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The growth of Hokkaido native horses kept outdoors all year round from birth to 100 months of age

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Abstract

KAWAI, M., T. YASUE, K. OGAWA, S. KONDO, M. OKUBO and Y. ASAHIDA (1997) The growth of Hokkaido native horses kept outdoors all year round from birth to 100 months of age, Res. Bull. Livestock Farm, Fac. Agric. Hokkaido Univ. 16 : 11−17

The growth of Hokkaido native horses kept outdoors all year round was studied. The body weight (BW), height of withers (HW), heart girth (HG) and cannon circumference (CC) of nine mares born in 1976 to 1982 and forty six mares born in 1986 to 1993 were measured at a interval of one per month from June in 1992 to May in 1994. The horses were grazed on the improved pastures from June to October, on the woodland pastures from November to January and fed timothy hay ad libitum on a dry lot from February to May.

The mean birth BW of fillies born in 1992 and 1993 was 33.3kg and mean BW of mares over 120 months of age was 349.6kg. The mean HW, HG and CC were 84.3, 75.5 and 11.2cm at birth and 130.8, 164.5 and 16.7cm at 120 months of age or over, respectively. The BW, HW, HG and CC regressed on age of days (X) resulted in the following equation :

BW : $Y(kg) = 191.4 + 68.2 \ln X$ ($r^2 = 0.90$, $P < 0.01$)

HW : $Y(cm) = 69.7 + 7.9 \ln X$ ($r^2 = 0.87$, $P < 0.01$)

HG : $Y(cm) = 43.8 + 15.4 \ln X$ ($r^2 = 0.81$, $P < 0.01$)

CC : $Y(cm) = 9.0 + 1.0 \ln X$ ($r^2 = 0.68$, $P < 0.01$)

If body weight and size of the mature horse are supposed as those of the horses over 120 months of age, the BW at 92 months attained to the mature weight according to these equations. The HW, HG and CC attained to mature size earlier than BW. The growth of BW was fast on the improved pastures and slow or negative on the woodland pastures and

the dry lot. The growth of HW, HG and CC were extremely fast from birth to weaning and became slowly thereafter.

Key words : Growth, Body measurements, Hokkaido native horses

Introduction

Hokkaido native horses are small sized horses introduced into Hokkaido from main land of Japan about one or two hundred years ago. They have been kept outdoors all year round and used for packhorses. Their population in Hokkaido is less than 3000 in 1995. The Livestock Farm of Hokkaido university has kept about 40 to 60 horses of this breed, include 20 to 30 mature mares, since 1950 to maintain their blood line.

For these horses in the livestock farm, thremmatology on body size and shape[2, 6], reproduction on transplantation of ovum[3, 8] and behavior on time budget[1] and location on the woodland pasture[9] have been studied. On the other hand, the standard growth curve of the native horse in Japan has not been established yet, and few studies have been conducted on the growth of these horses.

In the present study, the body weight, height of withers, heart girth and cannon circumference of Hokkaido native horses, which have been kept outdoors all year round in Livestock Farm of Hokkaido university, were measured through three years periodically, and the growth of Hokkaido native horses from birth to 100 months of age was discussed.

Materials and Methods

Experimental animals were fifty five Hokkaido native mares, of which nine mares were born in 1976 to 1982 and forty six mares were born in 1986 to 1993, kept in the Livestock Farm of Hokkaido University, located in Hidaka district, Hokkaido, Japan. The total area of this farm is 470 ha, which consists of broad-leaved woodland pasture with underlayer of *Sasa nipponica* (330 ha), hilly improved pasture established by hoof cultivation (60 ha) and other cultivated land.

From June in 1992 to May in 1994, the body weight (BW), height of withers (HW), heart girth (HG) and cannon circumference (CC) were measured once a month. The data included 16 fillies born in 1992 and 1993, 30 mares of various age to 100 months and 9 mares over 120 months of age. In the experimental period, a herd of the horses was kept outdoors to be grazing on the improved pastures from June to October, on the woodland pastures from November to January and be feeding timothy hay ad libitum on the drylot

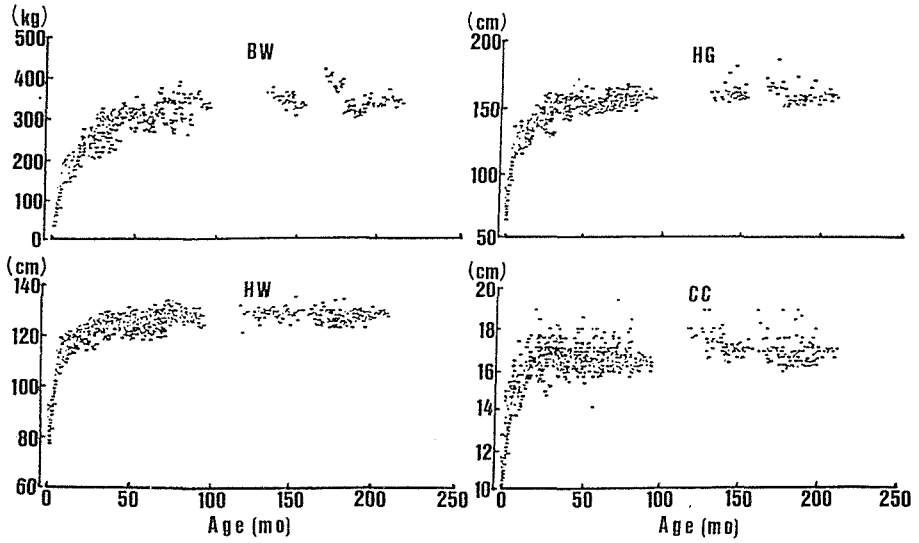

Fig. 1. Changes in body wight (BW), height of withers (HW), heart girth (HG), and cannon circumference (CC).

Table 1. Mean body weight (kg), and body measurements (cm) at birth and 120 months of age or over

	Birth	Over 120 months
Body wight	33.3±3.6	349.6±24.0
Height of withers	84.3±3.1	130.8± 2.4
Heart girth	75.5±4.3	164.5± 6.4
Cannon circumference	11.2±0.6	16.7± 0.7

Mean± S D

from February to May. The age at first breeding of mares were 36 months of age. A stallion was added to these mares over 36 months of age in this herd for natural breeding from June to July every year. The mares produced 15 to 25 foals in May to June every year and all partums were done outdoors. The foals were weaned at November. The data of BW and HG in pregnant mares were excluded from the analysis.

Result and Discussion

Figure 1 shows changes in BW, HW, HG and CC from birth to 216 months of age. It appeared that the growth of these body measurements were logarithmic functions from birth to 100 months of age. The inclination of the regressive straight lines on the body measurements of horses over 120 months of age were nearly equal zero. As the horses over

120 months of age were regarded as mature horses, the growth from birth to 100 months of age was compared with the mean value of horses over 120 months of age.

Table 1 shows mean body weight and body measurements at birth and horses over 120 months of age. The mean BW and HW at birth and 120 months of age or more were 33.3 and 349.6 kg, 84.3 and 130.8 cm, respectively. The body size of Hokkaido native horses in the Livestock Farm of Hokkaido University were smaller than those of this breed in Hokkaido Prefectural Shintoku Animal Husbandry Experimental Station[6]. The horses in the present study have been kept outdoors all year round without any supplements but the horses in Shintoku Experiment Station have been kept in stables and fed supplements in winter. Mastumoto[2] reported the CC of Hokkaido native horses were 17.5 cm in 1921 and 16.8cm in 1936, and the size of CC have got slender gradually. The mature size of CC in the present study was 16.7 cm, that was similar to the value in 1936 reported by Mastumoto[2]. The size of CC is increased by exercise[5]. The horses in the present study have not used for working, and this may be the reason why the size of CC got slender.

According to the relationship of body measurements and age of days, significant logarithmic curves were obtained. BW, HW, HG and CC regressed on age of days (X) resulted in the following equation :

BW : $Y(cm) = 191.4 + 68.2 \ln X$ ($r^2 = 0.91$, $P < 0.01$)

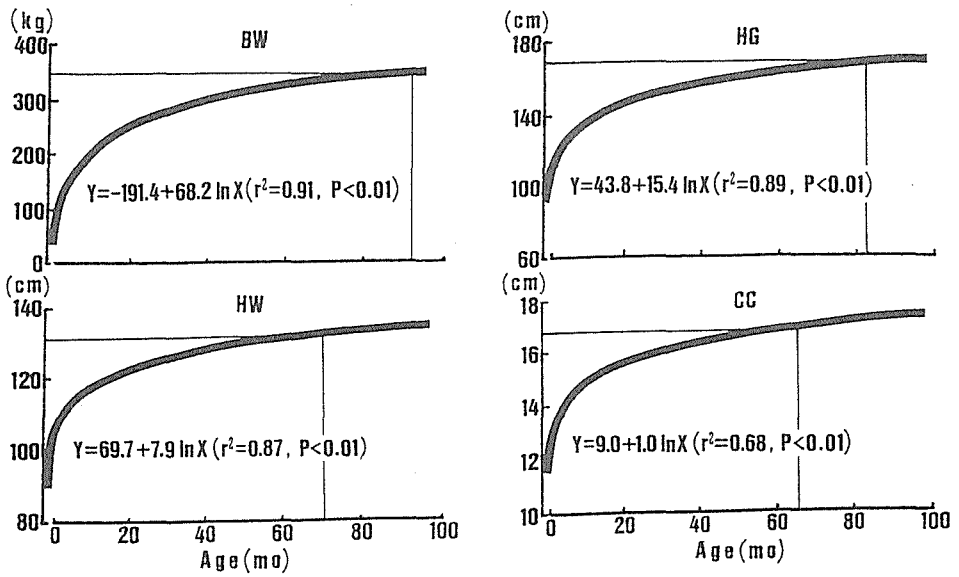

Fig. 2. Regression for body weight (BW), height of withers (HW), heart girth (HG) and cannon circumference (CC).

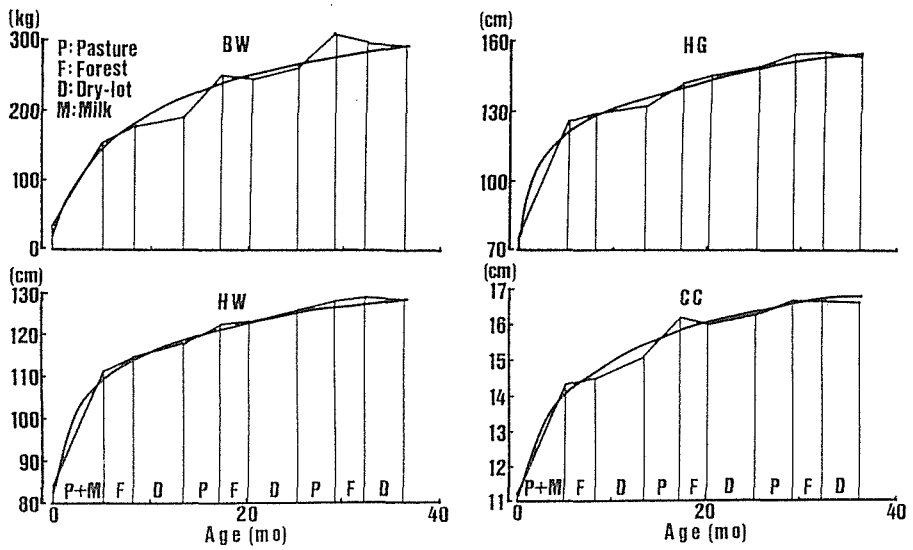

Fig. 3. Changes in body wight (BW), height of withers (HW), heart girth (HG), and cannon circumference (CC) from birth to first breeding.

HW : $Y(cm) = 69.7 + 7.9 \ln X$ ($r^2 = 0.87$, $P < 0.01$)

HG : $Y(cm) = 43.8 + 15.4 \ln X$ ($r^2 = 0.81$, $P < 0.01$)

CC : $Y(cm) = 9.0 + 1.0 \ln X$ ($r^2 = 0.68$, $P < 0.01$)

The results were shown in Figure 2. The horizontal straight-line in each figure express the mean value of horses over 120 months of age. The BW attained to the mean value of horses over 120 months of age at 92 months, while HW and HG attained to within 70 months of age. The CC attained to about 80 months, which were between BW and HW or HG. Oki[4] reported that body weight grew to 60 months of age in the Thoroughbred mares. The growth of Hokkaido native horses kept outdoors all year round were slower than those of Thoroughbreds, that were kept in stables at night and had received some periodical training.

Figure 3 shows changes of body weight and body measurements from birth to first breeding (36 months). The curved line express the regression of logarithmic function from birth to first breeding as the curve on Figure 2, and the straight line express the regression of linear equation on each feeding conditions, that is grazing on improved pasture, woodland pasture or feeding hay on drylot. The growth of HW, HG and CC were extremely fast from birth to weaning, thereafter those become slowly. The growth of BW was fast on the improved pasture and that was slow or negative on the woodland pasture and drylot. Yamamoto *et al.*[7] reported the growth of Thoroughbred foals was affected b

y the nutritive value of diets, amount of feed, size and form of pasture and amount of exercise on pasture. The growth of BW of these horses were influenced more by the grazing environment or forage than those of the other body size.

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周年屋外飼育している北海道和種馬の生時から100カ月齢までの成長

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周年屋外飼育している北海道和種馬の成長を測定した。1976年から1982年生まれの9頭および1986年から1993年生まれの43頭の雌馬を用い、体重、体高、胸囲、管囲を測定した。体重および体尺測定は1992年6月から1994年5月まで毎月1回行った。供試馬は6月から10月までは造成草地、11月から1月までは林間放牧地に放牧し、2月から5月まではドライロットにおいてチモシー乾草を給与した。

生時平均体重、体高、胸囲、管囲はそれぞれ33.3kg、84.3, 75.5, 11.2cmであり、120カ月齢以上の平均値はそれぞれ349.6kg、130.8, 164.5, 16.7cmであった。体重、体高、胸囲、管囲について日齢を独立変数として以下の回帰式を得た。

体重：$Y(kg)=191.4+68.2\ln X$ ($r^2=0.90$, $P<0.01$)

体高：$Y(cm)=69.7+7.9\ln X$ ($r^2=0.87$, $P<0.01$)

胸囲：$Y(cm)=43.8+15.4\ln X$ ($r^2=0.81$, $P<0.01$)

管囲：$Y(cm)=9.0+1.0\ln X$ ($r^2=0.68$, $P<0.01$)

体重が120カ月齢以上の平均値に達するまでの時間は92カ月であった。体高、胸囲、管囲が120カ月齢以上の平均値に達するのは体重よりも早かった。体重の増加は造成草地において早く、林間放牧地もしくはドライロットにおける成長は遅い、もしくは減少した。体高、胸囲、管囲の成長は生時から離乳までが非常に早く、その後は緩やかになった。