

Perch and litter preferences in chicks

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Abstract

There is a lack of research on the litter and perch preferences of chicks during the first three weeks of their lives. The purpose of this study was to identify which perch and litter types the chicks preferred, if their preference changes over time and if the preference of litter types change depending on the specific behaviours. First a pilot study was made to find out which different litter and perch types should be used. After that an experiment was carried out over three weeks with six different litters and six different perches to see which they preferred. For this study 94 LSL (Lohman selected leghorn) classic were used, they arrived at the research facility on the same day they were hatched. The different litters compared were; straw, sand, peat, wood shavings, hemp and crushed straw pellets. The different perches compared were a large rope, a small rope, a small flat, a large flat, a small round and a large round perch. The chicks had access to three different litter and perch types at a time, and they were changed every Monday, Wednesday and Friday. The result showed that the chicks overall had a preference for wood shavings, hemp and straw, the preferred litter types for preening and sleeping/resting was the same. For picking they preferred wood shavings, hemp and sand. The preferred litter types for dustbathing were sand and peat. The overall result for their perch preferences showed that they had a preference for the small flat, the large flat and the large rope. The most preferred perch types for preening was the large round, the small flat and the large flat perch. For sleeping and resting they preferred the small rope, the large rope, the small round and the large flat perch.

Background

In 2016 in Sweden 66% of the production systems in the egg industry are for loose-housed hens indoor (Jordbruksverket, 2017). Perches used in commercial production are often made of steel, wood or plastic. Research has shown that the material and perch width affects the time spent on and the time used standing on perches in laying hens (Pickel *et al.*, 2010; Struelens *et al.*, 2009). Do these even affect preferences for chicks? Their ability to keep good balance on perches is also affected by the perch material (Pickel *et al.*, 2010). According to EFSA (2015) some materials are more affected by temperature compared to others, steel as an example. Therefore the perch material may have an impact on the comfort for the animals when spending time on perches (EFSA, 2015). What type of perch material would chicks prefer? And does this change, as they grow older? As mentioned earlier there has been some research on this regarding adult hens (Pickel *et al.*, 2010; Struelens *et al.*, 2009) but not much on chicks.

There have been made observations of the wild red jungle fowl that shows that the red jungle fowl returned to their roosts for resting several times during the day. When somebody or something interrupts their roosting they would move and find new places to roost. The animals were often observed scratching in material on the ground. The observations even showed that the chicks were able to fly in an early stage of life (Collias & Collias, 1967)

According to Collias & Collias (1967) the red jungle fowl hen leads the chicks around and, when the mother hen alarms the chicks of danger, the chicks would sometimes perch and not move at all for a while. Brooded chicks compared to non-brooded chicks performed more active behaviours like picking and dustbathing (Riber *et al.*, 2007). Chicks reared with hens during the first weeks of their life started to use perches during daytime earlier than chicks reared without. The mean age for the brooded chick observed on perches during daytime was 10 days of age. They also performed more ground picking than chicks reared without hens (Riber *et al.*, 2007).

In the Swedish legislation there can be found several demands on both access to perches and litter. The Swedish Board of Agriculture's regulations and general advice in agriculture etc. (SJVFS 2010:15 Saknr L100) chapter 6 § 6 requires that all chicks should have access to perches. SJVFS 2010:15 (Saknr L100) chapter 6 § 23 (table 21) requires that chicks of three weeks of age should have 2cm perch space per chick. There are no recommendations about the type of perch and there is not much research done on chicks perch preferences.

It is suggested that when chicks are reared with early access to perches it has a positive effect on their development of spatial cognitive skills (Gunnarsson *et al.*, 2000), but also that hens without access to perches show behaviour indicating frustration (Olsson & Keeling, 2000). The study made by Gunnarsson *et al.*, (2000) even showed that chicks reared with access to perches were better at accessing higher levels compared to chicks reared without.

SJVFS 2010:15 (Saknr L 100) chapter 6 § 5 requires that laying hens should have constant access to litter that can provide the possibility to perform picking, dustbathing and scratching behaviour. In a study made by Gerinebreti re *et al.*, (2014)

with laying hens in furnished cages, the hens showed different preferences for litter depending on what behaviour they performed. Research shows that peat is one of the most preferred litter types for dustbathing (Wichman & Keeling, 2008; Gerinebretiére *et al.*, 2014).

Chicks in the industry are reared in a system similar to the one they are going to live in as adults (Jeremiasson, Alexandra, 2017 E-mail 2017.12.01). In aviary systems the litter normally used for chicks is wood shavings or chopped straw, but during the first three weeks they are housed on the bottom tier of the aviary system. The wire floor is covered with paper and usually the food is scattered on the paper, so also acting as litter (Jeremiasson, Alexandra, 2017 E-mail 2017.11.20 and 2017.12.01). What type of litter do chicks prefer and do their preferences change, as they grow older? Is the preference different depending in the specific behaviour they want to perform? A study made by Vestergaard & Baranyiová (1996) showed that chicks at the age of 9 days had a preference for picking in peat.

Object and purpose

This study was part of a larger project to investigate how to prepare chicks, in an early stage of life, to handle challenging situations better later in life. The purpose of this smaller study was to help select perches and litter for the larger project. By giving the chicks perches with different designs and different materials, hopefully with the result of this study it could be possible to identify the most preferred perches for chicks. The purpose is also to compare different kinds of litter materials, that could be feasible for commercial production, and hopefully be able to choose the most preferred litter types for chicks. It is also of interest to find out what specific perch types or litter types they prefer for performing different behaviours and to see if chicks have different preferences at different ages.

Hypothesis

The hypothesis for the litter materials is that the litter preferences will be different depending on what specific behaviour the chicks want to perform.

The hypothesis for the perches is that in the beginning the chicks will prefer the smaller perches since they are easier to grip with their feet, but as they grow older their preferences will change and they will then prefer bigger perches as their feet also grow bigger.

Material and method

The experiment was carried out at The Swedish Livestock Research Centre, Lövsta, from September to November 2017.

The set up for this study was to first have a pilot study to find out which different litter and perch materials and designs that was feasible for the final study. The pilot study was also used to try out different behavioural observation methods that could be used. This was done to make sure when the final experiment was starting everything had already been tested and everything was working as it should.

Pilot study

For the pilot study 30 Bovans Robust chicks were used. The pilot study was used to find out which litter types were suitable for the final experiment and also which perch types and how they should be presented to the chicks. Some different observation methods were tested to see what could work and a scan sampling approach was chosen. The selected litter and perch types for the final experiment should be relatively different, to give a more true result of their preferences, and also they should be feasible to be used in commercial production.

The result from the pilot study was that straw, crushed straw pellets, sand, wood shavings, hemp litter and peat were the different kinds of litters that should be used. Sawdust was tested as a litter, but was discarded because it was very dusty and expected to lead to a poor environment for the chicks. Two different kinds of trays to present the litter on was tried out and the best solution was to use a tray made out of plastic with a size of 71cm x 35cm. The six perches chosen were a small and a large flat perch made out of wood, a large and a small round perch made out of wood and, finally, a small rope and a large rope.

Experiment

Pens and environment

In this experiment six pens were used. The pen sizes were 1.14 x 1.5 meters. In the pens there was a feeder, a water container, three different perches placed at the same height and three trays with a different kind of litter in each (Figure 1). The chicks had water and feed *ad libitum*. An oilcloth was put up on the sides so that the chicks couldn't see each other and wouldn't choose the litter closest to the chicks in the other pen. Being able to see chicks in another pen was not considered a problem for the perches, as they were the same type across the whole width of the pen. As the perches were elevated more and more, the chicks began to be able to see each other. The temperature in the stall started out at around 30 degrees and was down to 26 degrees after 23 days. For the first five days there was a heat lamp in every pen. The first day the chicks had one hour of darkness, and day two and day three they had 2 hours of darkness per day, this to make sure the chicks were able to see and find the feed. After three days, the light was on for 18 hours and off for 6 hours. Everyday 30 minutes was used to increase and decrease the light.

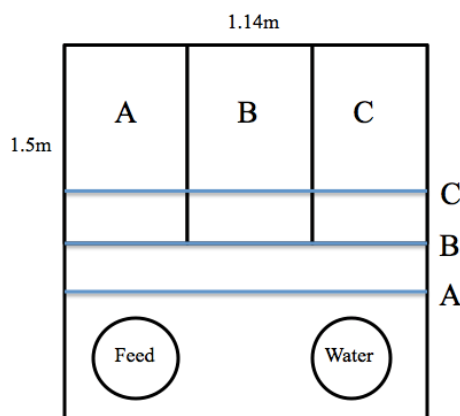


Figure 1. Drawing of the design of the pen. It shows the placement of litter and perches A, B and C.

Management

Before the morning observations started, all the pens were cleaned from feed and litter on the floor and the trays were filled with more litter if needed. When litters and perches were changed, the pen was cleaned again to make sure they only had the litter types that were intended to be presented to them in the trays, and nothing else. Every Monday, Wednesday and Friday for three weeks the litters and perches were changed. The chicks were checked twice a day by the staff at Lövsta research facility.

Animals

For this experiment 94 female Lohman selected Leghorn (LSL) classic chicks were used. They arrived at Lövsta research facility on the same day as they were hatched. On day six, one chick was put down after showing symptoms of illness. In four pens there were 16 chicks and in two pens there were 15. After the one chick was put down, there were three pens with 15 chicks and three pens with 16 chicks.

Perches and litters

In this experiment six different perches were used to find out which one the chicks preferred. There was a large and a small variant of three basic perch designs. These were a single dark green rope and a large dark blue rope, a small round and a big round wooden perch, a small squared perch with bevelled edges and a large flat one (Figure 2 & 3). Six different types of litter were presented to the chicks in this study; straw, crushed straw pellets, sand, peat, wood shavings and hemp (figure 4). Only three perches and three different litter types were in the pen at any one time.

From day one to day five, the six different perches were presented on the floor to make sure the chicks had a chance to get to know them before elevating them. The perches were elevated when a criteria was achieved. The criteria was that during one observation in each pen, at least three chicks should be observed on perches, this was to make sure that it was not the same chick on the perches every time. During the whole experiment the criteria was achieved in all the pens at the same time. On day five the perches were elevated to 16.8cm and in the end of the experiment the height of the perches was 46.8cm. The perches were attached in the grid of the sidewalls of the pens, which determined the exact heights of the perches at each stage.

When the perches were elevated they were elevated with 5cm a time, even though they were elevated with the same height there was a minor difference in height between the perches. The ropes, both large and small, were attached in the pen a little higher to make up for them hanging slightly lower in the middle of the ropes. The big round perch was higher because the perch itself was higher than the other perches. It was approximately 2cm higher. The small round was 1.5cm higher, the small flat was 1.5cm higher and the big flat was 0.6cm higher than the grid they were attached to.



Figure 2 (left). The different wood perches used in this study. From the left to the right: Small square with bevelled edges (1.5cm x 1.5cm) large flat (6.7cm x 0.8cm) big round (3.5cm diameter) and small round (1.5cm diameter).

Figure 3 (right). The different ropes used as perches in this study. From the left to the right: large rope (three ropes braided together, approximately 4.5cm diameter) and small rope (approximately 1.8cm diameter). Photos: Cecilie Nielsen



Figure 4. The different litter materials used in the study. From the top left to the top right; sand, straw and crushed straw pellets. The litters from the bottom left to the bottom right; wood shavings, peat and hemp. Photo of crushed straw pellets: Lena Skånberg, photo of the rest of the litters: Cecilie Nielsen

Schedule for changing litters and perches

A schedule was made for knowing which litter and what perch should be where and at what time in an even and balanced way (see attachments; schedules for litter/perch changes). This was done to make sure that all litters were compared with all the other different types of litter and that all perches were compared with all other types of perches. The different places for perches and litters in the different pens were named A, B and C, (see figure 1) to know where they should be presented every time. The litters and perches were changed every Monday, Wednesday and Friday. Three litters and three perches were presented in each pen through the whole experiment. Through the three weeks of the experiment nine changes were made. For every change every

pen was given at least two new litters and perches, and if the third would be the same as they had before, it would at least change place.

Behavioural study

On every observation day 11 scans were made in every pen, five morning observations and five afternoon observations and an observation during night time for each pen every observation day. Observations were made every Monday, Wednesday and Friday for three weeks. The total number of observations, with all different observations included and for all the groups was 594 during the three weeks of the experiment.

After every observation at least 15 minutes passed before the next observation in the same pen was carried out. The observations were in general always done starting with pen one to six, but with a few exceptions do to practical reasons. This was done to make sure that the time between the different observations in the different pens was done to get a time difference as equal as possible. For example to make sure that between observation one and two in pen one approximately 15 minutes passed, and to make sure this was the case for all the pens. The observations were carried out so that first the chicks on the perches and their behaviours were registered (See figure 5 for specific behaviours observed).

Ethogram

| | |
|---------------------------------|---|
| Sleeping/resting | The chicks were sitting, laying down still, sitting/standing/laying with their eyes closed |
| Preening | The chicks were arranging their feathers. |
| Dust bathing | They were lying on the side, shaking/vibrating to get the litter/dust in their feathers and down. |
| Picking/scratching | The chicks were picking on the floor, in the litter or on/in other material. Drinking and eating was also categorized as picking. Picking is when they were moving their beak up and down or forth and back and against something. |
| Moving/standing or other | When it wasn't possible to see what they were doing, when they were running, flying, moving around the drinker and feeder without doing anything but moving, and when they were standing still with open eyes performing no specific behaviour. |

Figure 5. The ethogram used for the behavioural observations.

Then the chicks in the litter and their behaviour were registered and at last the chicks outside the litter trays and around the feeder and drinker were scanned. The behaviours performed outside the litter trays and not on the perches were considered less important for the study and therefore observed as the last thing. Although done in this order, the observation is considered as an instantaneous scan of what each chick was doing at that moment in time.

In the afternoon at 4:00 PM one “night observation” in each pen was made. The first night observations were done with heating lamps with red light, unfortunately the heating lamps had the opposite effect of what was expected and the chicks seemed to be more active when the lamps came on. After that the night observations were

carried out slightly earlier, while the light in the stall was dimming down. The light dimming down took about 9 minutes before it was completely dark.

Statistical analysis

Every observation day, 11 observations were made in each pen, five morning observations, five afternoon observations and one night observation. For each pen, the data for the five observations in the morning were summarized into one observation and the same was done with the afternoon observations. This was done for every day. The data was then summarised according to proportion of observations on each litter type and on each perch type and according to their behaviour in the litter or on the perch. The data was then calculated into the average proportion of time spent in different litter types and on different perch types. The same was done to calculate average proportion of time performing specific behaviours. The data were then averaged across all days, to give an average for each pen. The results in the graphs are presented as a mean and standard deviation over these six pens. Minitab express was used to calculate the statistics and a one-way Anova was used to test if there were any significant differences between different litter types and perch types.

Result

In this section I first present the results for the litter preference and then the results for the perch preferences.

Result of litter preferences

On average the chicks spent 0.034 proportion of their time in litter dustbathing, 0.132 picking in the litter, 0.153 sleeping in the litter and 0.045 proportion of their time preening in the litter. So on the average the chicks spent 0.364 proportion of their time performing the behaviours mentioned above.

The result of litter preference overall showed a significant difference ($F = 6.28$, $df = 5,35$, $P = 0.0004$). Birds spent significantly more time in wood shavings than in peat ($F = 33.29$, $df = 1,11$, $P = 0.0002$), crushed straw pellets ($F = 13.99$, $df = 1,11$, $P = 0.00381$) and sand ($F = 7.73$, $df = 1,11$, $P = 0.0195$). Hemp was preferred over peat ($F = 33.36$, $df = 1,11$, $P = 0.0002$), crushed straw pellets ($F = 9.58$, $df = 1,11$, $P = 0.0113$) and sand ($F = 3.88$, $df = 1,11$, $P = 0.0772$) and straw was significantly different from peat ($F = 8.81$, $df = 1,11$, $P = 0.0141$).

Litter preferences during the experiment

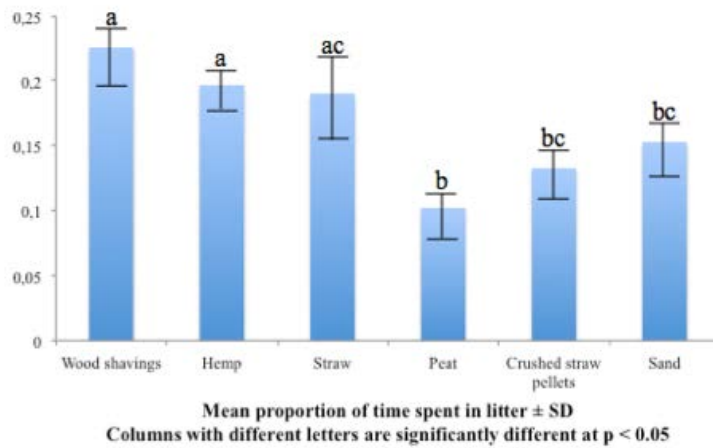


Figure. 6 The mean proportions of time when chicks were observed in the different litters during all three weeks of the experiment.

Litter preferences during week one

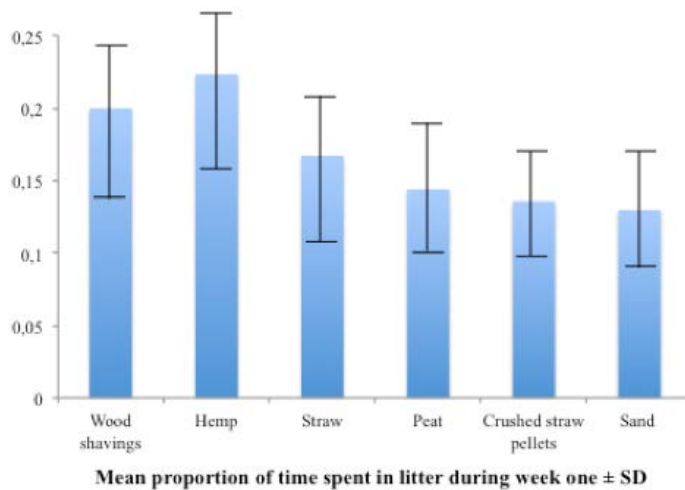


Figure. 7. The mean proportions of time when the chicks were observed in the different litters during week one.

There was no significant effect of the type of litter that chicks spent time in during the first week of the experiment ($F = 0.87$, $df 5,35$, $P = 0.5$).

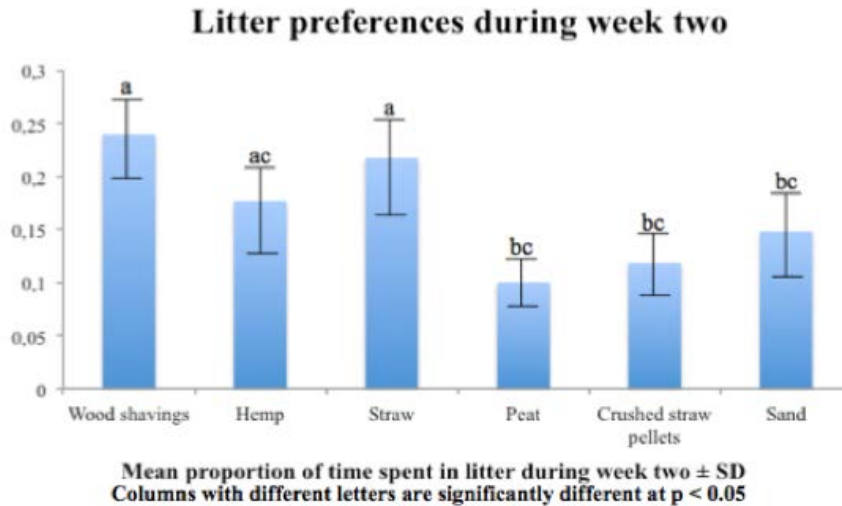


Figure 8. The mean proportions of time when the chicks were observed in the different litters during week two.

There was an overall significant effect of the litter types used most during the second week of the experiment ($F = 6.28$, $df 5,35$, $P = 0.0004$). The most preferred litter types were wood shavings, hemp and straw. The chicks were observed significantly more in wood shavings than in peat ($F = 15.20$, $df 1,11$, $P = 0.0030$), crushed straw pellets ($F = 9.39$, $df 1,11$, $P = 0.0120$) and sand ($F = 5.06$, $df 1,11$, $P = 0.0482$). It showed that straw was significantly more preferred during week two than peat ($F = 6.81$, $df 1,11$, $P = 0.0260$).

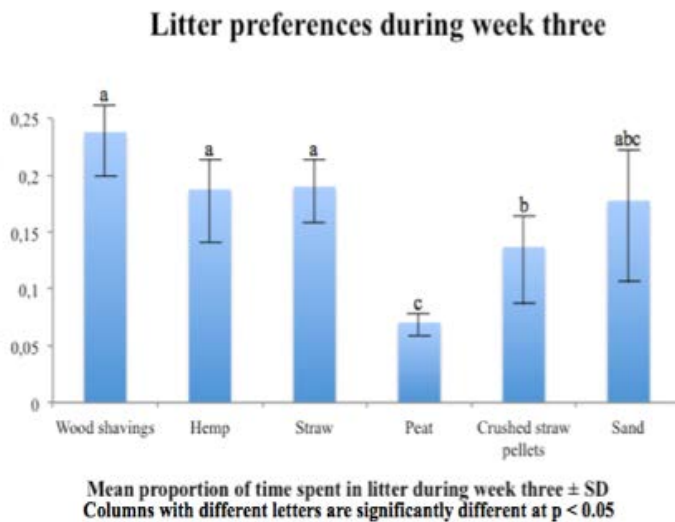


Figure 9 The mean proportions of time when chicks were observed in the different litters during week three.

There was an overall difference in time spent in the different litters (F -value = 3.51, $df 5,36$, P -value = 0.013,) with most time spent in wood shavings, followed by hemp, straw and sand. Peat was the litter that the chicks spent least time in. They spent less time in peat than in crushed straw pellets ($F = 5.11$, $df 1,11$, $P = 0.0473$) straw ($F = 24.00$, $df 1,11$, $P = 0.0006$), wood shavings ($F = 37.36$, $df 1,11$, $P = 0.0001$,) and hemp

($F = 14.58$, $df 1,11$, $P = 0.0001$). Wood shavings were preferred over crushed straw pellets ($F = 6.90$, $df 1,11$, $P = 0.0253$).

Litter preference when performing specific behaviours

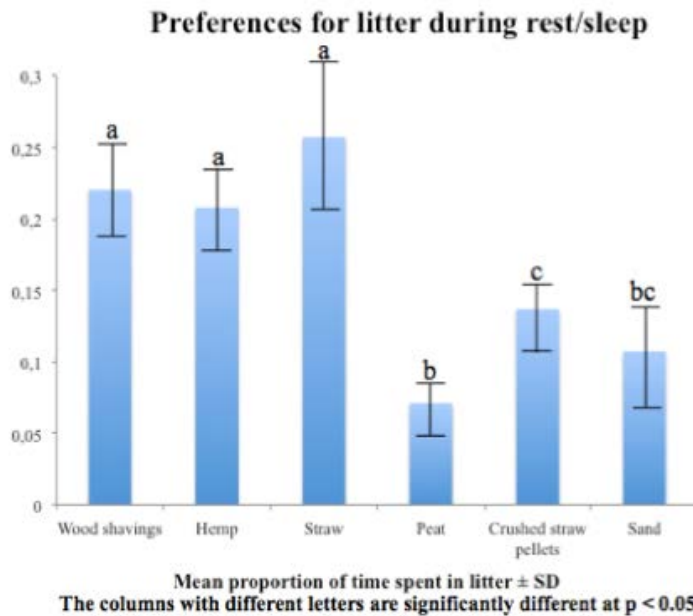


Figure 10 The mean proportions of time when the chicks were observed sleeping or resting.

There was an overall significant difference (F -value 7,42, $df 5,35$, P -value = 0,0002) and the result from preferred litter types when sleeping and resting showed that wood shavings, hemp and straw were the most preferred. Wood shavings were preferred over peat ($F = 25.05$, $df 1,11$, $P = 0.0005$), crushed straw pellets ($F = 6.43$, $df 1,11$, $P = 0.0295$), sand ($F = 8.57$, $df 1,11$, $P = 0.0151$). Hemp was more significantly preferred over peat ($F = 27.68$, $df 1,11$, $P = 0.0004$), crushed straw pellets ($F = 5.82$, $df 1,11$, $P = 0.0365$) and sand ($F = 7.95$, $df 1,11$, $P = 0.0182$). Straw was preferred over peat ($F = 17.28$, $df 1,11$, $P = 0.0020$) over crushed straw pellets ($F = 6.60$, $df 1,11$, $P = 0.0280$) and over sand ($F = 8.62$, $df 1,11$, $P = 0.0149$). Crushed straw pellets were used more than peat for sleeping ($F = 7.48$, $df 1,11$, $P = 0.0210$).

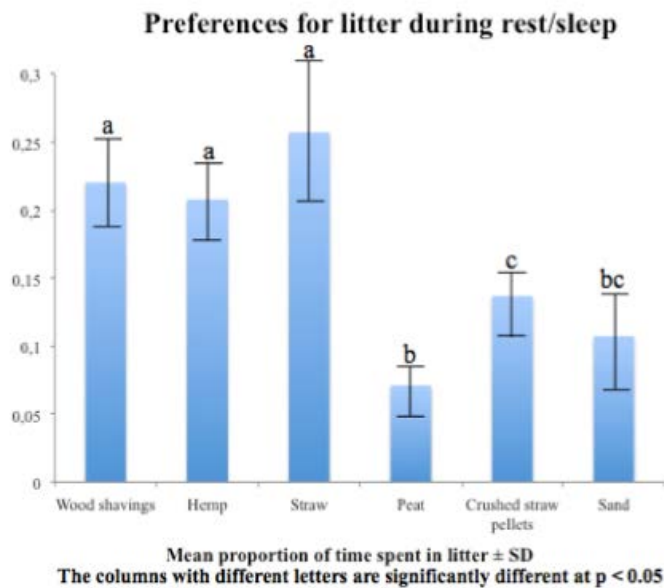


Figure 11. The mean proportions of time when the chicks were observed spent in litter when birds were observed performing preening behaviour.

There was a significant difference in the overall result of litter types preferred for preening (F -value = 6.51, df 5.35, P -value = 0.0003), the most preferred litter types for preening was wood shavings, hemp and straw. Straw was preferred over peat (F = 25.98, df 1,11, P = 0.0005), crushed straw pellets (F = 5.75, df 1,11, P = 0.0375) and sand (F = 6.17, df 1,11, P = 0.0323). Wood shavings were preferred over peat (F = 36.77, df 1,11, P = 0.0001), crushed straw pellets (F = 5.87, df 1,11, P = 0.0358) and sand (F = 6.13, df 1,11, P = 0.0327). Peat was the litter type where least animals were observed preening and hemp was more preferred for preening (F = 18.24, df 1,11, P = 0.0016). The crushed straw pellets were even preferred over peat for preening (F = 9.37, df 1,11, P = 0.0120).

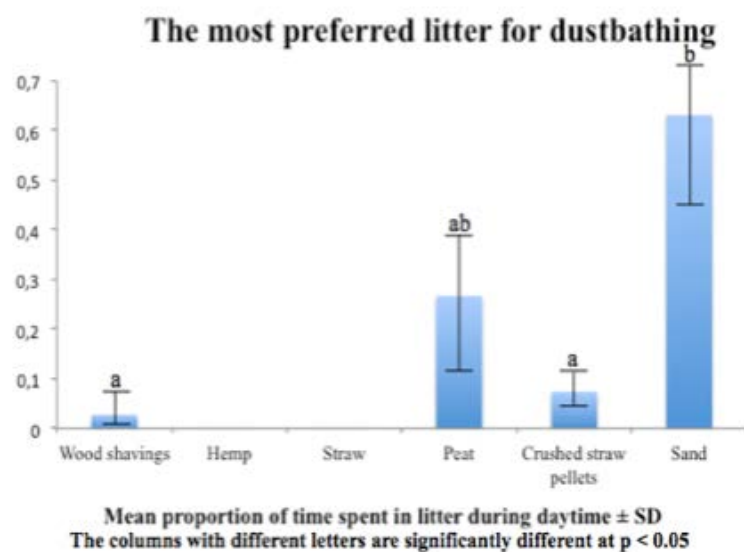


Figure 12. The mean proportions of time when chicks were observed in litter when birds were observed dustbathing.

Chicks were first observed dustbathing on day 5. There was an overall significant effect of the type of litter on dustbathing ($F = 12.47$, $df 5,35$, $P = 0.0001$). The birds dustbathed in sand significantly more often than in wood shavings ($F = 23.71$, $df 1,11$, $P = 0.0007$) and crushed straw pellets ($F = 19.70$, $df 1,11$, $P = 0.0013$) and there was a strong tendency for it to be greater than in peat ($F = 4.78$, $df 1,11$, $P = 0.054$). Birds were never observed dustbathing in hemp or straw.

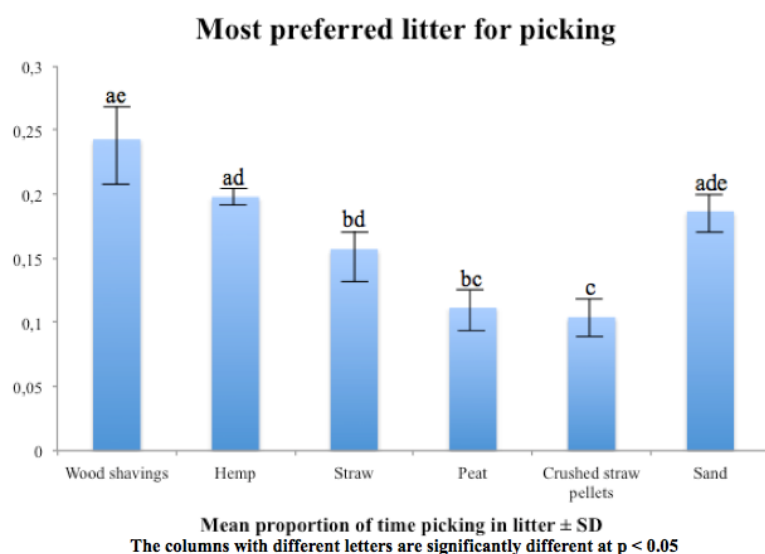


Figure 13. The mean proportions of time when chicks observed in litter when picking.

There was an overall significant effect of litter type ($F = 9.86$, $df 5,35$, $P = 0.0001$) with most picking being performed in wood shavings, hemp and sand. Wood shavings were picked in more than straw ($F = 7.84$, $df 1,11$, $P = 0.0188$) peat ($F = 22.04$, $df 1,11$, $P = 0.0008$) and crushed straw pellets ($F = 26.42$, $df 1,11$, $P = 0.0004$). Hemp was preferred over peat ($F = 33.60$, $df 1,11$, $P = 0.0002$) and crushed straw pellets ($F = 52.57$, $df 1,11$, $P = < 0.0001$). Sand was used more than peat ($F = 9.00$, $df 1,11$, $P = 0.0331$) and crushed straw pellets ($F = 1.99$, $df 1,11$, $P = 0.0063$). Straw was more preferred for picking than crushed straw pellets as well ($F = 6.10$, $df 1,11$, $P = 0.0331$).

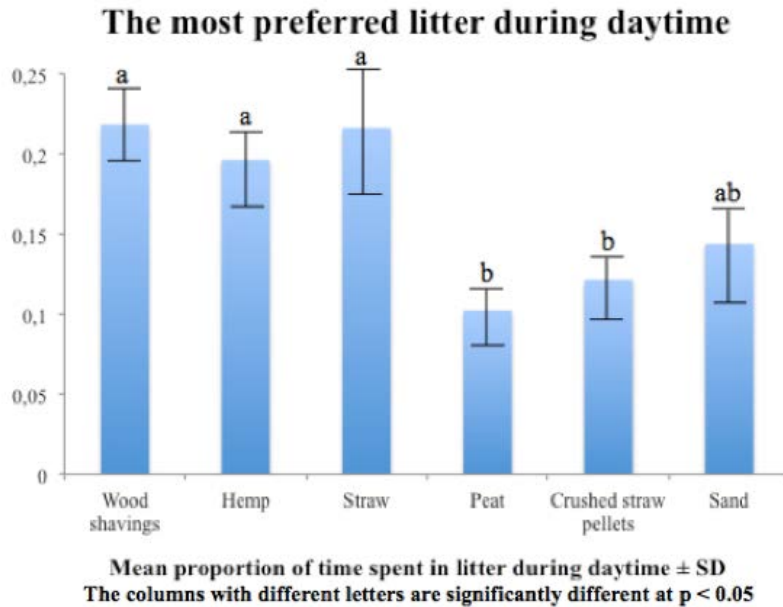


Figure 14. The mean proportions of time when chicks were observed in litter during daytime

There was an overall significant effect of the type of litter on the time spent in that litter during daytime ($F = 5.48$, $df 5,35$, $P = 0.0011$). The chicks spent significantly more time in wood shavings than in peat ($F = 22.81$, $df 1,11$, $P = 0.0008$) and in crushed straw pellets ($F = 13.63$, $df 1,11$, $P = 0.0042$). Hemp was preferred over peat ($F = 15.06$, $df 1,11$, $P = 0.0031$) and over crushed straw pellets ($F = 8.19$, $df 1,11$, $P = 0.0169$). The chicks spent significantly more time in straw than in peat ($F = 12.04$, $df 1,11$, $P = 0.0060$) and crushed straw pellets ($F = 7.66$, $df 1,11$, $P = 0.0199$).

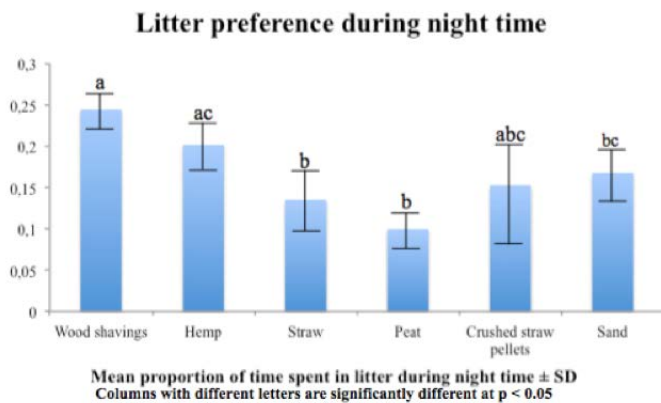


Figure 15. The mean proportions of time when chicks were observed in litter during night time.

The overall result of litter preferences during night time ($F = 3.03$, $df 5,35$, $P = 0.0247$) showed that the chicks spent most time in wood shavings, hemp and crushed straw pellets during night time. Wood shavings were preferred over straw ($F = 10.31$, $df 1,11$, $P = 0.0093$), peat ($F = 29.30$, $df 1,11$, $P = 0.0003$) and sand ($F = 5.97$, $df 1,11$, $P = 0.0346$). Hemp was significantly more used than peat ($F = 12.23$, $df 1,11$, $P = 0.0057$).

Result of perch preferences

The first chicks observed on the elevated perches was when they were five days of age, the same day the perches was elevated from the ground. Although they were seen on them when they were on the floor. On average the chicks spent 0.034 proportion of their time preening on perches and 0.051 proportion of their time sleeping on perches, which gives a total of 0.085 proportion of their time spent performing the behaviours above. The remaining time was spent, for example, moving/standing or picking on perches.

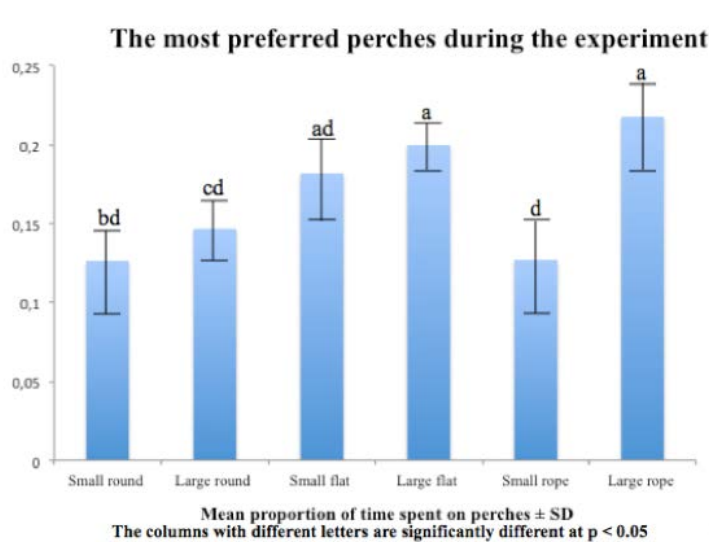
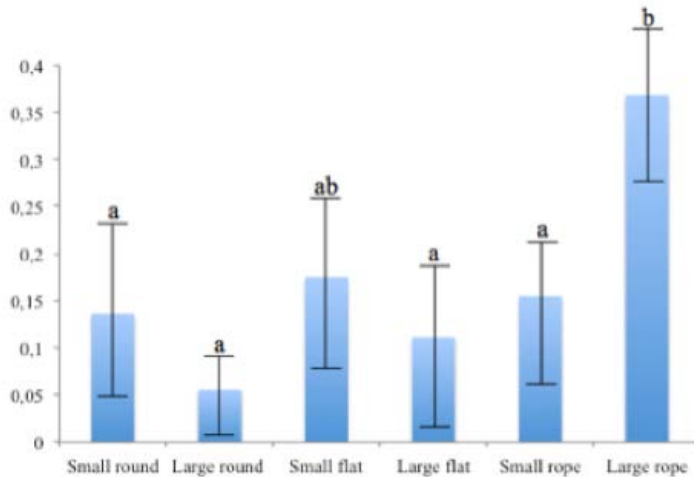


Figure 16. The mean proportions of time when chicks were observed on the perches during both night time and daytime.

There was an overall significant effect of perch type ($F = 3,72$, $df 3,35$, $P = 0.0098$) with a preference for the large rope, the large flat and the small flat perch. The large rope was preferred over the small round perch ($F = 8.26$, $df 1,11$, $P = 0.0166$), the large round ($F = 7.08$, $df 1,11$, $P = 0.0239$) and the small rope ($F = 7.88$, $df 1,11$, $P = 0.0186$). The large flat perch was preferred over the small round ($F = 8.71$, $df 1,11$, $P = 0.0145$), the large round ($F = 8.79$, $df 1,11$, $P = 0.0142$) and the small rope ($F = 8.13$, $df 1,11$, $P = 0.0172$).

Perch preferences during week one

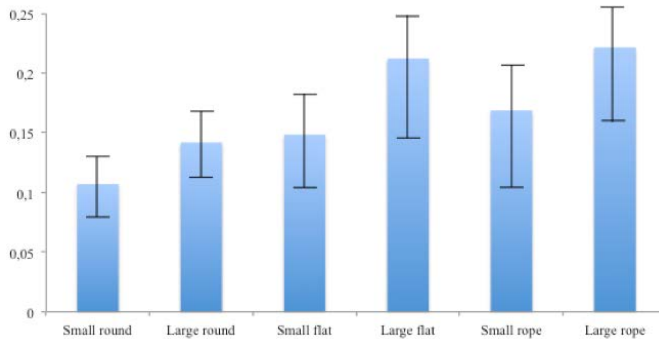


Mean proportion of time on different perches during week one \pm SD
The columns with different letters are significantly different at $p < 0.05$

Figure 17. The mean proportions of time when chicks were observed on different perches during week one.

The overall result showed an effect of perch type during week one ($F = 2.70$, $df 5,35$, $P = 0.004$). The large rope was used most often. The large rope was significantly preferred over the large round ($F = 16.92$, $df 1,11$, $P = 0.0021$), the small rope ($F = 5.40$, $df 1,11$, $P = 0.0424$) and the small round perch ($F = 5.41$, $df 1,11$, $P = 0.0424$).

Perch preference during week two



Mean proportion of time spent on different perches during week two \pm SD

Figure 18. The mean proportions of time when chicks were observed on different perches during week two.

The result changed when looking at week two. Here there was no overall significant effect of perch type ($F = 1.58$, $df 5,35$, $P = 0.1953$).

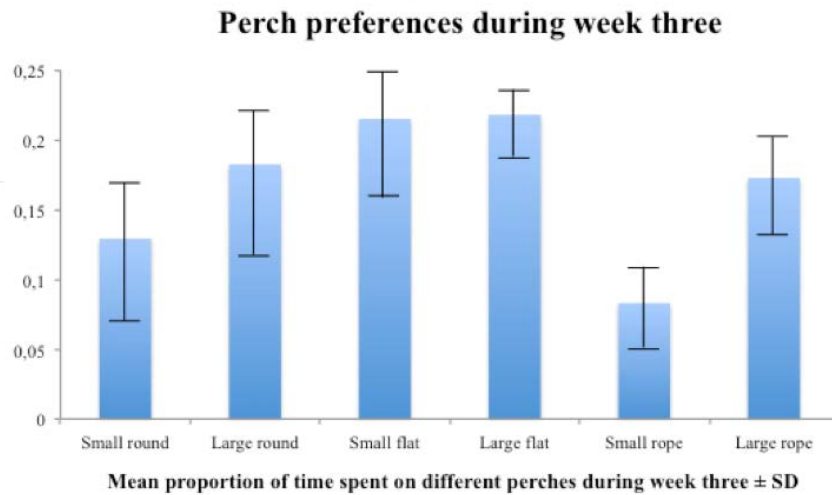


Figure 19. The mean proportions of time when chicks were observed on the different perches during week three.

The result from week three showed a strong tendency for there to be an overall difference between the different perch types ($F = 2,40$, $df 5,35$, $P = 0.06$).

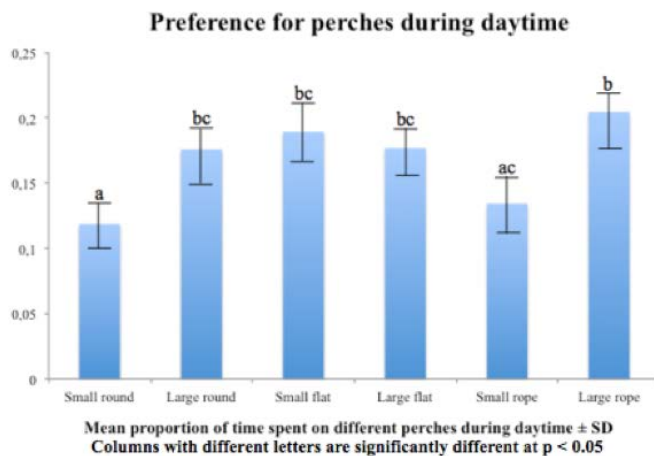


Figure 20. The mean proportions of time when chicks were observed on perches during daytime.

There was an overall significant effect of perch type during the daytime ($F = 3.74$, $df 1,11$, $P = 0.0094$). The large rope was used most often and the small round perch the least often. The large round was preferred over the small round perch ($F = 6.05$, $df 1,11$, $P = 0.0337$). The small flat perch was significantly more used than the small round perch ($F = 8.75$, $df 1,11$, $P = 0.0143$). The large flat perch was used more than the small round perch ($F = 8.69$, $df 1,11$, $P = 0.0146$). The large rope was more preferred than the small round perch ($F = 12.23$, $df 1,11$, $P = 0.0057$) and the small rope ($F = 6.62$, $df 1,11$, $P = 0.0278$).

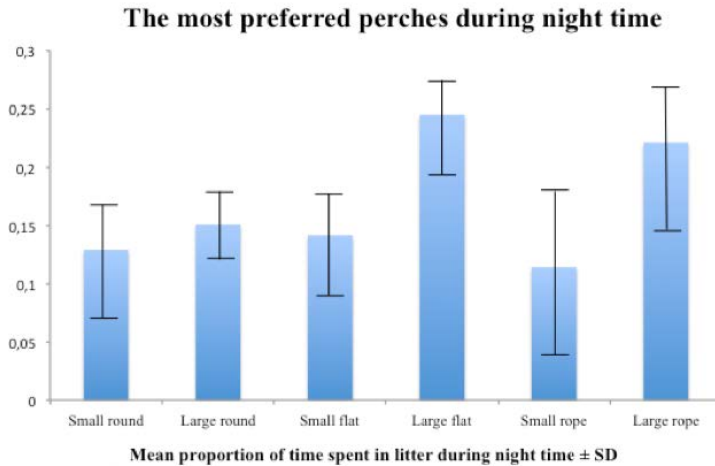


Figure 21. The mean proportions of time when chicks were observed on perches during night time.

The overall result of perch preferences during night time showed no significant difference ($F = 1.54$, $df 5,35$, $P = 0.2063$).

Perch preferences when performing specific behaviours

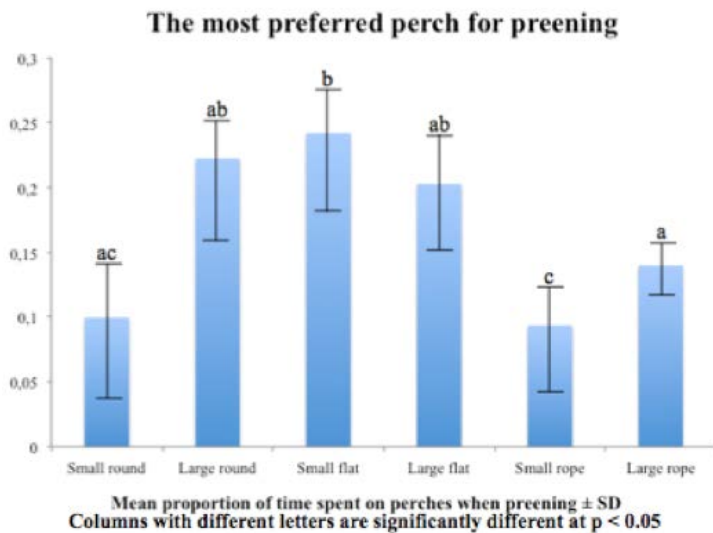


Figure 22. The mean proportions of time when chicks were observed preening on perches.

The overall result of perch preferences for preening showed that there was a significant effect of perch type ($F = 3.411$, $df 5,35$, $P = 0.0148$). The small flat perch was used significantly more than the large rope ($F = 5.51$, $df 1,11$, $P = 0.0409$). The large round was significantly more used than the small rope ($F = 6.58$, $df 1,11$, $P = 0.0281$). The small flat perch was preferred over the small rope ($F = 8.57$, $df 1,11$, $P = 0.0151$) and the large rope ($F = 5.51$, $df 1,11$, $P = 0.0409$). The large flat was more preferred for preening than the small rope ($F = 5.57$, $df 1,11$, $P = 0.0400$).

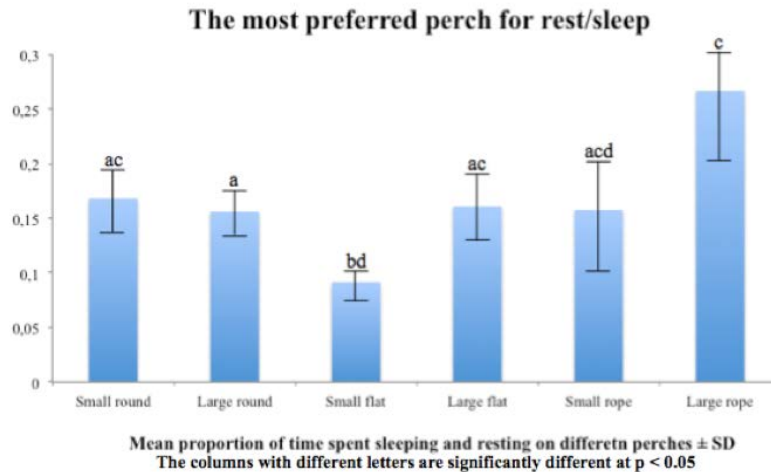


Figure 23. The mean proportions of time when chicks were observed sleeping on perches.

There was an overall significant effect of perch type on the results for perch ($F = 3.98$, $df 1,11$, $P = 0.0069$). The large rope was preferred over the small flat perch ($F = 16.47$, $df 1,11$, $P = 0.0023$) and over the large round ($F = 5.99$, $df 1,11$, $P = 0.0344$). The small flat was the perch that was used the least and the large flat was more preferred ($F = 6.54$, $df 1,11$, $P = 0.0285$), the large round perch ($F = 11.19$, $df 1,11$, $P = 0.0074$) and also the small round perch ($F = 9.03$, $df 1,11$, $P = 0.0132$).

Discussion

The result of this study showed that the chicks preferred different litters depending on what specific behaviour they were going to perform. According to the Swedish legislation SJVFS 2010:15 (Saknr L 100) chapter 6 § 5 requires that laying hens should have constant access to litter that can provide the possibility to perform picking, dustbathing and scratching behaviour. It can be discussed whether it is possible to provide one type of litter that chicks will perform all of these different types of behaviours in, and even if they do perform all different behaviours in the same litter types is it because they want to or because they don't have anything else to choose? The result showed that the chicks' initial perch preferences went away, but that perch preference over the whole period depended on the specific behaviour they were performing on the perches. So should we provide different perches for chicks when they are young and should they have different types of perches so they can choose different perches when going to perform different behaviours?

The result from this study showed that for picking and scratching the chicks preferred wood shavings, hemp and straw over all other litter types and that peat and crushed straw pellets were the two litter types least preferred for many behaviours. Research shows that chicks of the age of nine days preferred peat for picking (Vestergaard & Baranyiová, 1996). One could have thought that peat would have been more preferred for picking in this study because it is organic material and roots can be found in the litter, and therefore there is more to pick at. Though in this study less than one bale of peat was used and during the experiment the peat got drier and drier, this could be a possible reason that the peat was not a litter type preferred for many behaviours.

It is accepted to use feed as litter for chicks during the first three weeks of their life (Jeremiasson, Alexandra, 2017. E-mail 2017.12.07).. Crushed straw pellets could be compared with feed because the colour and the texture are similar, although there would be a big difference in the smell and taste of the feed compared to the crushed straw pellets. In this study the chicks didn't prefer crushed straw pellets for any behaviours at all. A few chicks were observed dustbathing in it and performing other behaviours, but it can be discussed whether it would be better to provide another type or litter, rather than only food, for the chicks during the first three weeks of their life.

Preening, as well as sleeping and resting was preferred to be performed in wood shavings, hemp and straw. I think that these litters were preferred for sleeping and resting because they are soft litter types, and maybe straw even provided a feeling of safety considering it would be possible for the chicks to lay in the straw and be less visible compared with sand for example.

Other studies showed that for dustbathing peat is one of the most preferred litters to use (Wichman & Keeling, 2008; Gerinebreti re *et al.*, 2014). The result from this study showed that they preferred sand and peat for dustbathing. A small proportion of chicks were observed dustbathing in wood shavings and crushed straw pellets but no chicks was ever observed dustbathing in straw or hemp. I think the reason for the preferences here is that for both sand and peat the structure was small and the chicks were able to get the litter in the feathers and their down when dustbathing. The crushed straw pellets and the wood shavings could also get a little dusty, but for the specific behaviour I think sand and peat could provide the structure that the chicks wanted to get, better than any of the other litter types in this experiment.

The perch preference results from this study showed, with all data combined, that the large rope, the small flat and the large flat perch were the most preferred. But if we look at the weeks separately, week one showed a preference for the large rope and the small flat. Week two they showed no preference for specific perch types and week three showed no preference either, but an overall tendency. This does indicate a change in preference for perch types, considering the first week showed a very clear result and the other weeks didn't. A study made by Pickel *et al.*, (2010) showed that both perch material and diameter has an effect on how well hens can keep their balance on perches. Fewer attempts trying to keep balance on the perches were observed on perches with a diameter of 4.5cm compared with perches with a smaller diameter. The animals used in that study were adult hens (Pickel *et al.*, 2010). The large rope and the large flat perch in this study had a width of 4.5 and 6.7cm respectively. I believe the large flat perch was easy to stand on because it was so big and, at least in the beginning of this study the chicks could stand on the large flat perch without needing to grip it with their feet. The large rope was soft and probably easier to grip compared to harder perches. The preference for the large rope could have been affected by the fact that the large rope was hanging a little lower in the middle compared to the wooden perches.

I assume that during week one the chicks in this study learned how to use the perches and developed their balance skills, and during week two they got better at keeping the balance and they learned how to get up on the more difficult perches. Maybe that is why they had a clear preference during the first week and no preference for week two.

The tendency for week three could indicate that they now were starting to develop a preference again. A fourth week in this study would have been good to see if they would prefer specific perch types then.

For preening the chicks preferred all the different perch types except the small rope. When preening they were sitting with their beak in the wings sometimes and arranging their feathers/down and making movement. Maybe it was too difficult to stay on the small rope while doing this, considering it had a smaller diameter than many of the other perch types and it was also a little unstable and moving when the chicks moved. The most preferred perch types for sleeping and resting was the large rope, small rope, large flat and the small round perch.

A question to be asked is whether the perch and litter changes made the different types more interesting. Did the chicks get tired and bored with the different types when they have had them in the same place for two days, and when the change was done, did they get more interested again because the perches and litter changed places? It is possible that this could have had an effect and that the changes worked as an environmental enrichment, but it is difficult to say.

Limitations and future research

For future research it could be interesting to do a similar project but use perches that are used in the industry like steel and plastic perches, and then compare this to soft perches, as used in this study, to see what chicks would prefer. It would also be interesting to use feed and paper as litter types considering it can be used by the industry for young chicks.

The limitation of this study is the duration during which the observations were carried out. Observations were only carried out for the first three weeks of the chicks' life. It would be interesting to have a similar project, but for a longer time, to see if their preferences would change even more than they did here when they get older. With regard to pen design, and for this specific project, a better frame for the litter trays with better buffer zones between the different litter types would have been good. The last week of the study when the chicks were getting older, they mixed the different litters a lot and spread the litter out on the floor as well, which meant a lot more cleaning before the observations could be done.

Conclusion

The conclusion of the preferences is that they chicks did prefer different litter types for performing different behaviours. It also changed, as the chicks grew older. Even the chicks' preferences for perches changed as they grew older and depending what behaviour they wanted to perform on the perches. However, there was no clear result to support the hypothesis suggesting that small chicks would prefer small perches and this would change to larger perches, as they grew older.

Acknowledgement

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