide in gas mixtures does not shorten the stunning time in turkeys (Raj and Gregory, 1994). When choosing a gas mixture to use for stunning birds, one should observe behaviors to aid in deciding which is the best for the bird welfare.

Gas stunning could also be important in other circumstances. Spent hens have very little economic value, so disposal of them must be efficient, quick and inexpensive. This may result in poor welfare for the birds. Cervical dislocation is often used to kill the birds, but this must be done by skilled operators to ensure the method is completed efficiently and quick. There has been recent research that has indicated cervical dislocation may not result in instantaneous death of the birds (Webster et al, 1996). If this is the case, then the method may not be satisfactory for welfare reasons. Modified Atmosphere Killing units (MAK) are being examined for on-farm killing. These are contained units with gas tanks supplying an enclosed area. Birds are placed into the pre-filled chamber, and death results (Webster et al, 1996). This method would eliminate the manual killing of the birds, and also the stresses placed on the birds during crating, transportation, waiting at the slaughter plant, and shackling.

Gas mixtures are also used in some hatcheries to dispose of day-old chicks. Traditionally, carbon dioxide is used, however respiratory distress occurs, which affects the welfare of the chicks (Raj and Whittington, 1995). The use of argon gas to cause unconsciousness, then carbon dioxide to kill the chick will improve welfare for these birds.
Issues in Specific Poultry Industries

Laying hen production

Spent hens

The issues of spent hens has been discussed above. To summarize, the value of spent hens has diminished, and has created a problem with how to dispose of the birds. Those birds housed in systems which restrict movement have very fragile bones (Knowles and Wilkins, 1998), and many breaks occur with handling. The welfare of these birds can be improved by careful handling. Since damage to the bird does occur upon cage removal, a system which could kill birds in their cages would provide the best welfare. Killing the birds with a unit such as the Modified Killing Unit (Webster et al, 1996) on farm would also eliminate transportation and many of the events leading up to it, which is also a positive step in the welfare of laying hens.

Molting

Forced molting of egg production hens is used to lengthen the life span of the birds. It also results in increased egg production and shell quality over the values found at the end of the first production cycle. There are a number of methods that are used to molt birds, including feed and/or water deprivation, alterations to the lighting program, and the addition or deletion of a wide variety of products to from the diet (Rolon et al, 1993). Water deprivation results in high mortality and morbidity rates, making this method unacceptable (Ruszler, 1998). Feed deprivation if the most common method used. Wild birds go through molting periods, and when this occurs, their feed intake drops for a period of time (Ruszler, 1998). Therefore, it is possible that using this technique mimics a situation found in nature (Ruszler, 1998). It is also possible that alternative methods of altering feeding programs may be effective in inducing molt, such as skip-a-day programs (Rolon et al, 1993).

The effect of feed restriction on egg production hens, other than production parameter values, has not been extensively researched (Webster, 2000). The restricted birds do show signs of frustration and aggression on day 1 of the program (Aggrey et al, 1990; Webster, 2000), and an increase in stress hormones are found during the restriction phase (Mench and Siegel, 1997). However behavioral studies performed on hens back in production after the molt indicate no differences between control hens and those feed restricted (Webster, 2000). This may indicate no long term negative effects result from feed deprivation. Overall, livability is improved in molted hens (Webster, 2000), as is bone strength (Gregory et al, 1991) which may both improve welfare for the hens.

Management during the molting phase, no matter what program is used, is particularly important. Mortality levels must be monitored continuously (Ruszler, 1998).

Housing systems

Perhaps the most discussed welfare issue in poultry production is that of battery cage housing for laying hens. Battery cages are still the most popular housing system for laying hens used in North America. The cage is a small wire unit, with access to a feeder and water. Litter drops
through the cage onto a belt or into a pit for disposal. The battery cage has a number of advantages for birds, including hygiene, less exposure to disease and parasites because of the removal of feces, small group numbers which helps to control aggression and cannibalism, good air quality, fewer broken bones throughout the production cycle as a result of less collisions, lack of necessity of beak trimming, and eggs are cleaner and less expensive (Appleby, 1998; Duncan, 2000). There are disadvantages as well. Space is very limited in battery cages, and birds do not have the space to perform important behaviors, in particular nesting. Exercise is also lacking, which leads to poor bone strength. The cage is barren, and equipment for nesting, perching or dustbathing is not present. These factors likely increase frustration levels in the hens, resulting in stress and a reduction of welfare (Baxter, 1994). The design of traditional cages has been improved, with fewer traps to catch toes, use of horizontal feeder bars on the front of the cage, and reversing the dimensions of the cage to allow more birds access to the cages at one time (Appleby, 1998).

There has been extensive research into alternative systems for housing of laying hens. This has been spurred on because of legislation in a number of countries (Tauson, 2000). The European Union now requires that by the year 2012, all traditional cages will be eliminated and hens must be housed differently (Groot et al, 2000). Systems that are acceptable under this legislation are modified cages or alternative, floor-based systems.

There are a number of floor-based housing systems that are being researched or are in use. These include aviaries, tiered wire floor systems, percheries and deep litter systems. Welfare is improved through a variety of aspects, including space for movement and hence improved bone strength, and equipment for behavioral enactment. This is particularly true of nest sites, which lack of are known to cause severe frustration in laying hens (Duncan, 2000). There are a wide number of disadvantages as well. Aviary system use results in increased labor requirements, difficulty in depopulation, poor air quality with high dust, bacteria, fungi, endotoxin and ammonia content, and less control over barn temperature (Groot et al, 2000). Even when manure is removed from the belts in a tiered wire floor system, ammonia and air contaminants are still higher (Groot et al, 2000). Alternative housing systems have the potential for cannibalism and feather pecking outbreaks (Blokhuis and Wiepkerma, 1998). This may lead to the necessity of beak trimming. However, as discussed above, beak trimming in itself is a welfare concern. Hygiene is poorer, and the potential for disease and parasite outbreak is greater (Abrahamsson and Tauson, 1995; Tauson, 2000). The incidence of bumble foot is increased in alternative systems. Floor eggs can be common, and can result in a reduction in egg productivity (Abrahamsson and Tauson, 1995). Data pointing to this is variable (Taylor et al, 1996). While perches are well used in aviary type systems (Abrahamsson and Tauson, 1995), incidences of keel bone deformities increase because of their inclusion (Tauson, 2000). More broken bones occur during the production cycle than when hens are housed in battery cages (Knowles and Wilkins, 1998), with differences being apparent between different alternative systems (Gregory et al, 1991). Feather cover is poorer, more pecking occurs, and mortality is often higher in alternative systems (Tauson, 2000).

Another housing system that is receiving much attention is the modified or furnished cage system. This involved a unit similar to a battery cage, but with the addition of a perch, nesting site and dustbathing area (Appleby, 1998). More space is allowed per bird (Appleby, 2000). This system attempts to maintain all of the advantages of the battery cage, plus incorporate the advantages of the alternative systems. Group sizes will be maintained at levels similar to
battery cage numbers (Tauson, 2000). These cages are still in the testing stage, but show indications of birds having improved bone strength over those housed in battery cages, and better feather cover, foot health, less pecking and less mortality over those housed in alternative systems (Tauson, 2000).

It is likely that there will never be a perfect housing system for egg production hens. The choice of a system must be based on a number of parameters, including behavior, health, immune system responses, physiology, and stress responses (Craig and Swanson, 1994). Altering the housing system for laying hens will also increase the cost of eggs for the consumer, with estimations of a 10 to 20% increase in egg costs using modified cages over battery cages (Barnett and Newman, 1997). Public opinion and consumers willingness to accept this price increase will likely play a factor in the housing system debate (Appleby, 1998; Duncan, 2000).

Perhaps another alternative is to create a bird for the system. This might be accomplished by using genetic selection to select for a hen that will be less aggressive, and therefore may fit into some of the alternative systems developed without the negative effects we now see (Craig and Swanson, 1994). This would also improve the welfare of the bird by eliminating the necessity of beak trimming (Craig and Muir, 1993; Barnett and Newman, 1997).

**Broiler and turkey production**

*Metabolic diseases and leg disorders*

Genetic selection and improved nutritional knowledge has resulted in growth rates of commercially raised broilers and turkeys to increase dramatically. With this have come problems. Skeletal defects have increased in both broilers and turkeys (Mench and Siegel, 1997). The result is lameness, and likely pain. Birds with leg disorders have a very different time budget than do healthy birds. More time is spent lying. Feeding patterns are disturbed, with fewer trips to the feeder but longer durations once there (Weeks et al, 2000). These changes indicate a reduction in welfare of the birds. Older birds appear to walk in pain (Julian, 1998). This pain alters behavioral patterns, increases fear levels, and may even inhibit birds from reaching feeders and waterers (Julian, 1998). Once birds reach this point, euthanasia should be considered.

There are methods that can be used to decrease the incidence of leg deformities. Lighting programs are exceptionally important, and allowing birds long periods of darkness in their photoperiod can decrease the deformities notably (Classen et al, 1994; Julian, 1998; Martrenchar, 1999). Management and nutrition must also be recognized as having a potential affect.

Metabolic disorders are also now much more common. Sudden Death Syndrome (SDS) and ascites are two such diseases (Mench and Siegel, 1997; Julian, 1998). Turkeys show an increased occurrence of deep muscle myopathy (Mench and Siegel, 1997).

Male breeder turkeys suffer from age dependant destructive cartilage, which may be partially strain dependent. Evidence of pain in these birds is not present, and welfare might not be compromised because of the disease’s presence (Hocking et al, 1999).
**Toe clipping in turkeys**

Toe clipping is sometimes performed on turkeys to reduce the incidence of scratching. Clipping may result in reductions in growth rates, and affect early livability negatively. It is likely welfare of these birds is reduced, and the procedures should not be done (Newberry, 1992).

**Enrichment devices for turkeys**

Pecking and cannibalism are problems that are associated with turkey broiler production. Environmental enrichment may be effective in redirecting this pecking behavior (Martrenchar, 1999). Research by Sherwin et al (1999) indicated that adding an enrichment source resulted in better feather cover and improved musculo-skeletal systems.

**Breeder Flock Production**

**Feed restriction**

It is necessary to control body weight in broiler breeders and breeder turkeys. This is accomplished with the use of feed restriction programs. Lowering the body weight can result in fewer skeletal deformities (Hocking et al, 1999). Other changes occur, including increased stereotypical behaviors (Savory, 1989) and physiological changes that indicate stress (Zuidhof et al, 1995). The increase in stereotypical behaviors appear to be a coping mechanism, as there is a relationship between these behaviors and opioid release (Savory, 1989).

Nutrient dilution may be a method of helping broiler breeders and turkey breeders to cope with feed restriction. This simply involves adding a low nutrient ingredient such as oat hulls into the diet to create gut fill. Stress hormone production is reduced when this is used as compared to birds that are restricted on a standard breeder ration, hence welfare is thought to be improved (Zuidhof, 1995).

**Aggression in broiler breeders**

Male broiler breeders have shown an increased aggression level towards female breeders, often resulting in fear and injury to the females. It is not clear why this occurs, but is believed to be associated with management practices such as feed restriction (Millman and Duncan, 1996; Shea-Moore et al, 1996). Adding tryptophan to the diet of the broiler breeders decreases aggressive acts, likely due to its effect on causing increased serotonin production (Shea-Moore et al, 1996).

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Abstract or Summary of Interesting Publications


Beak trimming (also known as debeaking or partial beak amputation), when performed on chickens or turkeys, has a number of advantages for either birds or producers, including a reduction in feather or aggressive pecking and cannibalism, better feather cover, possibility of lower stress for the birds, particularly in situations where pecking from others may occur, less aggression, lower mortality, lower feed consumption, less food wastage and lower energy requirements to meet normal body temperature. However, the practice is criticized for the resulting pain that occurs to the birds, and for removing the ability of the bird to have full use of the beak. It is known that there are a large number of nociceptors in the beak, which likely results in acute pain during the trimming procedure. Immediately following trimming, there appears to be a "pain-free" period, in which there is no indication of pain. Chronic pain does occur after this period, with the intensity dependent on the age and type of bird being trimmed. Long periods of inactivity, less feeding drinking, preening, and cage pecking are indicative behaviors showing this chronic pain. In older birds (>5 wks), it is believed that neuromas adjacent to scar tissue resulting from the beak trimming develop. These neuromas likely show spontaneous activity, and could result in the central nervous system interpreting these as feelings of pain. As well, removing a section of
the beak results in sensory deprivation. The authors believe this is a practice that should be used only when necessary and never on a routine basis. When it is performed, care must be taken to in the amount of beak that is removed, the age of the bird, and that the practice not be repeated a second time.


Vision is very important to avian species. Birds have the ability to differentiate wavelengths more effectively than do humans, and this is often used in management practices to manipulate growth, etc. There are four factors of light that are used in this method - light intensity, photoperiod, wavelength and light source. Birds have better vision at bright intensities, but generally low intensity is used to effectively control feather pecking and cannibalism in turkeys and broilers. Low light intensity used early in a production flock may result lower body weights. It can also lessen the activity level of birds, resulting in a higher incidence of leg abnormalities and more ammonia-induced blemishes. Eye damage may also occur. Nest box light intensity for laying hens is not a preference factor, but is for turkey hens, which prefer darker nesting sites. Continuous light is a lighting program that is often used in commercial broiler or turkey production. However, there are a number of disadvantages to this as compared to an intermittent or increasing program. Birds are less active, and leg disorders are common. Eye damage can occur. Higher stress levels are indicated by larger adrenal glands and lower immune responses. The use of intermittent or increasing programs can result in less leg disorders and lower mortality in either turkey or broiler flocks. Wavelength is important because it can alter bird behavior. Turkeys are less active in blue than white, green or red light. Broilers show the highest level of aggression in red and lowest in blue light. When given a choice, birds will choose blue or green light, which may be why they also choose fluorescent, containing these wavelengths, over incandescent lighting. Finally, using a light source such as fluorescent is less expensive than incandescent lighting. There have been no reported effects of fluorescent light resulting in changes to growth rate, feed efficiency, and mortality in broilers and turkeys, or to egg production, hatchability and feed conversion in broiler breeders. In conclusion, a number of recommendations to producers are made in this paper. It is also suggested that work continue into all aspects of light and their effects on domestic poultry.


Poultry production represents an enormous industry, and there is much concern about the welfare of the animals involved. There are a number of areas that are of particular interest, and these are discussed in this paper. Housing laying hens in cages has advantages and disadvantages. It is an efficient and cost effective system for the production of eggs, but is restrictive of space and behavioural allowances for the hens. Alternatives such as deep litter and free range housing are being researched, however cannibalism has been a recurring problem. At present, it is believed that cages, if proper space allowances are given, still represent the best solution to housing. Beak trimming is often performed on hens and turkeys to reduce aggressive pecking. This should only be used when necessary, not as a standard management tool. The type of trimmer and age of the bird used determines the amount of chronic pain that will persist, for example hot blade trimmers after 5 weeks of age can result in chronic and acute pain. Toe trimming is a procedure sometimes used in breeder chickens to reduce damage to other birds, and no evidence has been found to indicate chronic pain resulting from this trimming. Recycling laying hens requires that hens be moulted. This is usually accomplished by feed restriction or withdrawal, light manipulation, or altering dietary ingredients. Food deprivation is known to cause stress in birds, and an increase in stress hormones is noted. Therefore, of moulting is to be done, stress should be minimized by limiting the feed withdrawal to as short a time as possible. Feed restriction is also used in broiler breeders to control body weight, which can affect reproductive characteristics, and as mentioned cause increases in stress. Broiler
chickens have been genetically selected to have an amazing growth rate, but some problems have come with this. Turkeys may develop deep muscle myopathy. Chicken and turkey broilers have an increased incidence of skeletal defects, as well as metabolic diseases such as Sudden Death Syndrome and ascites. Crowding can increase mortality, decrease growth and reproduction in broilers and hens, and aggression in hens. Transportation and slaughter has a number of areas that are cause for welfare concern. Handling the birds at the farm, crating, removal from food and water, confinement, noise, and motion are all areas that can increase bird stress. Stunning at the slaughter plant is also a concern, as water bath stunning is not 100% effective. Research is being done into the use of more effective gas stunners. In conclusion, research should continue into finding better approaches to a number of production problems that would optimize welfare for the birds. Until that time, producers and processors should use the best management practices available.


Molting of laying hens is a management tool that is used to increase egg production and improve shell quality over the levels found at the end of the initial production period. Forced molting is commonly initiated by feed deprivation. Water deprivation has been used in the past, however high levels of mortality and morbidity during the molting phase rendered this unacceptable. There are three common programs that may be used. The first uses feed removal for four to six days, the second for 10 days, and the long fast method withdraws feed for twelve to sixteen days. All use alterations in daylength to assist. The addition of extra calcium in this period may help to maintain bone structure. Wild birds naturally go through a molting phase. When they do, they will consume little or no feed a period of time. Hence, it is possible that a forced molt is similar to the situation found in nature. Management of the molt is very important – levels of mortality must be monitored careful control of the molt kept in place. More research must be done in determining the levels of stress involved with each of the techniques used in molting.