A simple study of the social rank and perch competition of laying hens housed in small furnished cages

Yanan Wang [1], Xiang Li [1], Runxiang Zhang [1], Jianhong Li [2], Jun Bao [1, *]
1 College of Animal Science and Technology, Northeast Agricultural University
2 College of Life Science, Northeast Agricultural University

Abstract

Social animals form social hierarchies to maintain the relative stability of the population. Individuals with high social rank can, to some extent, limit the priority of individuals with lower social status to obtain resources, such as food, habitat and spouse. The perch behavior is the instinctive behavior of laying hens. Hens have the motivation to choose perch habitat. The objective of this study was to examine the social order of small groups of the laying hens housed in furnished cages and to determine the dominant and subordinate hens how to use the limited perch resources.

Results

1.The results of the social ranking perch group on the utilization perch of laying hens

Table 1 The number of use perch in IP group

Social order	Use number						
	1pi	2pi	3pi	4pi	5pi	6pi	P
1	12.6±4.6^{cd}	12.1±5.3^{cd}	13.6±3.4b^{cd}	14.1±3.3ab^{cd}	18.3±5.5^{ab}	17.8±2.4^{abc}	0.008
2	6.8±5.7^{fg}	9.1±4.8^{cdefg}	13.2±6.6^{bcd}	10.9±3.0^{bcdefg}	15.9±7.2^{abc}	19.7±6.3^{ab}	< 0.01
3	3.8±5.1^{fgh}	4.4±3.4^{gh}	8.8±4.8^{cdefg}	12.2±8.0^{bcdefg}	14.4±5.7^{bcd}	19.9±3.9^{ab}	< 0.01
4	0.6±0.9^{gh}	1.6±2.1^{gh}	5.7±5.9^{defgh}	9.3±4.6^{fgh}	16.1±9.0^{abc}	16.8±4.2^{ab}	< 0.01
5	0^{h}	0.2±0.4^{gh}	0.6±1.1^{gh}	2.6±3.7^{fgh}	5.3±8.4^{defg}	7.6±6.8^{defg}	0.004
6	0^{h}	0^{gh}	2.1±2.8^{gefgh}	3.0±3.1^{fgh}	7.1±7.4^{defg}	9.9±7.5^{defg}	< 0.01
P	< 0.01	< 0.01	< 0.01	< 0.01	0.001	< 0.01	0.078

The results in Table 1 show that with the increase of the length of perch, the number of use of perch increased significantly ($P < 0.01$); the higher the social rank of individuals, the more the number of use of perch increased significantly ($P < 0.01$).

Table 2 The use time of perch in IP group

Social order	Use time (min)						
	1pi	2pi	3pi	4pi	5pi	6pi	P
1	275.33±181.81^{A}	184.67±109.66^{ABC}	205.22±114.46^{A}	193.56±59.14^{A}	292.78±145.9^{AB}	276.78±60.43^{A}	0.217
2	110.89±87.54^{C}	223.89±180.31^{A}	121.67±66.66^{BC}	194.11±70.38^{A}	363.44±169.45^{A}	271.67±59.27^{A}	0.217
3	155.89±304.28^{ABC}	210.44±376.36^{A}	111.44±90.92^{BC}	219.44±167.9^{A}	204.22±85.23^{ABC}	228.33±44.51^{BC}	0.842
4	12±23.69^{BC}	12.33±18.66^{DE}	96.22±100.88^{BC}	202±62.90^{AB}	236±105.37^{ABCD}	260.11±64.93^{ABC}	< 0.01
5	0±0^{C}	22.78±67.96^{DE}	34.44±99.64^{C}	65.11±121.84^{B}	81.89±111.38^{E}	135.44±108.6^{C}	0.053
6	0±0^{C}	0±0^{E}	52.89±104.11^{BC}	47±60.41^{BCD}	124.22±140.75^{BCDE}	173±160.49^{ABC}	0.002
P	0.001	0.013	0.01	0.01	< 0.01	0.008	0.121

Table 2 shows that has a significant impact on the use time of perch ($P < 0.01$), and the length of perch has a significant impact on the use time of perch ($P < 0.01$).

Table 3 The single use time of perch in IP group

Social order	Single use time (min)						
	1pi	2pi	3pi	4pi	5pi	6pi	P
1	22.16±12.88	16.39±4.82	15.01±6.7	13.62±3.04	17.1±8.01	15.55±0.5	0.763
2	20.46±10.66	27.55±17.63	13.69±13.24	18.73±5.21	26.52±17.83	14.39±5.26	0.675
3	33.72±24.56	66.03±93.53	17.02±13.84	21.08±15.34	14.18±4.99	11.67±2.31	0.588
4	21.6±0	6.08±3.65	17.49±5.28	27.34±16.47	18.52±10.53	16.09±6.52	0.463
5	0	102.5±143.54	62±0	14.18±19.34	15.97±0.99	29.2±22.06	0.661
6	0	0	15.1±17.82	14.68±5.2	15.7±5.71	33.66±43.43	0.841
P	0.779	0.594	0.096	0.751	0.751	0.702	0.845

Table 3 shows that there is no significant effect of social rank and perch change on single perch use time ($P > 0.05$)

2.The results of the social order of the decreasing perch group on the utilization perch of laying hens

Table 4 The number of use perch in DP group

Social order	Use number						
	6dp	5dp	4dp	3dp	2dp	1dp	P
1	17.56±8.97^{abc}	17.11±4.94^{abc}	16.22±4.6^{abc}	18±3.81^{abc}	10±3.5^{bc}	12.56±4.72^{bc}	0.014
2	18.44±5.59^{abc}	15.89±5.09^{abcd}	13.89±4.83^{bcde}	11.78±4.44^{bcde}	9.89±3.37^{cde}	9.33±3.28^{de}	< 0.01
3	6.33±3.84^{fgh}	12.78±4.32^{cdef}	12.56±3.4^{def}	13±3.28^{def}	6.33±1.58^{efg}	9.89±2.57^{de}	< 0.01
4	9.89±2.93^{def}	11.56±3.24^{def}	10.11±4.08^{ef}	8.33±3.16^{defg}	5.56±4.45^{efg}	4.22±1.39^{fgh}	< 0.01
5	15.78±6.61^{abc}	12.78±7.34^{abcd}	11.22±7.63^{def}	7.22±6.42^{defg}	3.22±2.05^{efgh}	2.33±1.87^{efgh}	< 0.01
6	3.67±3.04^{fg}	4.22±4.15^{fg}	3.78±2.77^{fg}	2.33±1.8^{fg}	2.11±1.83^{fg}	2.33±2.35^{fg}	0.441
P	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Table 4 shows that the higher the individual's social level is the more the total number of uses of perch will increase; at the same time, with the decrease of the length of perch, the number of uses of perch will decrease correspondingly for individuals of each social level.

Table 5 The use time of perch in DP group

Social order	Use time (min)						
	6dp	5dp	4dp	3dp	2dp	1dp	P
1	206.56±118.49^{ab}	190.78±76.98^{ab}	215±58.32^{ab}	254.22±207.55^{a}	137.11±33.26^{ab}	183.56±98.82^{ab}	0.402
2	204.44±83.29^{abc}	183.11±38.26^{ab}	204.67±48.3^{ab}	116.67±71.37^{bc}	161.56±44.26^{abcd}	137.44±38.45^{abcd}	0.007
3	114.89±72.99^{bcdefg}	155.56±88.57^{abc}	175.56±44.28^{abcd}	195.44±92.44^{abcd}	72.11±31.32^{defg}	100.89±45.89^{cdefg}	0.002
4	103±60.97^{bcdefg}	142.56±50.68^{abcd}	181.11±43.37^{abcd}	133±49.19^{bcdefg}	68.89±42.54^{efg}	111±45.21^{bcdefg}	< 0.01
5	215.11±35.4^{ab}	149.89±83.33^{bcd}	140.56±26.4^{bcdefg}	89.11±80.53^{defg}	62.44±54.19^{fg}	85.89±68.39^{defg}	< 0.01
6	155.56±145.42^{bcdefg}	88.56±84.81^{cdefg}	70.22±42.1^{fg}	83.89±76.05^{efg}	64.44±74.99^{fg}	41.22±55.85^{fg}	0.126
P	0.042	0.066	< 0.01	0.011	< 0.01	0.001	0.01

Table 5 shows that the total use time of perch decreases with the decrease of the length of perch ($P < 0.01$), and the use time of perch increases with the increase of ($P < 0.01$).

Table 6 The single use time of perch in DP group

Social order	Single use time (min)						
	6dp	5dp	4dp	3dp	2dp	1dp	P
1	11.21±4.94	10.94±4.16	13.14±1.83	13.89±5.03	14.43±3.78	15.29±10.53	0.913
2	11.97±5.96	11.77±1.54	14.9±2.07	11.78±7.24	17.02±3.11	15.55±3.32	0.56
3	21.92±16.68	14.74±10.41	13.96±2.97	15.65±5.41	11.41±3.29	10.53±3.91	0.664
4	11.95±8.8	12.8±5.08	18.74±3.22	17.47±8.23	20.02±12.63	27.38±9.11	0.316
5	15.73±6.85	12.01±1.57	23.81±26.73	11.65±1.98	18.62±6.42	34.41±21.58	0.431
6	31.44±21.26	26.41±24.34	24.8±12.68	54.28±34.58	28.07±13.22	15.13±15.04	0.521
P	0.346	0.516	0.758	0.032	0.327	0.217	0.356

Table 6 shows that the change of perch has no significant effect on the single use time of perch in daytime ($P = 0.753$).

3.The results of the social rank of the control group on the utilization perch of laying hens

Table 7 Perch usage counter, single use time and use time in C group

Social order	Use time	Usage counter	Single use time
1	101.2±69.27^{b}	9.79±6.87	17.64±11.54
2	111.67±79.73^{b}	8.07±5.21	11.81±4.58
3	125.67±94.36^{b}	8±7.04	17.52±7.28
4	164.6±73.76^{ab}	12.14±5.56	16.16±8.86
5	121.53±101.98^{b}	9±8.36	23.38±15.5
6	192.47±70.71^{a}	13.29±6.22	16.45±6.5
P	0.026	0.187	0.814

Ttable 7 shows that when the availability of perch length was enough for all birds, no significant difference was found in perch use counter ($P = 0.187$)and single use time ($P=0.814$) among different individuals while the total use time was found to be significant among the social ranked individuals ($P=0.026$).

4.The correlation analysis of social rank and perch use in group C, IP and DP

Table 8 Analysis of the correlation of social rank and perch use in group C, IP and DP

Treatment groups	Indicators	Usage counter	Use time	Single use time
C	Ranks	.216	.377*	.154
	Perch changes (C)	/c	/c	/c
IP	Ranks	-.543**	-.435**	.132
	Perch changes (ip)	.516**	.325**	-.161
DP	Ranks	-.575**	-.392**	.396**
	Perch changes (dp)	-.345**	-.260**	.099

The results of Table 8 shows that when the length of perch is contant, the social rank is correlated with the use time of perch($P < 0.05$); when the length of perch increases, the times and total time of perch use are negatively related to the social level but positively related to the increase of perch ($P < 0.01$), and the social level and the increase of perch are not related to the time of single use.

Conclusions

Through our experimental setup, the the superior in the perch change group take priority in occupying the priority resources; the perch usage counter of three parameters we set is positively related to the social rank of hens.

Acknowledgments

This work was supported by the National Natural Science Foundation of China (Grant No. 31672466 and 31501992) .