

Play Behavior and its Importance for Welfare in Chickens and Other Farm Animals.

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Sammanfattning

Abstract

Play is a self-motivated seemingly non-functional behavior mainly observed in young animals. Moreover, play behaviors can be divided into three categories; social play, object play and locomotor play. The type of activity the category contains varies, as play behaviors vary between species. Play behavior is seen as an indicator of positive emotions in animals, therefore play could be an indicator of welfare. However, the relationship between play and welfare requires further studies. In this study, information was compiled from various articles about play and its relation to welfare. Above all, the study focuses on welfare and play in chickens, as studies on chickens are most lacking. Play provides several benefits regarding motor training, social cohesion and cognitive training. Livestock such as calves, piglets and lambs have all been observed playing. No play has been confirmed in chickens which is mainly due to lack of research. However, play has been observed in other bird species, including birds within the order Galliformes. Amount and type of play varies depending on the environment, which suggests that animal welfare has a great significance for play. If no play occurs, one could conclude that welfare needs to be improved. Lack of play observed in chickens could be due to poor welfare or lack of research. After all, presence of play in other bird species increases the probability that chickens also play. Results indicate that play could be used as an indicator for welfare.

Nyckelord

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Animal behavior, Animal welfare, Avian play, Galliformes, Gallus domesticus, Play behavior, Play functions

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1. Abstract

Play is a self-motivated seemingly non-functional behavior mainly observed in young animals. Moreover, play behaviors can be divided into three categories; social play, object play and locomotor play. The type of activity the category contains varies, as play behaviors vary between species. Play behavior is seen as an indicator of positive emotions in animals, therefore play could be an indicator of welfare. However, the relationship between play and welfare requires further studies. In this study, information was compiled from various articles about play and its relation to welfare. Above all, the study focuses on welfare and play in chickens, as studies on chickens are most lacking. Play provides several benefits regarding motor training, social cohesion and cognitive training. Livestock such as calves, piglets and lambs have all been observed playing. No play has been confirmed in chickens which is mainly due to lack of research. However, play has been observed in other bird species, including birds within the order Galliformes. Amount and type of play varies depending on the environment, which suggests that animal welfare has a great significance for play. If no play occurs, one could conclude that welfare needs to be improved. Lack of play observed in chickens could be due to poor welfare or lack of research. After all, presence of play in other bird species increases the probability that chickens also play. Results indicate that play could be used as an indicator for welfare.

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2. Introduction

All of us have at some point observed play, whether we think about it or not. It can be either your own child playing or your pet, or the animals you observe while walking outdoors. If you walk past a pasture with cows, goats or sheep, you have certainly seen young individuals engage in running, jumping and mock fighting by head butting each other (Hass & Jenni, 1993; Mintline et al., 2012). Play behavior and its significance is something that has been studied early in both humans and animals. However, it has not always been clear what play really is and what criteria should be met for behavior to be defined as play (Burghardt, 2005). Play behavior has for instance been described as redundant and nothing more than an immature behavior (Lazar & Beckhorn, 1974). But on the contrary, there are studies that describe how behavior differs between play behavior and non-play behavior, where the behavioral sequences

of play have been found to be exaggerated, repetitive, incomplete and different compared to corresponding non-play activities (Loizos, 1967; Fagen, 1974). The reason why play behavior can be difficult to define and understand may be due to several factors, but partly it can be because play behavior differs widely between species and that the behavior varies depending on the age of the animal. Some species are also more studied and have clearer play behaviors than others (Bekoff, 1984).

In today's society animal husbandry is very common where animals are kept for a variety of purposes such as fur-, meat-, and egg production. As early as the 1980's, Fagen (1981) formulated a theory that play behavior could be of importance to animal welfare, and since then several articles have suggested the same (Fagen, 1981; Newberry & Wood-Gush, 1988; Held & Špinka, 2011). So far, there are studies on play behavior in most of livestock animals, however, the behavior of chickens is poorly understood. The chicken industry in the world is large, which means that we are in need of studies on chickens, as a better understanding could also lead to improved welfare for hens.

Play behaviors are behaviors of great diversity. In some species play behavior is easier to study than others, and it has been difficult in some species to identify whether or not a behavior should be classified as play (Smith, 1982). To make play behavior easier to study, five criteria for play were developed, all of which must be met for a behavior to be considered as play. According to the five criteria, play behavior must: (1) not help with the current survival; (2) be spontaneous and self-rewarding; (3) be different from functional behaviors, either structurally or temporally; (4) be recurrent; and (5) occur when the organism is relaxed in the sense of not being sick or under stress (Burghardt, 2005). The five criteria can be summarized according to Burghardt (2014): "Play is repeated, seemingly non-functional behavior differing from more adaptive versions structurally, contextually, or developmentally, and initiated when the animal is in a relaxed, unstimulating, or low stress setting" (Burghardt, 2014).

Play can be divided into different categories which are social play, object play and locomotor play (Bekoff, 1984). Social play is when the activity includes two (or more) living individuals, object play is when the activity is directed towards an inanimate object and locomotor play is a hectic and sudden movement regardless of its environment (Bekoff, 1974; 1984). These categories are somewhat overlapping since social and object play both can be locomotory. Self-

play, which includes all types of play that is not social play, can include both object and locomotor play (Bekoff, 1984).

Using the criteria and categories of play, the importance of play behavior can be further investigated, as an indicator of welfare (Held & Špinka, 2011). Play behavior is seen as an indicator of positive emotions in animals (Boissy et al., 2007). Play could therefore indicate good welfare while lack of playful behavior could be an indicator that welfare needs to be improved (Held & Špinka, 2011). However, we are still in need of more studies on the relationship between play and welfare. The aim of this essay is therefore to study the connection between play behavior and welfare with focus on chickens, as studies on chickens are the most lacking among livestock species.

3. Materials and methods

The study was entirely literature-based where information was collected from books and various sources online. Search engines used to find literature were primarily Google Scholar and Web of Science. Web of Science was in this case used as a primary search engine, but it has varied over the course of the study depending on the topic and purpose. When information was difficult to find, Google Scholar was a valuable search engine considering its broad search base. Otherwise, Google Scholar was mainly used to find specific articles and authors. Articles have also been found through references from other relevant sources. Literature was chosen mainly based on its relevance to play and welfare. Year of publication has also played a role in selection of articles, as newer articles were preferred over older ones. When searching for articles, keywords such as Animal behavior, Animal welfare, Avian play, Galliformes, Gallus domesticus, Play behavior and Play functions were used.

4. Functions and mechanisms of play behavior

Play behavior may occur in adults, but it occurs mainly in young individuals with less independence who are still under parental care. The proportion of time spent on different activities depends on what other activities are performed (Bekoff, 1984). According to Surplus Resource Theory (SRT), play occurs when there is plenty of resources such as time and energy (Burghardt, 2014). Higher occurrence of play in young individuals may therefore have an explanation that they do not yet need to perform other type of behaviors, such as behaviors related to survival and reproduction (Bekoff, 1984).

Evolutionarily, play behavior is hypothesized to occur due to factors such as excess metabolic energy and lack of stimulation due to high activity levels (Burghardt, 2014). Furthermore, play has proven to be advantageous from various aspects as play trains the animal for future vital activities (Burghardt, 2005). Play is important in shaping behaviors of species and influencing how behavior will develop and change, both during an individual's lifetime and in a longer evolutionary perspective (Bekoff, 1984; Burghardt, 2014).

Since play consists of behaviors that vary depending on the species and embodiment (social, object, and locomotor play), the exact function of play can also vary. However, play behavior is believed to provide direct benefits to the individual in the form of motor training, social cohesion and cognitive training (Bekoff, 1984; Burghardt 2014). Motor training includes training on various skills that later in life may be considered important (such as hunting) and building the individual's muscle strength and stamina. Motor training also includes the practice of fine motor skills that require motor coordination, better balance and flexibility (Bekoff, 1984). Play also strengthens social bonds and relationships of individuals, which in turn can help increase an individual's inclusive fitness (Burghardt, 2014). Social status can also increase with the help of play, which can lead to increased reproductive success (Burghardt, 2005). Cognitive training leads to increased brain development, which improves the ability to understand the surroundings and lastly adapt depending on the situation (Burghardt, 2014). Since play behavior differs between species in terms of how play behavior is performed, it can be said that the genes and natural behavior of an individual are the underlying causes of play. Predators for example, prepare for future hunting during play, while prey animals rather play in forms of running and kicking that prepares them for eventual future predator attacks (Berghänel et al., 2015). As a summary, it can therefore be said that play behavior plays an important role for the individual's future survival and fitness. In order for the individual to show their surroundings that the behaviors performed, especially during social play, are meant as play and not serious behavior, there is something called play markers. Play markers are behaviors that signal that the activity is playful. How the play marker looks varies depending on the species (Bekoff, 1984). An example of a play marker is dogs that bend their front legs and wiggle their tail when they want to play (Bekoff, 1974).

Play behavior's adaptive value seems to be the foundation of the evolutionary origin of behavior. Since play has both costs as well as benefits, it suggests that the benefits must outweigh the costs in order for play to be adaptive (Burghardt, 2005). The costs are mainly in

the form of energy costs and that play can make the individual less aware of its surroundings, thus leaving them more exposed to predators. Benefits of play are primarily associated with increased survivability and improved fitness (Burghardt, 2014). Spiders who play before sexual maturity in the form of courtship are a good example. Males are usually eaten by the female during mating, but spiders that have trained courtship through playing are more likely to survive. Survival can lead to more offspring and increased fitness. Females also appear to benefit from courtship play as they have been shown to be able to lay larger egg sacs and consequently more eggs (Pruitt et al., 2011). After all, a costly behavior like play would not evolve unless it provided benefits (Berghänel et al., 2015).

5. Welfare

Just like play behavior, welfare is difficult to define. Welfare has to do with both man's own view of ethics concerning animal husbandry as well as the animal's own needs (Held & Špinka, 2011). Scientifically produced information regarding physiology, behavior, health condition and psychology can help to determine animal needs (Held & Špinka, 2011). Since welfare has several aspects, welfare can be defined differently depending on who you ask. However, most commonly the definition and view of welfare includes: (1) animals health and biological functioning; (2) affective state (feelings of pain or distress); and (3) to which extent the animal can perform natural behaviors and live a natural life (Fraser, 2009).

5.1. Welfare of laying hens

Hens kept for egg production have different types of housing systems that differ from one another, especially in terms of space (Dikmen et al., 2016). Four common housing systems for laying hens are: conventional cage, enriched cage, barn and free range (Shields & Duncan, 2009; Dikmen et al., 2016). The extent to which the systems are used depends on part of the world, conventional cages were for instance banned in the European Union back in 2012 (EU Directive 1999/74/EC).

Conventional cages are small cages with bare environment without enrichment, resulting in the hen not being able to perform natural behaviors (Dikmen et al., 2016). Enriched cages differ from conventional cages in that enriched cages are larger and equipped with a perch, nest, claw shortening device and an area with litter or sand for pecking and scratching, allowing the hen more natural behavior (Lay et al., 2011). Both barn and free range provides the hens with the same enrichment benefits as enriched cages but also more space and flooring litter. The

difference between barn and free range is that free range has outdoor access while barn does not (Shields & Duncan, 2009). Different housing systems have different advantages and disadvantages, but from a welfare perspective, small and non-enriched environments often cause welfare issues (Dikmen et al., 2016). Natural behavior occurs when there is enough space and resources to allow the behavior. When natural behavior cannot be expressed in hens it results in stress and possibly harmful replacement behavior, such as feather pecking (Lay et al., 2011).

Common welfare problems in laying hens depend on the housing system used. Caging systems often cause foot health problems such as hyperkeratosis (thickening of outer layer of skin), which is caused by the lack of litter in cages and the pressure it causes on the footpad (Weitzenbürger et al., 2006). Cages also prevent activities such as movement and behaviors like wing flapping and flying, which affects the health of the skeleton and makes the skeleton weaker (Lay et al., 2011). The lack of freedom means that the hen cannot express natural behaviors, which can cause behavioral disorders such as feather picking, pacing and even cannibalism (Tanaka & Hurnik, 1992; Lay et al., 2011). Systems without cages such as free range allow the hen to explore freely and perform natural behaviors to a greater extent, but even here problems such as cannibalism and feather pecking occur (Swarbrick, 1986). Problems in populations with free-ranging hens arise because of the large quantity of hens kept together, especially when a large amount of the population chooses to stay indoors instead of going outdoors (Hegelund et al., 2005).

5.2. Welfare of broilers

The housing system for broilers (chicken kept for meat production) differs slightly from the system for egg laying hens. Most commonly, broilers are kept in an indoor area that is usually divided according to the sex of the chickens. Inside the area, the broilers move freely and have access to food and water ad libitum (Meluzzi & Sirri, 2009). The floor where the broilers are reared is covered with litter that is replaced after each cycle before new chickens are brought into the area. In addition, cleaning of the floor surface is done. The length of the cycle, ranging from 40 to 60 days, depends on the market demand and the sex of the chicken. Besides this housing system, there are also broiler housings with an alternate feeding system and free range where the broilers are allowed going outdoors (Meluzzi & Sirri, 2009).

Although broilers are allowed to move freely, they are often reared in large populations. Large populations and high stocking density may increase the economic profits for production, but it is also the root cause of many welfare issues (Meluzzi & Sirri, 2009). Activities such as movement, preening and scratching are affected by stocking density, as the behaviors have proven to be less frequent at a high stocking density (Bessei, 1993; Ferrante et al., 2006). High stocking density reduces the movement surface of each individual, which in turn reduces the broiler's freedom of movement and the ease of access to food and water (Meluzzi & Sirri, 2009).

It has also been found that a high stocking density affects air quality since it increases the amount of gases (such as ammonia, carbon dioxide and oxide), dust and microorganisms, which increases the risk of respiratory diseases as well as eye infections. Ammonia comes from uric acid, which affect air quality and litter humidity. Litter humidity in turn is related to the amount of dust and microorganisms in the area. In order to reduce the risk of respiratory diseases, it is therefore important to both have good ventilation and litter quality (SCAHAW, 2000). When it comes to litter, it is also important to think about the type of litter used and depth, as these factors when not optimal can cause additional problems such as contact dermatitis. Contact dermatitis is characterized by hyperkeratosis, hock burns and breast blisters which mainly affect the feet of the chicken and cause pain (Bessei, 2006). Litter with greater depth has been shown to increase the risk of contact dermatitis, which probably is due to contact dermatitis being affected by the moisture of the substrate and thicker litter tends to be wet (Ekstrand et al., 1997). However, the main welfare issue for broilers is related to their rapid growth. The rapid growth affects the skeleton, which can cause impaired mobility and possibly even deformed legs (Meluzzi & Sirri, 2009).

6. Play behavior of different livestock animals

6.1. Play behavior in calves (*Bos taurus*)

Cattle are social animals that live in herds. Social bonds are strong within a herd and the social relationships they build to each other are long lasting (Bouissou et al., 2001). After birth, a calf stays with its mother until weaning, which naturally occurs at 8-11 months of age (Johnsen et al., 2015). In the dairy industry however, the calf is separated from its mother almost immediately after birth. The calf is then often placed in an individual pen, while the mother is moved to a group with other lactating cows (Jensen, 2011). After some time, the calf is placed

together with other calves of the same age. How much the calf socializes with other individuals has been shown to increase with the calf's age (Bouissou et al., 2001).

Calves are very much involved in locomotor play in the form of running, jumping, bucking and kicking, probably because they are naturally prey animals (Mintline et al., 2012; Berghänel et al., 2015). Social play in calves is in the form of mock fighting, head butting and mounting. Butting has also emerged in the form of object play as calves have been seen to push their heads against inanimate objects such as water bowls, bars and milk separators (Jensen et al., 1998; Duve et al., 2012). In adult individuals, head butting is used primarily to show aggression and dominance. Head butting in males is also related to courtship and accordingly, play behavior in the form of head butting is more present in males than in females (Aierqing et al., 2019). The time the calf spends on playing decreases with age, where social play is the type of play behavior that seems to last the longest (Jensen et al., 1998; Aierqing et al., 2019).

The calf's environment seems to influence the amount and type of play behavior. For example, locomotor play has been found to occur to a greater extent in larger pens than in small ones, probably because small pens lack enough space for the calves to run and jump around (Jensen et al., 1998). In addition, social contacts appear to affect the amount of play as calves kept alone are less active and play less than calves kept in groups (Jensen et al., 1998; Duve et al., 2012). The type of play also differs between calves kept alone and calves kept in groups, since calves in groups appear to devote themselves more to social play instead of locomotor play (Jensen et al., 2015). Factors such as the amount of bedding and straw have also been shown to affect play, as play occurs more frequently when they receive straw in connection with feeding (Jensen et al., 1998). The energy intake of the calf also affects play as well-fed calves have been shown to play more and devote more time to locomotor play (Krachun et al., 2010; Duve et al., 2012; Jensen et al., 2015). Since play occurs in animals that do not feel distress, it is suggested that the formation of the pen, social contacts and the amount of food all are factors that affect the calf's welfare. More specifically, it is well-fed calves with plenty of space, pen mates and bedding that seem to have better welfare. This suggestion is reinforced with the knowledge that weaning and restricted food are distressing (Weary et al., 2008).

6.2. Play behavior in piglets (*Sus scrofa domesticus*)

Pigs are just like cows, highly social animals. In the wild, pigs usually live in groups that mostly consist of females and young individuals. Males are often solitary or in groups with males only

(Graves, 1984). One can see the importance of social contact even in domestic pigs as they seek companionship by huddling up together, for instance when they sleep (Algers & Uvnäs-Moberg, 2007). Pigs are omnivorous and spend much of their time foraging, which they often do through rooting and digging (Kongsted et al., 2013). Rooting is when the pig uses their snout to push or move things to reach what they want. In addition to foraging, rooting is also used to communicate. Among other things, rooting is used between piglets and their mother when piglets use their snout to massage the udder, which is required for them to receive milk (Graves, 1984).

Play behavior in piglets has been observed to begin as early as the first days of life, where the piglets climb, nudge and bite the sow in a playful way. Social play with other individuals besides the sow has been observed in the form of pushing, butting, biting and mounting. Locomotor play in piglets has been found mainly in the form of running or sudden jumping or leaping. Besides this, pushing, biting or sniffing on inanimate objects has also been observed in piglets, which is classified as object play (Blackshaw et al., 1997). Play markers such as hop, scamper, pivot, toss head, shaking and carrying objects have been defined in pigs (Newberry et al., 1988). The mentioned play markers have been found in connection with described play behaviors in piglets, which helps determine these behaviors as play rather than something else (Blackshaw et al., 1997). Play occurs more frequently in males than in females and more often between individuals from the same litter (Dobao et al., 1985). Above all, it is social play in the form of mounting that occurs to a greater extent in males, which can be explained by the males' need to develop mounting skills (Newberry & Wood-Gush, 1988). Most frequent play occurs when the piglet is between two and six weeks of age (Newberry & Wood-Gush, 1988; Newberry et al., 1988). The fact that play behavior decreases after six weeks could be explained by that this time also is the start of the piglet's weaning process (Newberry & Wood-Gush, 1985). Reduction of play is probably due to other behaviors becoming more important and frequent, such as foraging behavior (Newberry et al., 1988).

The structure of the pen is crucial to how much, and what type of play occurs. For example, play in the form of sudden jumping and leaping occurs to a greater extent in round crates than in parallel ones (Blackshaw et al., 1997). Size of the pen also matters as piglets with limited space have been shown to devote less time to locomotor play (Newberry et al., 1988). The fact that piglets engage in locomotor play is seen as important and can affect welfare, as the amount of movement can affect foot health. Pigs kept in intensive housing conditions have shown to

have poorer foot health than pigs that can move freely (Perrin & Bowland, 1977). Well-fed piglets have also been shown to spend more time playing than others (Barnes et al., 1976). Since conventional piglets should have all their primary needs provided, such as enough food, water and weather protection, play should occur. If there is no play, one could therefore conclude that welfare needs to be improved (Newberry et al., 1988).

6.3. Play behavior in lambs (*Ovis aries*)

Sheep are grazing flock animals. They often move together as a group which helps in protection against predators (Fisher & Matthews, 2001). In the wild, males and females are often in separate flocks, except during the breeding season. Usually, the female flock consists of females and young individuals. It is common for males to be between two and four years old when they leave the female group to find a new flock with males only (Geist, 1971). The male flock often consist of fewer than 10 individuals and have a clear social hierarchy based on dominance. Larger individuals with large horns are often the most dominant. As body- and horn-size are factors related to age, older individuals are usually higher up in the hierarchy. Dominance hierarchy also applies during the breeding season as dominant males have a greater chance to breed. After birth, the relationship between mother and offspring is strong, which can be seen by the lamb following its mother (Fisher & Matthews, 2001).

When lambs play, they engage in locomotor play in the form of running, jumping and kicking (Berger, 1980). Lambs also spend a lot of time on social play, often in the form of mock fighting. During mock fighting, lambs are usually head butting, butting other body parts or kicking towards each other. Social play has also appeared in lambs in the form of mounting (Hass & Jenni, 1993). More males than females are engaged in social play in the form of butting and mounting. Contrary, females play in the form of locomotor play to a greater extent than males (Sachs & Harris, 1978). During social play, the behavior patterns of lambs seems to be similar to adult individual's behavior patterns performing corresponding behavior, during for instance conflict or courtship. What distinguishes play and seriousness seems to be the amount of time devoted to the activity and that lambs do not seem to use a big variety of behaviors as adults (Hass & Jenni, 1993).

Sheep kept as livestock are kept for a variety of purposes. Consequently, there are a variety of different housing systems for sheep, where some sheep may be outdoors all year round while others may periodically stay outdoors or always stay indoors (Richmond et al., 2017). The wide

variety of housing systems can make it difficult to determine the welfare of sheep, but play can be used as an indicator. For instance, it has been found that lambs kept in a zoo play less compared to free-ranging lambs (Bennett & Fewell, 1987). On the other hand, studies have shown indications that play does occur to a large extent in zoo environments. It is rather a rule than an exception that play occurs to a large extent in zoos (Fagen, 1981). The reason why lambs play less in said zoo is most likely because the environment is not optimal for play to occur. Specifically, it is believed that less play may be due to the zoo's hard floor surface and the risk of injury when falling (Bennett & Fewell, 1987). When the population density is higher, such as in some zoos or when animals are kept for production, the amount of social interactions increases. As the amount of social interactions increases, so should the amount of social play (Berger, 1979). However, this was not the case for sheep kept in the zoo (Bennett & Fewell, 1987). The reason why social play does not increase could be the social hierarchy, as sheep have been found to be more aggressive towards each other when kept in a zoo compared to when free-ranging (Bennett, 1986). Adult individuals have also been found to be aggressively dominant against lambs (Geist, 1971). Out in the wild, the lambs can get away from the aggressive adults to find their own space for play, but that is not the case in an enclosure. Therefore, the risk is that adult individuals prevent lambs from playing (Geist, 1971; Bennett & Fewell, 1987). Since play occurs to a much lesser extent in an enclosure (such as a zoo) than in free-ranging lambs, it is a possibility that the lamb's physical environment, the amount of social contacts and space are all factors that can affect welfare (Bennett & Fewell, 1987). Accordingly, studies show that behavior and amount of play varies between housing systems with different sizes. In smaller enclosures, sheep have been shown to prioritize food over play. Eating is one of the sheep's primary needs. The fact that food is prioritized over play in small enclosures reinforces the indication that space has importance for welfare in sheep (Anderson et al., 2015).

7. Behavior and play in chickens (*Gallus gallus domesticus*)

7.1. Natural behaviors in chickens

The domestic chicken (*G. gallus domesticus*) is a subspecies of the red jungle fowl (*Gallus gallus*), which is a wild variant of a chicken living in southeast Asia (Al-Nasser et al., 2007). Domestication of chicken began long ago, as domestication of red jungle fowl was observed as early as 8000 years ago (West & Zhou, 1988). Although chickens have been domesticated for a long time, they are still similar to the red jungle fowl in many aspects such as basic needs and

behaviors. There is also no evidence that the chicken's cognitive abilities should have been affected by domestication (Marino, 2017). Chickens are omnivores and therefore have a wide diet, ranging from berries and seeds to insects and small vertebrates (Savory et al., 1978). Senses of chickens are characterized by a great eyesight and sense of touch, especially in the beak which is used for a variety of purposes. Uses of the beak includes picking up items, drinking, preening, as well as investigating and exploring the environment. The beak is also used during fights as a weapon (Gentle & Breward, 1986; Marino, 2017). Besides this, chickens also have other well-developed senses, such as those for taste and smell (Jones & Roper 1997).

Both the domesticated chicken and red jungle fowl form social groups, which usually consist of one dominant male and female as well as other individuals of mixed rank and gender (Appleby et al., 2004). Within the group, the chickens communicate with each other in a variety of ways, such as through visual displays and sounds, where each type of sound has its own unique meaning (Joos & Collias, 1953; Collias, 1987). Even young individuals communicate using a variety of sounds as the chicks have been shown to give off alarm calls when predators are close. The type of call has also turned out to be different depending on whether it is an aerial or terrestrial predator (Evans et al., 1993a; 1993b). In addition to alarm calls, males also perform food calls. During food calls the male vocalizes while picking up and dropping food repeatedly. This behavior is also called tidbitting display and is used by males for females to decide which male they want to mate with (Marino, 2017). When the hen is about to lay its eggs, the hen often wanders away from the group to find a secluded place to nest (Lundberg & Keeling, 1999). The hen then performs brooding behavior where the hen incubates the eggs by sitting on them. It takes about 21 days for the eggs to hatch (Archer & Mench, 2014). After the eggs are hatched, the hen stays with the chicks to protect them and keep them warm. In addition to this, the hen shows the chicks where there is food and water. It usually takes until the chicks are several weeks old before the hen stops taking care of them (Leboucher et al., 1991). On average, it takes four months for the chicken to reach sexual maturity (Debnath et al., 2019).

Natural behavior in chickens includes activities such as nesting, dust bathing, preening, scratching and pecking (Costa et al., 2012). Since the chicken has an internal motivation to perform these behaviors, the behaviors will be performed regardless of external environment (Duncan, 1998). Nesting, which was mentioned earlier, is when the chicken looks for a good place to lay its eggs. Dust bathing is when the chicken sits down in dust, dry earth or sand with the goal to spread around the sand in its feathers. During dust bathing the chicken engages in

movement to allow the dust to spread and land on the feathers, which is done by rolling in the sand or by shaking their wings (Costa et al., 2012). Dust bathing comes with several benefits such as keeping the feathers healthy and removing parasites. However, the main consequence of dust bathing is that it balances the lipid levels in the feathers (Duncan 1998; Shields & Duncan, 2009). Besides providing benefits dust bathing is a social behavior, since the behavior is often performed in groups (Olsson et al., 2002). Preening is, just like dust bathing, a way in which chickens clean their feathers removing eventual parasites. Scratching and pecking are both behaviors related to foraging, as scratching and pecking occurs when the chicken scratch and peck the ground in search for food (Costa et al., 2012). In addition to all these behaviors, chickens also appreciate sitting on perches, as they in nature like to sit above ground while sleeping. After all, in the wild chickens perch in trees (Collias & Collias, 1967).

7.2. Play behavior of chickens and other birds

Animals living in social groups, such as chickens, can learn by observing and imitating each other's behaviors (Zentall, 2012). Besides imitating, there are other possible ways to learn, such as through play (Burghardt 2014). Previously, it has not been believed that birds play, which has led to studies being restricted to mammals. Recent studies, however, show that the brain of birds and mammals have several similarities when it comes to cognitive function (Jarvis et al., 2005). These similarities create a possibility that even birds, such as chickens, play.

So far, play behavior of the domestic chicken is next to unknown. However, there are behaviors observed in chickens classified as aggression which could as well be examples of play (Fält, 1978). Behaviors in chicken that could be examples of play are food-running, running-frolicking and sparring (Kruijt, 1964; Dawson & Siegel, 1967; Fält, 1978). Food-running is when a chicken picks up an item, preferably edible, and runs. During food-running the chicken is chased by other chickens, which makes food-running a type of social and object play (Kruijt, 1964). Running-frolicking is when the chicken runs or jumps around without any clear purpose, which could be considered locomotor play (Fält, 1978). Sparring has similarities to fighting in adults except for physical contact and risk of injury. Sparring can therefore be considered play fighting which is a type of social play (Dawson & Siegel, 1967). Although food-running, running-frolicking and sparring are not confirmed as play, there are other bird species where play behaviors has been described and confirmed to a greater extent. Play has been observed in other birds within the order Galliformes, which is the same avian order the domesticated chicken belong to. Birds within the order Galliformes have been shown to engage in locomotor

play (Ortega & Bekoff, 1987). An example of a bird within the order Galliformes which engage in locomotor play is the Grey partridge (*Perdix perdix*). Chicks of the Grey partridge have been observed playing by running and engaging in activities similar to behaviors used in courtship, such as dipping and bouncing at each other (McCabe & Hawkins, 1946). Another bird within Galliformes that engage in locomotor play is the Red-legged partridge (*Alectoris rufa*), which has been observed to play by performing fleeing movements (Goodwin, 1953). Besides the possibility that some behaviors in chicken can be considered play, object and social play have not yet been confirmed in Galliformes. However, no confirmation do not exclude the possibility that object play and social play occurs. After all, object and social play has been found in several other avian orders, of which object play has proven to be most common (Ortega & Bekoff, 1987).

Examples of birds that have been observed to engage in locomotor play, object play and social play are corvids and parrots (Auersperg et al., 2015). In corvids, more specifically ravens (*Corvus corax*), social and object play is commonly occurring, and the behaviors are well described. When ravens engage in object play, they often manipulate objects such as sticks and stones. Ideally, the ravens choose to play with objects that they have never seen before. However, with increased age and experience, playing with edible objects seems to be preferred (Heinrich, 1995). Ravens have also been observed to play by collecting various inedible items and placing them in caches. While the raven is engaged in this play-cache behavior, the raven interacts with other unfamiliar individuals over their caches. These interactions are believed to teach the raven strategies of potential competitors, which can be helpful later when the raven caches food (Bugnyar et al., 2007). Just like ravens, parrots devote themselves to object play. The play method, however, differs between ravens and parrots. When parrots engage in object play, they engage in activities that can help develop skills of manipulating food and foraging (Ortega & Bekoff, 1987; O'Hara & Auersperg, 2017). For example, young African grey parrots (*Psittacus erithacus*) have been observed using their beak to combine or stack objects on top of each other (Pepperberg & Shive, 2001). Similar play behavior has been observed in the New Zealand kea (*Nestor notabilis*), since kea has been observed to combine different objects as well as insert objects into other objects (Gajdon et al., 2014). Social play in birds often consists of play chasing, play fighting or social object play. Play chasing is when birds follow each other, either on the ground or while flying. This type of play behavior is common in both corvids and parrots (Diamond & Bond, 2003). When parrots play fight, they usually engage in a beak duel where they fence and parry with their beak. During play fight parrots might also try to bite

or push each other with their feet (Engesser, 1977; Diamond & Bond, 2003). Social object play is when individuals interact and play with an inanimate object together. The most common of these types of social play are play chasing and play fighting (Diamond & Bond, 2003).

Play has also been observed in birds such as the Neotropic cormorant (*Phalacrocorax brasilianus*) and the Green heron (*Butorides striata*), both of which are birds that live by the water. Cormorants engage in object play by manipulating objects such as sticks, leaves and small plants, both on land and in water. During object play in water, the object is repeatedly captured and held under the water surface. Other objects that cormorants play with are alive and dead fish, where the fish, just like other objects, has been captured and kept under the water, but also thrown into the air. The fact that cormorants manipulate objects, such as sticks, may be related to the bird practicing its ability to collect nesting material. Fish seem to be caught and thrown into the air by the cormorant to train for future hunting (Sazima, 2008). Just like cormorants, herons also engage in object play. Herons play by picking up sticks, fruits or other floating objects and throwing them into the water. In herons, this behavior is believed to train the ability to control and track objects at a distance and to attract fish, which improves their future hunting ability (Sazima, 2007; 2008).

8. Discussion

Play has great diversity and is a concept for a variety of behaviors. What different play behaviors have in common is the great importance for the motor and behavioral development of an animal. Many benefits are gained from play in the form of motor training, social cohesion and cognitive training (Bekoff, 1984; Burghardt 2014). Play has been observed in most animals, including calves, piglets and lambs. In calves, piglets and lambs, play occurs mainly in the form of running, jumping and mock fighting (Mintline et al., 2012; Blackshaw et al., 1997; Berger, 1980). No play behavior has so far been confirmed in chickens. However, locomotor play has been confirmed in other species within the order Galliformes (McCabe & Hawkins, 1946; Goodwin, 1953). Play has also been observed in many other species of birds such as corvids, parrots, cormorants and herons (Auersperg et al., 2015; Sazima, 2008). Studies show that the surrounding environment has significant importance for the amount and type of play performed (Jensen et al., 1998; Blackshaw et al., 1997; Bennett & Fewell, 1987).

The definition of welfare is primarily based on the fact that the animal should not suffer (Fraser, 2009). However, there are several factors other than suffering that affect welfare. For an animal to have good welfare, suffering must, of course be absent, but in addition to absence of suffering, the animal must also live a dignified life. In order for an animal to live a dignified life, the individual must feel happy. It is difficult to measure how happy an animal is by using different parameters, but this is where play behavior is useful. Play behavior is an indicator of positive emotions in animals (Boissy et al., 2007). If play occurs, then it can be concluded that welfare is better here than where play does not occur at all. After all, play is a behavior with a long evolutionary history and significance, which means that play is part of the animals' natural behaviors (Burghardt, 2005). If natural behavior cannot be performed, then neither can play. Basic welfare regarding suffering can also be measured by the amount of play, since play occurs when an individual has plenty of time, energy and an environment that allows playing behavior (Burghardt, 2014). Primary needs must also be met for an animal to play, which are needs linked to survival, such as hunger, thirst, sleep and shelter (Bekoff, 1984). In other words, animals do not play when vital activities need to be prioritized. Play can be seen as a lower priority luxury behavior, that only is performed when an animal is satisfied. For example, studies show how food is prioritized over play, which suggests that the motivation to eat is greater than the motivation to play (Anderson et al., 2015). Since animals that are suffering do not play, play will not occur in animals that are sick or in pain. This is reinforced by the knowledge that the amount of play in animals in pain depends on the amount of pain relief. The more pain relief an animal in pain has, the more time will be devoted to play (Mintline et al., 2013). If play is absent, one can conclude that there is room for a lot of improvement regarding welfare. However, it is not always clear what kind of improvement is needed. To determine what is needed to improve welfare, the type of play can be a significant factor. For example, restriction of movement may cause less locomotor play while lack of social contacts may cause less social play (Jensen et al., 1998). Therefore, the environment an animal is exposed to is of great importance for welfare and play.

The surrounding environment can affect play in several ways. Partly, the size of the enclosure and the amount of social interactions and enrichment can affect playing. When it comes to enrichment, it is important that the enclosure is enriched in a way that suits the species. For example, a perch makes no difference to a sheep while it makes a big difference to a hen. It is therefore important to know about the natural behavior of an animal when preparing an enclosure. Play in calves and piglets have been shown to be affected by the size and structure

of the enclosure. More specifically, locomotor play occurs to a greater extent in large enclosures where there is plenty of space (Newberry et al., 1988; Blackshaw et al., 1997; Jensen et al., 1998). The reason for more locomotor play in large enclosures could be because there is more space to move around. Possibly, there may not be enough space in small enclosures for locomotor play to occur. Increased amount of play could also indicate that calves and piglets thrive better in larger enclosures than in small ones. Perhaps small enclosures even induce stress in the animals, leading to less play. The amount of social contacts also affects the amount of play, since play occurs to a lesser extent in calves kept alone than calves kept in groups (Jensen et al., 1998). The reason that calves kept alone play less could be because calves usually live in herds. When the calf is deprived of being in a herd, this may cause stress, which results in the absence of play. The lack of playmates can also affect the amount of play. In contrast, it has been found that lambs kept in the zoo do not play more despite having social contacts. When sheep are free-ranging, however, play occurs to a large extent (Bennett & Fewell, 1987). Less play in lambs kept at the zoo could be due to the fact that adult individuals with high hierarchy status are aggressive and thus prevent play from occurring (Bennett, 1986). The explanation for this could be that the enclosure where individuals live is too small. High population density can cause stress and aggression between individuals. For example, chickens can harm other individuals through feather pecking when many individuals are kept close together (Swarbrick, 1986; Hegelund et al., 2005). In calves, play has also been shown to occur to a greater extent during feeding (Jensen et al., 1998). More play during feeding could partly be due to the animal not being hungry. It could also be because feeding makes the animal happy, which leads to play. After all, adding straw to the enclosure leads to more material to explore and roll around in.

Since humans began to look after the needs of animals and learned more about natural behaviors, the welfare of our animals in captivity has improved. In chickens, welfare has improved marginally in the European Union since conventional cages were banned (EU Directive 1999/74/EC). Chickens are now allowed to perform natural behaviors such as nesting, dust bathing, preening, perching, scratching and pecking. However, there is still room for improvement as many welfare issues with chickens remain (Lay et al., 2011). When an animal has all the primary needs provided, which is the minimum requirement for animal husbandry, play should occur. As mentioned, play occurs in calves, piglets and lambs, which is expected and means that primary needs of these species should be met. So far, however, play has not been confirmed in chickens, which may be because the welfare of chickens still requires a large improvement. The improvement required could be providing chickens with more space and

resources to be able to perform natural behaviors. After all, more welfare issues appear to occur in bare environments as well as in populations with high stocking density (Meluzzi & Sirri, 2009; Dikmen et al., 2016). Of course, enrichment is important when improving the welfare of all types of animals kept in captivity. Another possible explanation that play has not yet been confirmed in chickens could be due to lack of studies and knowledge. Perhaps even chickens play to the same extent as calves, piglets and lambs, only that we do not yet know about it.

Play behavior of chickens is not yet described as in other animals. A possibility is that play behavior of chickens is similar to play of other species within Galliformes. The reason why play has not been confirmed in chickens may be because it is difficult to determine the purpose of behaviors. For instance, it can be difficult to decide whether behaviors are playful or serious. There are studies that classify certain behaviors of young chickens as aggression (Fält, 1978). However, behaviors classified as aggression in chickens could as well be playful. It would not be the first time that behaviors for play and aggression are similar, after all, calves, piglets, lambs and even dogs engage in mock fighting which has great similarities with real fighting (Bekoff, 1974; Hass & Jenni, 1993; Blackshaw et al., 1997; Aierqing et al., 2019). The reason why play and seriousness can be distinguished in several animals is because they are carefully studied. When play began to be studied, it was, after all, generally difficult to determine whether a behavior should be classified as play or not (Burghardt, 2005). More studies lead to identification of play markers, which can be crucial to distinguish play and seriousness (Bekoff, 1984). Play markers have not been identified in chickens, which makes identification of play more difficult. Again, this is a sign of lack of studies and knowledge of chickens and their behavior. Thus, more behavioral studies on chickens are needed with the aim of identifying play behaviors in different situations. The best alternative to identify play behaviors would probably be to study chickens in their natural environment in normal-sized populations for the species, preferably with minimal human influence. After confirmed play behaviors in chickens, play behavior should be checked in production environment to identify welfare issues.

8.1. Conclusions

Since play is an indicator of positive emotions in animals, play behavior can be used as a welfare indicator. Play can determine whether the animal's primary needs are satisfied, but also if the animal feels happy. More specifically, play occurs in satisfied and happy animals, which is why play can be linked to positive welfare. Play is common in many of our livestock animals, but it is not yet confirmed if play occurs in chickens. Since play is commonly occurring in birds, there

is a high likelihood that even chickens play. The fact that locomotor play was observed in other species within the order Galliformes strengthens the hypothesis further. So far, only locomotor play has been observed in Galliformes, but since both object and social play are common in birds, it is also possible that Galliformes engage in other types of play. The welfare of chickens requires improvement and since play is a good method of indicating welfare, more research is needed on the behavior of chickens with the aim to improve chicken welfare.

9. Societal and ethical considerations

Since this study is entirely literature-based, no animals are subjected to potential suffering, however, most sources used are based on animal studies. When selecting sources, the method has been checked to ensure that the animals are experiencing as little suffering as possible. However, it is not possible to guarantee that animals do not experience suffering, despite a well thought out working method. Several of the sources used are older and are from a time when animal welfare was not seen as an important subject. From a welfare perspective, it is therefore possible that studies that were allowed back then might not have been allowed today. All sources referred to are not practical, but several are also literature studies. The fact that a source is a literature study does not automatically make it ethically acceptable. Studies referred to may as well have been based on other sources with ethically questionable working methods.

Studies on animals can cause suffering, both during the experiment and afterwards. One example is how this study has referred to sources with conclusions that space and hunger affect play. In these studies, animals may have been subjected to confined spaces and to some extent hunger. Confined spaces and hunger expose animals to suffering, as it prevents the animal from performing natural behavior (in this case, play). Even behavioral studies in which the animal is only observed can also cause suffering since it can disrupt the environment and cause fear, thus affecting the animal's natural behavior. When performing studies on animals, it is important to determine if the benefits outweigh the potential suffering. Benefits can be multiple and include many different perspectives. Studies can improve the lives of people, but also of animals and the environment, and contribute new knowledge that may be important for the future. In some cases, studies with working methods that causes suffering may also be worthwhile to perform, as it provides important knowledge. The fact that studies have even been carried out can contribute to further research in the subject and improve future working methods. The question is how to determine if the benefits are worth the suffering, which probably depends on each

situation. If possible and there are other alternatives to gain knowledge, animal research should be avoided. Unfortunately, animal research cannot always be avoided in order to get the knowledge needed. For example, in order to gain knowledge about play behavior of chickens, there are no other alternatives than performing research on chickens.

Although this study is only based on literature and no new practical studies have been performed, it can contribute to future research. The study may contribute to an increased understanding of chickens and their behavior. Significance of behavior in chickens and other animals could also be taken more seriously. The fact that the study was carried out leads to more published material on the subject play and welfare, which could lead to more people choosing to research this subject in the future. Perhaps this study even raises new ideas for further research. In a larger perspective, an increased understanding of the subject could lead to improved welfare, not only for chickens but also for other animals. Further in the future, play could also be used as a standard indicator of welfare. In addition to improved well-being of our livestock animals, the financial benefits of our farmers could also be improved. After all, there is a possibility that healthy animals may produce more or better products.

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