Flight Distance and Avoidance Score in Thoroughbred Foals and Yearlings and the Relationship with Handling Frequency in the Young Ages

Tatsuya MASUDA1, Aya TAKAKURA1 and Shigeki KOBAYASHI1*
1Laboratory of Animal Management Caring Environment, School of Agriculture, Meiji University, Higashimita 1–1–1, Tama-ku, Kawasaki, Kanagawa 214-8571, Japan

Flight and avoidance reactions from human were examined using 168 postweaning Thoroughbred foals in 22 breeding farms. Further 114 yearlings of 168 foals were tested in the following summer. The foal handleings by the stabler were asked in questionnaire. The relationship between the behavioural reactions and the foal handling frequencies was analyzed. The flight reaction was estimated as the distance from the animal to a stranger when the animal began to flight away from his approach. The avoidance scores were set up from (1) (not resistant) to (5) (touch rejection) from human touching. In the stabler questionnaire, handling frequencies of “body brushing”, “rectal temperature measurement”, “hoof cleaning”, and “stall cleaning” in the early nursing period were asked. The handling frequencies were scored from (1) (not done) to (5) (every day). In the preliminary test, a measurement reliability of the flight distance and the avoidance score was confirmed. The mean flight distances were 0.56 m and 0.27 m in the postweaning foals and the yearlings, respectively. Touch-avoidance scores of the highest frequency were (3) and (2) in the postweaning foals and the yearlings, respectively. As the results of Spearman’s rank-correlation analysis, “body brushing” showed highly negative relationships with “flight distance” ($\rho = -0.31$, $P<0.001$) and “avoidance score” ($\rho = -0.37$, $P<0.001$) in the postweaning foals. In the yearlings, “hoof cleaning” also showed significantly negative relationships with these behavioural indices ($\rho = -0.24$, $P<0.01$; $\rho = -0.22$, $P<0.01$, respectively).

Key words: avoidance score, flight distance, foal handling, Thoroughbred foal, Thoroughbred yearling

Although thousands of years have passed since some wild animals were domesticated, the domestic animals still hold similar, sensitive temperaments as their ancestors [7, 11, 13, 15, 18]. Horses need escape and evasion from carnivores. Horses also have fear of strange circumstances, such as strangers, novelty objects, large noises, fire, and so on [2, 20, 21, 23].

Dairy cows remember the persons or the circumstances from which they experienced pains [14, 17]. Gentle and friendly handlings for young horses will decrease the fear, and aversive handlings will increase the fear in foals [10]. The animal fear of humans can cause injuries in both of animals and humans, and it results in the productivity reduction. The fear can be guessed by their behaviour of a flight away from human approach and an avoidance reaction from human touch [5].

In general in Thoroughbred raising in Japan, foals are nursed and raised in breeding farms of small scale. After the next summer of birthyear, yearling colts and fillies are raised and trained in training farms of large scale. A large part of the characters of the Thoroughbred yearlings will be formed in the progress of nursing and raising in the young ages. Horses of gentle characters are desired for race in future [9].

Horse behaviour researches were performed in “test
areas” for flight [12] and for approach and body touch [19, 22]. The measurement in “test area” enables measurements of many kinds of behaviour, however, the standardized “test area” setting in private farms might rather lead inaccurate test results, because the new, separate surrounding will affect the psychological state of animals. An individual person is distinguished by horse [8] and also by cattle [3, 14]. Contacts of animal with persons were generalized in horses [6]. Therefore, in the measurement and evaluation of the reaction behaviour, a stranger for animals is required.

In the preliminary test in November, 2003, measurement value reliabilities of the reaction tests were confirmed. The preliminary test was performed using 36 Thoroughbred foals in 6 farms of all the 168 foals in 22 farms. Further in the following summer, 28 yearlings of all the 114 yearlings were also used for the preliminary test.

In the main test, 168 Thoroughbred foals (81 males, 87 females) born in spring, 2003, in Mitsuishi-cho, Hokkaido, Japan, were used for “human approach-horse flight away (approach-flight away)” test and “human touch-horse avoidance (touch-avoidance)” test. The foals were nursed and raised in 22 Thoroughbred breeding farms of 4–17 mares. The reaction tests were performed after weaning of 168 foals in the individual farm in November and December, 2003. Nine months later from the test after weaning, 114 yearlings (47 males, 67 females) of 168 foals were again used for the tests before moving into the training farm where the yearlings were trained for the race. Mean age of the foals at the postweaning test was 240 ± 30 d and that of the yearlings at the test before moving into the training farm was 501 ± 32 d.

The method of “approach-flight away” test basically followed that of Purcell et al. (1988) [16]. The test was performed during 9:00–15:00 after foal entering into the usual pasture, areas of which varied from ca. 0.2 to ca. 0.6 ha according to each farm. A foal for the test was selected at random. A stranger wearing a grey jacket slowly approached it with a step of 0.6 m/sec from a distance of 10 m. When the foal showed a warning posture, the stranger stopped his step for some minutes. After when the animal began grazing at the same site, the man approached again. The distance of flight away was estimated as the distance (m) from the man to the animal when the animal began to flight away. When the animal walked toward the stranger during the test and could be easily touched by him, the distance was judged 0 m. The test was repeated three times for an animal. The test was further continued using other animals, one by one, but taking rests of some time. The animal which was estimated “0 m” was submitted to the following “touch-avoidance” test. The same method of “approach-flight away” test was applied to the yearlings before moving into the training farm before training start.

The method of “touch-avoidance” test was performed on the animal of that flight distance was judged 0 m. The forehead of the animal was touched with a right hand of the stranger. The reaction of the animal was estimated by five scores; (1) quiet and not resistant, (2) a little resistant, (3) less resistant but not flight, (4) much resistant and flight, and (5) flight away without touching including animals with flight away distance of more than 0 m.

The handling of foals in their early nursing period by the stabler in the breeding farms were orally asked in August and September, 2004. The following four handlings were asked; “body brushing”, “hoof cleaning”, “rectal temperature measurement” and “stall cleaning”. The frequency of the handling in a week was estimated by 5 scores; (1) no working, (2) working once or twice, (3) working three or four times, (4) working 5 or 6 times, and (5) working every day.

Although the values of flight distance didn’t show a formal distribution, the means and standard deviations were calculated for convenience. The values in the avoidance reaction and the animal handling frequency were treated as non-parametric values. In difference analysis of means, the method of Wilcoxon signed rank test was used. In correlation analysis, the method of Spearman’s rank-correlation was used.

In the preliminary test, the flight distance of 24 foals was 0.00 m. The mean distances of 36 foals were 0.58 ± 0.89 m and 0.66 ± 0.98 m in the first and the second trials, respectively (Table 1). Difference of the two trials was not significant. No significant difference was also recognized between the mean distances of two trials in 12 foals which showed over 0.10 m distances. In the subsequent preliminary test, the flight distance of 23 yearlings was 0.00 m. The mean distances of 28 yearlings were 0.34 ± 0.79 m and 0.38 ± 0.84 m in the first and the second trials, respectively (Table 1). Difference of the two trials was not significant. No significant difference was also recognized between the mean distances of two trials in 5 yearlings which showed over 0.10 m distances. The measurement values obtained in the “approach-flight away” test were verified to be statistically reliable.
In the “touch-avoidance” test of the preliminary test of 36 foals, the frequency of score (3) was highest in both of the first and the second trials (Table 2). The result was analyzed by “Cross-classification” method. Same scores in the first and the second trials were observed in 25 of 36 foals. In the Cross classification, 0.59 of Kappa coefficient was obtained (P<0.001).

In the subsequent “touch-avoidance” test of the preliminary test of 28 yearlings, the frequency of score (2) was highest in both of the first and the second trials (Table 2). The result was analyzed by “Cross-classification” method. Difference of the scores was not significant. Same scores in the first and the second trials were observed in 20 of 28 yearlings. In the Cross classification, 0.62 of Kappa coefficient was obtained (P<0.001). The avoidance scores obtained in the “touch-avoidance” test were verified to be statistically reliable.

In the main test, mean distances in the approach-flight away test were 0.56 ± 0.90 m in 168 postweaning foals and 0.27 ± 0.70 m in 114 yearlings before training start (Table 3). The distances were zero in 109 of 168 foals. No significant difference was recognized between the flight distances of male (n=81) and female

---

**Table 1.** Comparison of flight distances between the first and the second measurements in the behaviour test of Thoroughbred foals and yearlings

| Animal                  | Measurement         | Number of animal | Mean (m) | S.D (m) |
|-------------------------|---------------------|------------------|----------|---------|
| Postweaning foal        | First time (All)    | 36               | 0.58     | 0.89    |
|                         | (Except 0 m)        | 12               | 1.49     | 0.90    |
|                         | Second time (All)   | 36               | 0.66     | 0.98    |
|                         | (Except 0 m)        | 12               | 1.59     | 0.81    |
| Yearling before training start | First time (All)  | 28               | 0.34     | 0.79    |
|                         | (Except 0 m)        | 5                | 1.88     | 0.51    |
|                         | Second time (All)   | 28               | 0.38     | 0.84    |
|                         | (Except 0 m)        | 5                | 1.92     | 0.41    |

**Table 2.** Comparison of avoidance scores between the first and the second measurement in the behaviour test of Thoroughbred foals and yearlings

| Avoidance experiment | Score in 1st measurement | 1 | 2 | 3 | 4 | 5 | Total |
|----------------------|--------------------------|---|---|---|---|---|-------|
| Score in 1st measure | [1]                      | 2 | 1 | 0 | 0 | 0 | 3     |
| Score in 2nd measure | [2]                      | 2 | 4 | 1 | 0 | 0 | 7     |
| Score in 3rd measure | [3]                      | 0 | 3 | 6 | 0 | 0 | 9     |
| Score in 4th measure | [4]                      | 0 | 0 | 2 | 1 | 0 | 3     |
| Score in 5th measure | [5]                      | 0 | 0 | 2 | 0 | 12| 14    |
| Total                |                          | 4 | 8 | 11| 1 | 12| 36    |

**Table 2.** Comparison of avoidance scores between the first and the second measurement in the behaviour test of Thoroughbred foals and yearlings

| Avoidance experiment | Score in 1st measurement | 1 | 2 | 3 | 4 | 5 | Total |
|----------------------|--------------------------|---|---|---|---|---|-------|
| Score in 1st measure | [1]                      | 6 | 2 | 0 | 0 | 0 | 6     |
| Score in 2nd measure | [2]                      | 1 | 5 | 3 | 0 | 0 | 9     |
| Score in 3rd measure | [3]                      | 0 | 2 | 3 | 0 | 0 | 5     |
| Score in 4th measure | [4]                      | 0 | 0 | 0 | 0 | 1 | 1     |
| Score in 5th measure | [5]                      | 0 | 0 | 0 | 0 | 5 | 5     |
| Total                |                          | 7 | 9 | 6 | 1 | 5 | 28    |
The maximal flight distance was recorded in No. 15 farm (mean=1.7 m), and the minimal distance in No.11 and No. 12 farms (mean=0.0 m). The difference was significant (P<0.01).

In the subsequent main test, the touch-avoidance test was applied to the animals that gave flight distances over 0 m. The animals which gave flight distances over 0 m were estimated at score (5). In the postweaning foals, the animal ratio of score (5) was the highest (35.1%), however, the ratio of score (1) was the highest in the yearling before training start. A significant correlation was recognized between the avoidance scores of the postweaning foals and the avoidance scores of the corresponding yearlings (Spearman’s rank correlation, \( r = 0.53, P < 0.001 \)). No significant difference was recognized between avoidance scores of male (n=47) and female (n=67) yearlings (Wilcoxon signed rank test). The maximal score between breeding farms was recorded in No. 15 farm (mean=4.4), and the minimal score in No. 12 farm (mean=1.5). The difference was significant (Wilcoxon signed rank test, P<0.01).

The relationship between the behavioural reactions of 168 postweaning foals and the stabler handling frequencies in 22 breeding farms are shown in Table 4. The “body brushing” showed high negative correlations with flight distance (\( r = -0.31, P < 0.001 \)) and with avoidance score (\( r = -0.37, P < 0.001 \)). The “rectal temperature measurement” showed a significant correlation only with flight distance (\( r = -0.22, P < 0.01 \)). A high frequency of human touching with animals was suggested to be effective to make animals familiar to humans.

The relationship between behavioural reactions of 114 yearlings and stabler handling frequencies was shown in Table 5. All of the stabler handling frequencies showed low correlations with flight distance and also with avoidance score for 114 yearlings. While in the corresponding 114 foals, “body brushing”, “rectal temperature measurement” and “hoof cleaning” showed significant correlations with avoidance score (\( r = -0.22, P < 0.01; r = 0.24, P < 0.05; r = -0.22, P < 0.05 \); respectively). The general high correlations of behavioural reactions with handlings in the young ages in the experimented foals became lower in the experimented yearlings. It was suggested that the frequent animal-human relationship in the age from postweaning to training start in the following spring/summer will also be more important for a mild character formation in yearlings.

The following articles were discussed. In the approach-flight away test, it was apprehended that a stranger will become not strange to other animals during the test in the same pasture division. However, the test was finished in 40 min in one division. It was hypothesized that an animal acclimation to the stranger would not increase in the short period and the

| Table 3. Flight distances of horse at the approach-flight away test |
|---------------------------------------------------------------|
| Horse | n* (head) | M (m) | S.D. (m) | Max. (m) | Min. (m) |
|----------------------------------|
| Postweaning foal | 168 (109) | 0.56 | 0.90 | 5.90 | 0.00 |
| Yearling before training start | 114 (98) | 0.27 | 0.70 | 2.70 | 0.00 |

* Parenthesized numbers show horses which reacted by zero meter.

| Table 4. Correlations between behavioural reaction scores of postweaning foals and handling frequency in the young ages (n=168, all of the foals) |
|----------------------------------|
| Stabler handling | Distance of flight away | Score of avoidance reaction |
| | r | P-value | r | P-value |
| Body brushing | -0.31 | <0.001 | -0.37 | <0.001 |
| Rectal temperature measurement | -0.22 | <0.01 | -0.14 | ns |
| Hoof cleaning | -0.24 | <0.01 | -0.22 | <0.01 |
| Stall cleaning | -0.11 | ns | -0.22 | <0.01 |

(n=87) foals. The maximal flight distance was recorded in No. 15 farm (mean=1.7 m), and the minimal distance in No.11 and No. 12 farms (mean=0.0 m). The difference was significant (P<0.01).

In the subsequent main test, the touch-avoidance test was applied to the animals that were estimated 0.00 m distance. The animals which gave flight distances over 0 m were estimated at score (5). In the postweaning foals, the animal ratio of score (5) was the highest (35.1%), however, the ratio of score (1) was the highest in the yearling before training start. A significant correlation was recognized between the avoidance scores of the postweaning foals and the avoidance scores of the corresponding yearlings (Spearman’s rank correlation, \( r = 0.53, P < 0.001 \)). No significant difference was recognized between avoidance scores of male (n=47) and female (n=67) yearlings (Wilcoxon signed rank test). The maximal score between breeding farms was recorded in No. 15 farm (mean=4.4), and the minimal score in No. 12 farm (mean=1.5). The difference was significant (Wilcoxon signed rank test, P<0.01).

The relationship between the behavioural reactions of 168 postweaning foals and the stabler handling frequencies in 22 breeding farms are shown in Table 4. The “body brushing” showed high negative correlations with flight distance (\( r = -0.31, P < 0.001 \)) and with avoidance score (\( r = -0.37, P < 0.001 \)). The “rectal temperature measurement” showed a significant correlation only with flight distance (\( r = -0.22, P < 0.01 \)). A high frequency of human touching with animals was suggested to be effective to make animals familiar to humans.

The relationship between behavioural reactions of 114 yearlings and stabler handling frequencies was shown in Table 5. All of the stabler handling frequencies showed low correlations with flight distance and also with avoidance score for 114 yearlings. While in the corresponding 114 foals, “body brushing”, “rectal temperature measurement” and “hoof cleaning” showed significant correlations with avoidance score (\( r = -0.22, P < 0.01; r = -0.30, P < 0.001; r = -0.24, P < 0.05; r = -0.22, P < 0.05 \); respectively). The general high correlations of behavioural reactions with handlings in the young ages in the experimented foals became lower in the experimented yearlings. It was suggested that the frequent animal-human relationship in the age from postweaning to training start in the following spring/summer will also be more important for a mild character formation in yearlings.

The following articles were discussed. In the approach-flight away test, it was apprehended that a stranger will become not strange to other animals during the test in the same pasture division. However, the test was finished in 40 min in one division. It was hypothesized that an animal acclimation to the stranger would not increase in the short period and the
warning nature of animals would be kept.

In the similar approach-flight away test, the mean distance was 3.3 m in foals experiencing little contact with humans [12], and 7.0 m in Japanese breed in Hokkaido, which was kept outdoor all year round [1]. The small flight distances in our study will reflect a large amount of contact of foals and mares with humans in the usual Thoroughbred management by stablers.

When the approach-flight away test was tried by a farm manager before this study using several foals, almost all of the flight distance were 0.0 m and the avoidance score (1) occupied a large part of the score. The gentle character of animals, which was cultivated by the farm persons, would be generalized to a stranger from outside of the farm. The similar character generalization was also reported by Heusberger and Mueller [6].

An importance of the stableman handling, especially “body brushing”, was confirmed in this study. In the similar behavioural investigation, the body brushing was also effective for reducing equine high tensions [4].

We appreciate Mr. Yoshinori Sanada, Veterinarian, and Mr. Norihisa Maekawa, Manager of Mitsubishi Thoroughbred Training Center, for helping and giving us lots of advices and collaboration.

### References

1. Aiba, T., Takida, N., Matsuura, A., and Kondo, S. 2004. Effects of hand-touching at weaning on flight distance in young horses. Annual meeting report. *Jpn. Soc. Livestock Management* 40: 80–81.

2. Christensen, J.W., Rundgren, M., and Olsson, K. 2006. Training methods for horses: habituation to a frightening stimulus. *Equine Vet. J.* 38: 439–443.

3. de Passille, A.M.B., Rushen, J., Ladewig, J., and Petherick, C. 1996. Dairy calves’ discrimination of people based on previous handling. *J. Anim. Sci.* 74: 969–974.

4. Hana, H., Yogo, M., and Matsuyama, Y. 1996. Effects of stroking horses on both humans’ and horses’ heart rate responses. *Jpn. Psychol. Res.* 38: 66–73.

5. Hemsworth, P.H., and Coleman, G.J. 1998. Human-livestock interactions. In: The stockperson and the productivity and welfare of intensively-farmed animal. CAB International, Oxon, U.K.

6. Heusberger, M., and Mueller, C. 2002. A brief note on some possible factors involved in the reactions of horses to humans. *Appl. Anim. Behav. Sci.* 76: 339–344.

7. Jensen, P. 1986. Observations on the maternal behaviour of free-ranging domestic pigs. *Appl. Anim. Behav. Sci.* 16: 131–142.

### Table 5.

Correlations between behavioural reaction score of postweaning foals/yearlings and handling frequency in the young ages (n=114)

| Stabler handling | Distance of flight away | Score of avoidance reaction |
|------------------|------------------------|-----------------------------|
|                  | r    | P-value | r    | P-value |
| Body brushing    | –0.15 | ns     | –0.30 | < 0.001 |
| Rectal temperature measurement | –0.18 | ns     | –0.24 | < 0.05 |
| Hoof cleaning    | –0.17 | ns     | –0.22 | < 0.05 |
| Stall cleaning   | –0.06 | ns     | –0.12 | ns     |

| Stabler handling | Distance of flight away | Score of avoidance reaction |
|------------------|------------------------|-----------------------------|
|                  | r    | P-value | r    | P-value |
| Body brushing    | –0.07 | ns     | –0.14 | ns     |
| Rectal temperature measurement | –0.14 | ns     | –0.01 | ns     |
| Hoof cleaning    | –0.15 | ns     | –0.18 | ns     |
| Stall cleaning   | –    | –      | –    | –      |
8. Kusunose, R. 1997. Equine psychology: Can horses recognize humans? Anim. Sci Res. 51: 179–181.
9. Kusunose, R. 2000. Behaviours and performances of race horses. Jpn. J. Vet. Sci. 53: 1029–1032.
10. Lansade, L., Bertrand, M., Boivin, M., and Bouissou, M.F. 2004. Effects of handling at weaning on manageability and reactivity of foals. Appl. Anim. Behav. Sci. 87: 131–140.
11. Lidforset, L., and Jensen, P. 1988. Behaviour of free-ranging beef cows and calves. Appl. Anim. Behav. Sci. 20: 237–247.
12. Mal, M.E., McCall, C.A., Cummins, K.A., and Newland, M.C. 1994. Influence of preweaning handling methods on post weaning learning ability and manageability of foals. Appl. Anim. Behav. Sci. 40: 187–195.
13. McBride, G., Parer, I.P., and Foenander, F. 1969. The social organization and behaviour of the feral fowl. Animal Behaviour Monographs 2: 127–181.
14. Munksgaard, L., de Passille, A.M.S., Rushen, J., Thodberg, K., and Jensen, M.B. 1997. Discrimination of people by dairy cows based on handling. J. Dairy Sci. 80: 1106–1112.
15. Newberry, R., and Wood-Gush, D.G.M. 1985. The suckling behaviour of domestic pigs in a semi-natural environment. Behaviour 95: 11–25.
16. Purcell, D., Arave, C.W., and Walters, J.L. 1988. Relationship of three measures of behavior to milk production. Appl. Anim. Behav. Sci. 21: 307–313.
17. Rushen, J., Munksgaard, L., de Passille, A.M.S., Jensen, M.B., and Thodberg, K. 1998. Location of handling and dairy cows’ response to people. Appl. Anim. Behav. Sci. 55: 259–267.
18. Schiff, W. 1965. Perception of impending collision: a study of visually directed avoidance behaviour. Psychological Monographs 604: 79–81.
19. Simpson, B.S. 2002. Neonatal foal handling. Appl. Anim. Behav. Sci. 78: 303–317.
20. Visser, E.K., C.G. van Reenen, H. Hopster, M.B. Schilder, J.H. Knaap, A. Berneveld, and H.J. Blokhuis. 2001. Quantifying aspects of young horses’ temperament: Consistency of behavioural variables. Appl. Anim. Behav. Sci. 74: 241–258.
21. Visser, E.K., C.G. van Reenen, J.T. der Werf, M.B. Schilder, J.H. Knaap, A. Berneveld, and H.J. Blokhuis. 2002. Heart rate and Heart rate variability during a novel object test and a handling test in young horses. Physiol. Behav. 76: 289–296.
22. Williams, J.L., Friend, T.H., Toscano, M.J., Collins, M.N., Sisto-Bur, A., and Nevill, C.H. 2002. The effects of early training sessions on the reactions of foals at 1, 2 and 3 months of age. Appl. Anim. Behav. Sci. 77: 105–114.
23. Wolf, A.M., M. Hausberger, and N. le Scolan. 1997. Experimental test to assess emotionality in horses. Behavioural Processes 40: 209–221.