JOURNAL OF ADVANCED VETERINARY AND ANIMAL RESEARCH
ISSN 2311-7710 (Electronic)
http://doi.org/10.5455/javar.2020.g444
A periodical of the Network for the Veterinarians of Bangladesh (BDvetNET)

September 2020
VOL 7, NO. 3, PAGES 477–481

SHORT COMMUNICATION

The effect of facial hair whorl position and raising environment on the temperament of the Chinese Yellow cattle in Shinjang Uyghur Aptonom Rayoni, China

Sarengaowa Aierqing, Akiko Nakagawa, Yoshimitsu Ouchi, Takashi Bungo
Laboratory of Animal Behavior and Physiology, Graduate School of Integrated Sciences for Life, Hiroshima University, Hiroshima, Japan

ABSTRACT

Objective: The objective of this study is to determine whether there is a relationship between hair whorl position and temperament in Chinese Yellow cattle using a questionnaire. Also, the effect of the raising environment is investigated.

Materials and methods: A total of 122 Chinese Yellow cattle were surveyed in 3 village areas and four grassland areas in the northern area of China. For each cattle, an investigator asked the care-person about each item of a temperament questionnaire and determined the facial hair whorl position of each cattle. The location of hair whorl was categorized as low, middle, or high in relation to the eyes.

Results: The overall distribution was 20.5% high, 58.2% middle, 13.1% low, 6.6% double, and 1.6% no hair whorl. There was no significant difference between the grassland and village area cattle in the distribution of whorl position. The scores of grassland areas were significantly higher than those of village areas in terms of "Retentive memory", "Sensitivity," and "Timidity" and lower in "Docility" and "Fortitude." The scores for the high position tended to be higher than those for the middle plus low positions in terms of "Adaptability" and "Obedience." On the other hand, there was a tendency for a score for the high position to be lower than the other positions in "Excitability." A significant interaction between area and whorl position was observed in "Friendliness to cattle."

Conclusion: These findings suggest that hair whorl location may be useful in predicting the temperament in cattle, but temperament can be influenced by environment and/or handlings.

ARTICLE HISTORY

Received May 25, 2020
Revised June 19, 2020
Accepted July 11, 2020
Published August 22, 2020

KEYWORDS

Temperament; questionnaire; hair whorl, environment; Chinese Yellow cattle.

Introduction

Temperament is an essential factor in selecting livestock. There must be an interaction between farm animals and their care-person; the animal–human relationship is particularly important in animal production. As well as handling by the care-person, the temperament of the animals strongly influences the interaction. There are several studies about the effect of interaction on the safety and quality of animal handling [1–3]. In the case of cattle, they are easily fearful of or irritated by the care-person, and consequently are hard to control during routine work [4]. It is necessary to exploit easy ways to select animals for submissiveness because it is challenging to deal with animals that have an aggressive or excitable temperament. Horse trainers have noted the position of round hair whorls (trichoglyphs) on the forehead of horses, and researchers have reported that hair whorl position can be used to foretell the behavior of a horse during training [5,6]. Similar to horses, some investigations suggest the relationship between temperament and position of facial hair whorl in cattle [7–13]. Environmental factors also affect how cattle act during treatment. Cattle with a timid temperament may be more fearful and uncontrollable by a care-person when encountering a novel situation. On the contrary, animals with an unagitated temperament may grow accustomed to a new environment and handling [14]. Therefore, it is essential to investigate what kind of temperament is influenced by environmental factors.

Chinese Yellow cattle is a major cattle breed and can be classified into three types (South China, Central China, and

Correspondence Takashi Bungo ✉ bungo@hiroshima-u.ac.jp 🏢 Laboratory of Animal Behavior and Physiology, Graduate School of Integrated Sciences for Life, Hiroshima University, Hiroshima, Japan.

How to cite: Aierqing S, Nakagawa A, Ouchi Y, Bungo T. The effect of facial hair whorl position and raising environment on the temperament of the Chinese Yellow cattle in Shinjang Uyghur Aptonom Rayoni, China. J Adv Vet Anim Res 2020; 7(3):477–481.

North China types) [15,16]. They contribute to not only beef production but also the improvement of meat quality in China [17]. However, little is known about the temperament of Chinese Yellow cattle. The objective of the present study is to determine whether there is a relationship between temperament and position of facial hair whorl in cattle using a questionnaire. Hair whorl position could then possibly be used to foretell future temperament traits in cattle. Besides, the effect of the raising environment is investigated.

Materials and Methods

The survey was conducted at 7 locations (3 village areas and 4 grassland areas) in Qobuy-a Sairi-yin Moŋyol öbertegen Jasaqu Siyan, Shinjang Uyghur Aptonom Rayoni, China (Fig. 1; Table 1).

A total of 122 Chinese Yellow cattle were used in this survey: 9 heifers, 20 primiparae, and 93 multiparae (Table 1). Cattle in the village areas were reared in nearby pastures in the daytime and kept in their barn at night. In the grassland areas, they were raised fulltime in the prairie away from the village areas. It was assumed that there were few genetic differences between the cattle at the two locations because the owners of the cattle at both locations buy and sell their cattle from and to each other.

The questionnaire was designed to measure the personality of the cattle in general (Table 2). The questionnaire was modified from the one used for horses by Momozawa et al. [18]. For each cattle, the investigator conducting the survey asked the care-person about each item of the questionnaire and evaluated the responses to approaching or touching the cattle. The evaluations were made on a five-point scale ranging from one to five (Table 2).

The hair whorl position of each animal was recorded by the investigator, who took facial photographs at approximately 0.5 m above the face. The investigator and another person then collated the records with the photographs and classified the position of the whorl individually. The hair whorl position was categorized as low, middle, or high about the eyes, according to the classification in previous studies [7,19]. In brief, the center of the whorl was used as the reference point. An individual with a whorl above the eyes was classified as high, an individual with a whorl between the eyes was classified as middle, and an individual with a whorl below the eyes was classified as low. Ten cattle had double whorls (n = 2) or no whorl (n = 8), so they were excluded from the present study (Table 3).

Figure 1. The survey location in China (Qobuy-a Sairi-yin Moŋyol obertegen jasaqu siyan, Shinjang Uyghur Aptonom Rayoni).

Table 1. Distribution of calving number in the surveyed Chinese Yellow cattle.

Location	Calving number		
	0	1	≥2
Grassland	3	10	53
Village	6	10	40
Total	9	20	93

Table 2. Questionnaire items.

	Item	1	⇔	5
Q1	Nervousness	calm	⇔	nervous
Q2	Independence	never	⇔	always
Q3	Adaptability	poor	⇔	excellent
Q4	Excitability	never	⇔	always
Q5	Friendliness (to people)	unfriendly	⇔	friendly
Q6	Curiosity	rarely	⇔	frequently
Q7	Retentive memory	poor	⇔	excellent
Q8	Fearfulness	never	⇔	always
Q9	Docility	never	⇔	always
Q10	Inconsistent emotionality	consistent	⇔	inconsistent
Q11	Obedience	poor	⇔	excellent
Q12	Sensitivity (vigilance)	never	⇔	always
Q13	Fortitude	poor	⇔	excellent
Q14	Friendliness (to cattle)	unfriendly	⇔	friendly
Q15	Timidity	never	⇔	always

Table 3. Distribution of hair whorl patterns in the surveyed Chinese Yellow cattle.

Location	Hair whorl position				
	High	Middle	Low	(double)	(none)
Grassland	12	37	11	1^{W}	5^{Y}
Village	13	34	5	1^{X}	3^{Z}
Total	25	71	16	2	8

W = a primipara; X = a heifer; Y = five multiparae; Z = a heifer and two multiparae.

Consequently, the surveyed cattle consisted of 7 heifers, 19 primiparae, and 86 multiparae.

The data were analyzed using the commercially available package, StatView (Version 5, SAS Institute, Cary, NC, 1998). A chi-square test was used to analyze the area differences in the distribution of the hair whorl patterns. Logarithmic and square root transformations were applied for skewed distributions of parameters for the questionnaire. Data were analyzed using two-way analysis of variance (ANOVA) with respect to the effects of whorl position and raising environment. When a significant interaction was detected, a post-hoc test was conducted using the Steel–Dwass test. A high whorl position was compared with the middle + low position, according to the suggestion by Grandin et al. [7]. The level of significance was set at $p < 0.05$ and $p < 0.1$ for a trend.

Results and Discussion

The distribution of hair whorl patterns in the surveyed Chinese Yellow cattle is shown in Table 3. The overall distribution was as follows: 20.5% high, 58.2% middle, 13.1% low, 6.6% double, and 1.6% no hair whorl. There was no significant difference between the grassland and village area cattle in the distribution of whorl position ($\chi^2 = 2.11$, n.s.). A report on Holstein cattle with a single whorl showed 10.0% high, 39.0% middle, and 51.0% low hair whorl [9], and a report on Angus cattle with a whorl showed 8.2% high, 36.7% middle, and 25.8% low [12]. There was a similar report that showed 26% of the cattle had low hair whorls, 54% had middle whorls, and 18% had high whorls [19]; this finding was the lowest percentage of cattle with a low hair whorl, compared with the results in other reports (25.8%–51.0%) [7–13]. Also, the percentage of cattle with a high hair whorl was relatively higher than that in other reports (8.2%–13.2%) [8–13]. Notable variations in the positioning of the hair whorls on the head of Chinese Yellow cattle were identified, and there appeared to be breed differences in whorl distribution.

Table 4 shows the relationship between hair whorl position and temperament in the Chinese Yellow cattle. The results of two-way ANOVA showed that there were no significant differences in four of the fifteen questions ("Independence," "Friendliness to people", "Fearfulness," and "Inconsistent emotionality") ($p > 0.1$). There were significant differences between areas in five questions relating to raising the environment. Namely, the scores of the grassland areas were significantly higher than those of the village areas in terms of "Retentive memory", "Sensitivity," and "Timidity" ($p < 0.05$, $p < 0.05$, $p < 0.001$, respectively) and lower in "Docility" and "Fortitude" ($p < 0.05$, $p < 0.01$, respectively). Additionally, the score for "Nervousness" tended to be lower for the village areas than for the grassland areas ($p < 0.1$). Generally, the temperament in animals is affected by the rearing environment and also handling. According to Franz [20], social conditions can change exploration and orient in open-field tests. Bunger and Kaphengst [21] also found that, in an open-field arena, locomotor behavior in calves was significantly affected by the rearing environment. The present findings showed that cattle in the grassland areas seemed to be more nervous and cautious than those in the village areas (Table 4).

Table 4. Relationship between hair whorl position and temperament in Chinese Yellow cattle.

Item	Grassland		Village		*p*-value		
	High	Md/Lw	High	Md/Lw	Site	Whorl	Interaction
Nervousness	2.7 ± 0.43	2.8 ± 0.18	2.1 ± 0.33	2.3 ± 0.20	0.063	0.450	0.989
Independence	2.3 ± 0.35	2.3 ± 0.17	2.2 ± 0.32	2.4 ± 0.22	0.863	0.660	0.731
Adaptability	3.8 ± 0.22	3.7 ± 0.12	4.2 ± 0.12	3.7 ± 0.16	0.326	0.099	0.214
Excitability	2.4 ± 0.34	2.8 ± 0.16	2.2 ± 0.32	2.5 ± 0.16	0.302	0.089	0.932
Friendliness to people	3.8 ± 0.34	3.6 ± 0.17	3.8 ± 0.32	3.8 ± 0.19	0.603	0.572	0.784
Curiosity	2.3 ± 0.31	3.1 ± 0.16	2.6 ± 0.21	2.6 ± 0.14	0.932	0.125	0.091
Retentive memory	4.1 ± 0.31	3.8 ± 0.12	3.5 ± 0.18	3.4 ± 0.14	0.037	0.418	0.784
Fearfulness	2.4 ± 0.38	2.9 ± 0.18	2.8 ± 0.32	2.6 ± 0.16	0.694	0.535	0.197
Docility	3.3 ± 0.36	3.5 ± 0.16	4.3 ± 0.17	3.7 ± 0.18	0.034	0.441	0.119
Inc. emotionality	2.4 ± 0.36	2.6 ± 0.17	2.1 ± 0.35	2.5 ± 0.18	0.352	0.168	0.536
Obedience	3.9 ± 0.36	3.3 ± 0.18	4.1 ± 0.24	3.6 ± 0.20	0.355	0.076	0.954
Sensitivity (vigilance)	3.3 ± 0.28	3.4 ± 0.15	2.8 ± 0.32	2.8 ± 0.19	0.027	0.893	0.946
Fortitude	2.5 ± 0.36	2.5 ± 0.17	3.4 ± 0.27	3.3 ± 0.20	0.002	0.637	0.810
Friendliness to cattle	2.8 ± 0.45a	3.3 ± 0.22a	4.7 ± 0.13b	3.6 ± 0.21a	<0.001	0.558	0.021
Timidity	3.3 ± 0.38	3.0 ± 0.17	2.2 ± 0.32	2.3 ± 0.16	<0.001	0.924	0.429

Md = Middle; Lw = low.
Values are means ± SEM.

It is reasonable to consider that cattle in a village may grow accustomed to various stimulations and become insensible because there are many stressors (bustle) in the rearing environment of a village.

In terms of the effect of whorl positions, the scores for high position tended to be higher than those for the middle plus low positions in "Adaptability" and "Obedience" ($p < 0.1$). On the other hand, there was a tendency for the score of high position to be lower than other positions in "Excitability" ($p < 0.1$). In terms of the relationship between environment and whorl positions, a significant interaction between area and whorl position was observed in "Friendliness to cattle" ($p < 0.05$), and a significant area effect was also detected ($p < 0.001$). Besides, the score for the high position for cattle in the village areas was significantly higher than the other positions. For "Curiosity", a tendency in interaction (area × whorl position) was detected ($p < 0.1$).

The facial whorl position of cattle is associated with temperament and behavior [7,8,19] and maybe of value in selective breeding for a calm temperament [22]. The present results indicated that cattle with facial hair whorls located above the eyes tended to be more adaptable and obedient, and less excitable in the questionnaire scales (Table 4). There was a similar report that Holstein bulls with high-placed whorls were more behaviorally restless in the crush as measured on an ordinal rating scale [9,23]. Therefore, hair whorl location could be used to predict the temperament during routine management in frequently handled cattle.

Temperament prediction using whorl positions in cattle, however, was affected by the effect of the environment (Table 4). Although a post-hoc analysis did not indicate a significant difference between groups in terms of "Curiosity," it is likely that the cattle with middle and low hair whorls were more curious than the ones with high hair whorls in the grassland areas. It seemed that the environment of the grassland areas with various stimulations might influence the cattle, which became easily excited because, as mentioned earlier, cattle with facial hair whorls located above the eyes seemed to be more excitable. On the other hand, cattle with high facial hair whorls were friendly with other cattle. Although unclear, these results indicate that temperaments are easily affected by the environment and handling [24,25].

Conclusion

The current study suggests that hair whorl location may be useful in predicting the temperament in cattle, but temperament can be influenced by environment and/or handling.

Acknowledgment

This work was partially supported by a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (No. 17K08064).

Conflict of interest

The authors declare that they have no conflict of interest.

Authors' contributions

Sarengaowa Aierqing collected the data with field observation, analyzed the data, and drafted the manuscript. Akiko Nakagawa designed the questionnaire and analyzed the partial data. Yoshimitsu Ouchi performed the statistical analysis. Takashi Bungo designed the study, interpreted the data, and reviewed and improved the manuscript.

References

[1] Kling-Eveillard F, Allain C, Boivin X, Courboulay V, Créach P, Philibert A, et al. Farmers' representations of the effects of precision livestock farming on human-animal relationships. Livest Sci 2020; 238:104757; https://doi.org/10.1016/j.livsci.2020.104057

[2] Napolitano F, Serrapica F, Braghieri A, Masucci F, Sabia E, Rosa GD. Human-animal interactions in dairy buffalo farms. Animals 2019; 9:246; https://doi.org/10.3390/ani9050246

[3] Takeda K, Uchida H, Inoue K. Genetic relationships between temperament of calves at auction and carcass traits in Japanese Black cattle. Anim Sci J 2017; 88:1475–81; https://doi.org/10.1111/asj.12787

[4] Breuer K, Hemsworth PH, Barnett JL, Matthews LR, Coleman GJ. Behavioural response to humans and the productivity of commercial dairy cows. Appl Anim Behav Sci 2000; 66:273–88; https://doi.org/10.1016/S0168-1591(99)00097-0

[5] Shivley C, Grandin T, Deesing M. Behavioral laterality and facial hair whorls in horses. J Equine Vet Sci 2016; 44:62–6; https://doi.org/10.1016/j.jevs.2016.02.238

[6] Górecka A, Golonka M, Chruszczewski M, Jezierski T. A note on behaviour and heart rate in horses differing in facial hair whorl. Appl Anim Behav Sci 2007; 105:244–8; https://doi.org/10.1016/j.applanim.2006.05.013

[7] Grandin T, Deesing MJ, Struthers JJ, Swinker AM. Cattle with hair whorl patterns above the eyes are more behaviorally agitated during restraint. Appl Anim Behav Sci 1995; 46:117–23; https://doi.org/10.1016/0168-1591(95)00638-9

[8] Lanier JL, Grandin T, Green RD, Avery D, McGee K. A note on hair whorl position and cattle temperament in the auction ring. Appl Anim Behav Sci 2001; 73:93–101; https://doi.org/10.1016/S0168-1591(01)00132-0

[9] Evans RD, Grandin T, DeJarnette JM, Deesing M, Garrick DJ. Phenotypic relationships between hair whorl characteristics and spermatozoal attributes in Holstein bulls. Anim Reprod Sci 2005; 85:95–103; https://doi.org/10.1016/j.anireprosci.2004.03.004

[10] Olmos G, Turner SP. The relationships between temperament during routine handling tasks, weight gain and facial hair whorl position in frequently handled beef cattle. Appl Anim Behav Sci 2008; 115:25–36; https://doi.org/10.1016/j.applanim.2008.05.001

[11] Broucek J, Kisac P, Mihina S, Hanus A, Uhrincat M, Tancin V. Hair whorls of Holstein Friesian heifers and affects on growth and behaviour. Arch Tierz 2007; 50:374–80; https://doi.org/10.5194/aab-50-374-2007

[12] Flörcke C, Engle TE, Grandin T. Individual differences in calf defence patterns in red Angus beef cows. Appl Anim Behav Sci 2012; 139:203–8; https://doi.org/10.1016/j.applanim.2012.04.001

[13] Flöcrke C, Grandin T. Loss of anti-predator behaviors in cattle and the increased predation losses by wolves in the Northern Rocky Mountains. Open J Anim Sci 2013; 3:248–53; https://doi.org/10.4236/ojas.2013.33037

[14] Grandin T, Deesing MJ. Genetics and animal welfare. In Grandin, T, Deesing, MJ (eds.). Genetics and the behavior of domestic animals. Academic Press, Cambridge, MA, 2014; https://doi.org/10.1016/B978-0-12-394586-0.00012-3

[15] Zhang GX, Wang ZG, Chen WS, Wu CX, Han X, Chang H, et al. Genetic diversity and population structure of indigenous yellow cattle breeds of China using 30 microsatellite markers. Anim Genet 2007; 38:550–9; https://doi.org/10.1111/j.1365-2052.2007.01644.x

[16] Ma J, Li P, Zhao X, Xu H, Wu W, Wang Y, et al. Occurrence and molecular characterization of *Cryptosporidium spp.* and *Enterocytozoon bieneusi* in dairy cattle, beef cattle and water buffaloes in China. Vet Parasitol 2015; 207:220–7; https://doi.org/10.1016/j.vetpar.2014.10.011

[17] Chen Y, Li C, Liu L, Zhou G, Xu X, Gao F. Prediction of yield of retail cuts for native and crossbred Chinese Yellow cattle. Anim Sci J 2007; 78:440–4; https://doi.org/10.1111/j.1740-0929.2007.00459.x

[18] Momozawa Y, Ono T, Sato F, Kikusui T, Takeuchi Y, Mori Y, et al. Assessment of equine temperament by a questionnaire survey to caretakers and evaluation of its reliability by simultaneous behavior test. Appl Anim Behav Sci 2003; 84:127–38; https://doi.org/10.1016/j.applanim.2003.08.001

[19] Randle HD. Facial hair whorl position and temperament in cattle. Appl Anim Behav Sci 1998; 56:139–47; https://doi.org/10.1016/S0168-1591(97)00086-5

[20] Franz H. Methode zur Untersuchung der Lernfähigkeit von Kälbern in Gruppenhaltung und Ergebnisse bei visuellen Differenzierungsaufgaben. Arch Anim Breed 1999; 42:241–54; https://doi.org/10.5194/aab-42-241-1999

[21] Bünger U, Kaphengst P. Zum Verhalten von Tränkkälbern in einer fremdartigen Umwelt. Monatsh Veterianärmed 1987; 42:378–83.

[22] Grandin T. Solving livestock handling problems. Vet Med 1994; 89:989–98.

[23] Kadel MJ, Johnston DJ, Burrow HM, Graser HU, Ferguson DM. Genetics of flight time and other measures of temperament and their value as selection criteria for improving meat quality traits in tropically adapted breeds of beef cattle. Aust J Agric Res 2006; 57:1029–35; https://doi.org/10.1071/AR05082

[24] Petherick JC, Holroyd RG, Doogan VJ, Venus BK. Productivity, carcass and meat quality of lot-fed Bos indicus cross steers grouped according to temperament. Aust J Exp Agric 2002; 42:389–98; https://doi.org/10.1071/EA01084

[25] Probst JK, Neff AS, Leiber F, Kreuzer M, Hilmann E. Gentle touching in early life reduces avoidance distance and slaughter stress in beef cattle. Appl Anim Behav Sci 2012; 139:42–9; https://doi.org/10.1016/j.applanim.2012.03.002