aJava

Asian Journal of Animal and Veterinary Advances

Academic
Journals Inc.

www.academicjournals.com

Asian Journal of Animal and Veterinary Advances 6 (5): 451-459, 2011
ISSN 1683-9919 / DOI: 10.3923/ajava.2011.451.459

Comparative Study on Some Chemical-physical Indicators in Colostrum of Two Mare Breeds

[1]X.K. Yao, [1]S.J. Yu, [1]W.J. Liu, [1]J. Meng, [1]X.D. Pan, [2]X.H. Tan and [1]Q.J. Luo
[1]College of Animal Science, Xinjiang Agricultural University, Urumqi, Xinjiang 830052, Peoples Republic of China
[2]Zhaosu Stud, Yi Li, Xinjiang 835600, Peoples Republic of China

Corresponding Author: Q.J. Luo, College of Animal Science, Xinjiang Agricultural University, Urumqi, Xinjiang 830052, Peoples Republic of China

ABSTRACT

This study was designed to understand the dynamic changes of physical and chemical indicators in the Yili horse colostrum in order to provide the scientific basis for Yili horse breeding. Fat, non-fat solids, protein, density, freezing point, ash, electrical conductivity and so on in milk between Yili horse and F1 hybridization mare of new Kirghiz horse and Yili horse (hybrid horse for short) in 2, 4, 6, 8, 12, 24 and 48 h, 72 and 96 day, 120, 144 and 168 h after foaling were compared and analyzed. The results showed that: (1) Protein, non-fat solids, density, ash, electrical conductivity in colostrum of Yili horse and hybrid horse were higher than that in milk and gradually close to milk with the extension of lactation. (2)Protein, ash and non-fat solids in colostrum of Yili horses and hybrid horse were decreased dramatically in 12 h after foaling. (3) Protein, density, ash, electrical conductivity and non-fat solids in Yili horse colostrum were different with hybrid horse at the same lactation period, as most measured values of Yili horse were higher than hybrid horse and the difference was gradually narrowing with extended lactation period. (4) Protein in colostrum of Yili horse after foaling in 4 h were extremely significantly higher than that in hybrid horse ($p<0.01$).(5) Protein, density and crude ash in colostrum of Yili horse after foaling in 72 h were significantly higher than that in hybrid horse ($p<0.05$). (6) Non-fat solids in colostrum of Yili horse after foaling in 8 h were significantly higher than that in hybrid horse ($p<0.05$).

Key words: Yili horse, hybrid horse, colostrum, fat, protein, ash

INTRODUCTION

Colostrums of mare are nourishing and immune for newly born foals, the effect changes as time. It is reported that the content of nutritive elements in colostrums among breeds are different (Pieszka, 2001), therefore, both time and the breeds of mares can influence the content of nutritive elements in colostrums. Colostrum of Haflinger, Breton, Boulonnais and Hungarian Draught breeds were studied and found that the content of dry matter were 25.57% in average after foaling in 0-0.5 day, 12.55% in average after foaling in 2-5 day, 10.42% in average after foaling in 8-45 day, the content of dry matter was dramatically decreased with the time after foaling in 2 day. Fat content were 2.91% in average after foaling in 0-0.5 day, 2.13% in average after foaling in 2-5 day, 1.25% in average after foaling in 8-45 day. The content of total protein were 16.41% in average after foaling in 0-0.5 day, 4.13% in average after foaling in 2-5 day, 2.31% in average

after foaling in 8-45 day, it was dramatically decreased with the time after foaling in 2 day. Due to the large variation, breed differences were not significant (Csapo *et al*., 1995; Csapo-Kiss *et al*., 1995). There were reports on colostrum of Wielkopolska horse breeds, found that fat content were 2.95, 2.68, 2.06, 1.47, 1.26, 1.05 and 1.02 g/100 g after foaling in 1, 2, 30, 60, 90, 120 and 150 day, separately (Pikul and Wojtowski, 2008).

Yili horse is a breed both used as riding and drafting, which was based on Kazakh horse, cultivated by hybridization with introduced Orlov Trotter, Don, Budyonny, Akhal-teke (Xinkui and Guocai, 2008). Some articles about Yili horse have been reported by Xinkui and Hong-luo (2004a, b); Jirong *et al*. (2007) and Suyu *et al*. (2007). There are 120,000 horses at present, is mainly used for riding. Meanwhile, the horse was used for milk production in pasturing areas. In order to improve the performance of their sporting and milk production, New Kirghiz horse was introduced for genetic improvement of Yili horse in 1991, so as to obtain better performance sporting and milk production. This makes feeding and management of hybrid foal become more important, it must be according to the changes of each component in colostrum of hybrid mare if you want to raise the level of feeding and management of hybrid foal. But it doesn't have systematic research on colostrum of horse in China, lack of theoretical guidance for production practice, which result in lower resistance and stress resistance of newborn foal due to not so good feeding and management and affect future growth and development and even death (Xinkui and Guocai, 2008). This experiment was designed to do systematic research on dynamic changes of colostrums component of two mare breeds, in order to clarify the trend and scale of changes of components in different colostrums and discover the relations among them, to provide theoretical support and basic data for genetic improvement as well as management of newly born foals.

MATERIALS AND METHODS

Experimental animals: Experimental time: 2008. Experimental animals: offered by Yili Zhaosu Stud, 10 Yili horses and 12 hybrid horses; all experimental animals are in the same husbandry and management conditions, with same pasturing areas (1.5 ha grassland of per mare-foal pair in average).

Equipments and instruments: FOSS-4000 automatic milk analyzer, distiller, thermometer, refrigerator, etc.

Methods and procedures: The date of parturition was predicted on the basis of the record of copulation and then was carried out 24 h consistent observation on pregnant mares.

After the parturition, newly born foals were kept in a fixed range, with mares freely foraging around. All the samples of colostrums were milked by hand. It was collected in 2, 4, 6, 8, 12, 24, 48, 72, 96, 120, 144 and 168 h after the parturition. The milk samples were cooled after collected and then was stored immediately into refrigerator with the temperature under -20°C.

The samples were firstly heated to 40°C by water bath after thaw and then were cooled naturally to 20°C. Later, we tested the main components of the milk samples by FOSS-4000 automatic milk analyzer. The data was analyzed using SPSS 13.0 for windows, aiming at revealing the difference of components of colostrums of Yili mares and hybrid mares.

RESULTS

Dynamic changes of the chemical-physical indicators of colostrums of Yili mares and hybrid mares

The stat. result shows that: The fat in colostrums of both Yili mares and hybrid mares arrived to maximum value at 24 h after parturition, amount to 3.71 and 2.91%, respectively. The fat in colostrums of Yili mares was extremely significantly higher than that of hybrid mares at 2 h after parturition ($p<0.01$). On the 168 h after parturition, the fat in colostrums of Yili mares was significantly higher than that in hybrid mares ($p<0.05$).

As for all the samples, the protein in colostrums of Yili mares was more than that in hybrid mares. In the first 4h after parturition, the protein in colostrums of Yili mares was extremely significantly higher than that of hybrid mares ($p<0.01$) and significantly higher from the 6 to 72 h ($p<0.05$). As time went by, such difference became non-significant ($p>0.05$). And protein in colostrums of Yili mares could be discovered significantly higher than that of hybrid mares until 144 h after parturition ($p<0.05$).

As for all the samples, the density of colostrums of Yili mares was higher than that of hybrid mares. Within 24 and 72 h after parturition, the density of colostrums of Yili mares was significantly higher than that of hybrid mares ($p<0.05$), difference decrease as time went by ($p>0.05$).

As for all the samples, the crude ash in colostrums of Yili mares was higher than that of hybrid mares. In 2 h after parturition, the crude ash in colostrums of Yili mares was extremely significantly higher than that of hybrid mares ($p<0.01$) and significantly higher within the period from 4 to 72 h after parturition ($p<0.05$).

Conductivity reflects the number of conductive ions in colostrums. For the samples collected in different periods from 2 to 96 h after parturition, the conductivity of colostrums of Yili mares was higher than that of hybrid mares. And on 24 h the conductivity in colostrums of Yili mares was significantly higher than that in hybrid mares ($p<0.05$).

As for all the samples, the NFS in colostrums of Yili mares was higher than that of hybrid mares and the difference narrowed as time went by. From 2 to 6 h after parturition, the NFS in colostrums of Yili mares was extremely significantly higher than that of hybrid mares ($p<0.01$) and significantly higher at 8h after parturition ($p<0.05$). Twelve hour later after parturition, there was no significant difference between the NFS in colostrums of Yili mares and that of hybrid mares ($p>0.05$).

Comparison on chemical-physical indicators in colostrums of Yili mares and that of hybrid mares

Fat: Figure 1 shows the fat in colostrums of both Yili mares and hybrid mares changes irregularly. From 2 to 24 h, the fat increases, while decreases after 24 h. The curve of fat in colostrums of hybrid mares is smoother than that of Yili mares. The fat in colostrums of Yili mares and hybrid mares arrived to minimum value, respectively 1.5% on 168h after parturition and 1.31% at 2 h after parturition. But the fat in colostrums of both Yili mares and hybrid mares arrived to maximum value at 24 h after parturition, respectively 3.71 and 2.91%, stabilizing at 96 h after foaling.

Protein: Figure 2 shows protein in colostrums of both Yili mares and hybrid mares arrived to maximum value at 2 h after parturition, respectively 11.1 and 9.79%, about five times more than ordinary milk. Within the 24 h after parturition, the content of protein in colostrums of both

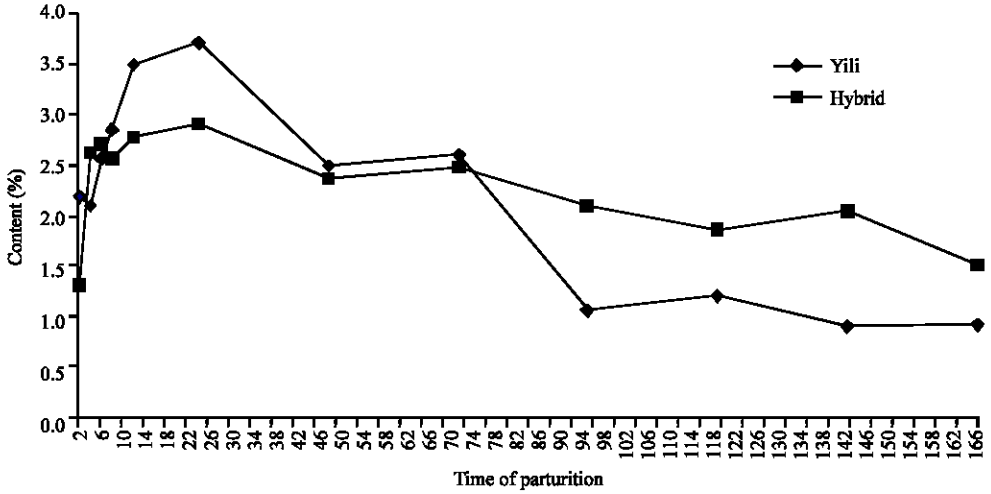

Fig. 1: The change of fat level of colostrums in Yili mares and hybrid mares

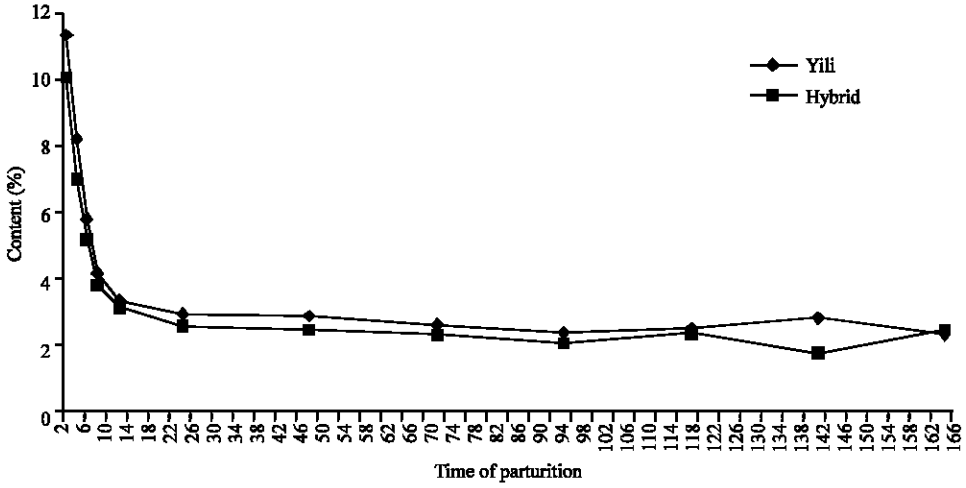

Fig. 2: The change of protein level of colostrums in Yili mares and hybrid mare

Yili mares and hybrid mares decreased dramatically to 3.71 and 3.40%, respectively. The content of protein in colostrums of both mares decreased fast after foaling in 12 h, but slowly at 24 h after foaling. Since, 96 h after parturition, the curve became stable and protein in colostrums of both breeds of mares was nearly the same as that of milk.

Density: Figure 3 shows density of colostrums of both Yili mares and hybrid mares decreases as time goes by. The trend of decrease was especially sharp in 12 h after parturition. In the period between 2 and 24 h after parturition, density of colostrums of Yili mares decreased from 1.0826 to1.0343 g cm^{-8} and hybrid mares from 1.06085 to 1.0307 g cm^{-8}.

Crude ash: Figure 4 shows the crude ash in colostrums of both breeds of mares changed dramatically in 24 h, especially within 8 h after parturition. In the period between 2 and 8 h after parturition, crude ash in colostrums of Yili mares decreased from 1.79 to 0.81% and hybrid mares from 1.46 to 0.7%. The curve decreased slowly from 8 to 96 h after the parturition.

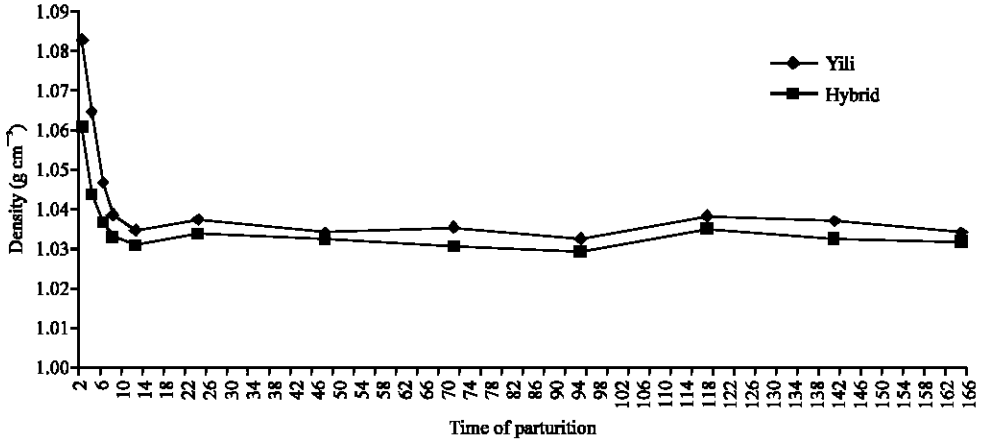

Fig. 3: The change of density level of colostrums in Yili mares and hybrid mares

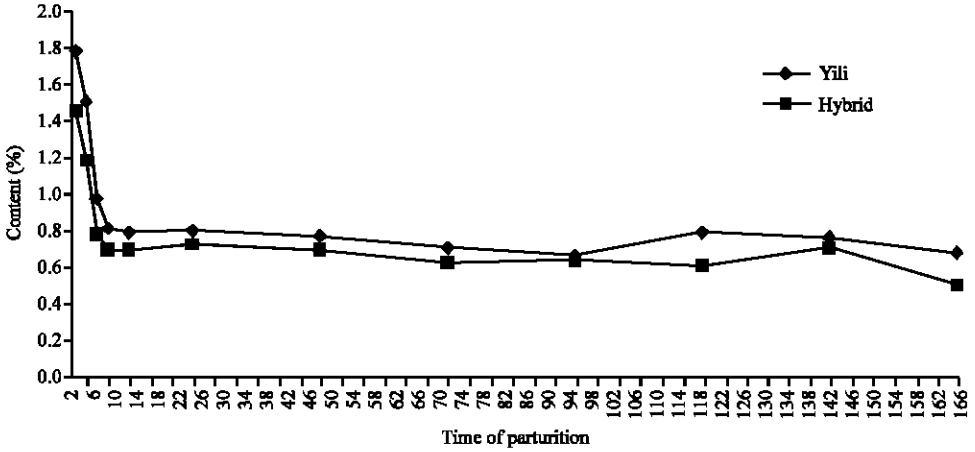

Fig. 4: The change of crude ash level of colostrums in Yili mares and hybrid mares

Conductivity: Conductivity, mainly influenced by the change of electrolyte components in colostrums, reflects the number of conductive ions in colostrums. Figure 5 shows the conductivity of colostrums of Yili mares reached maximum(4.07 S cm^{-1}) value at 2 h after parturition. The conductivity of colostrums of hybrid mares reached maximum (3.67 S cm^{-1}) value at 4 h after parturition. After that, the conductivity of colostrums of both Yili mares and hybrid mares decreased until 96 h. In the period between the 96 and 144 h, the curves of conductivity of colostrums of both Yili mares and hybrid mares were stable.

NFS: The NFS in colostrums of both Yili mares and hybrid mares reached maximum value at 2 h after parturition, respectively 23.35 and 21.18%. After that, the NFS in colostrums of both Yili mares and hybrid mares decreased fast until 12 h after parturition, respectively 9.84 and 9.14%. Later, the curves of NFS became stable. At 96 h, the NFS in colostrums of both Yili mares and hybrid mares reached minimum value, respectively 8.94 and 8.23% (Fig. 6).

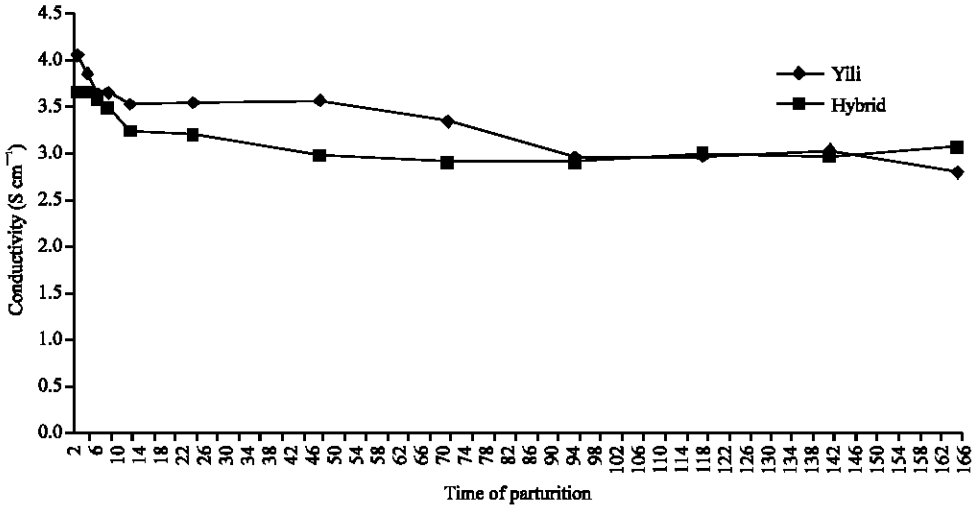

Fig. 5: The change of conductivity level of colostrums in Yili mares and hybrid mares

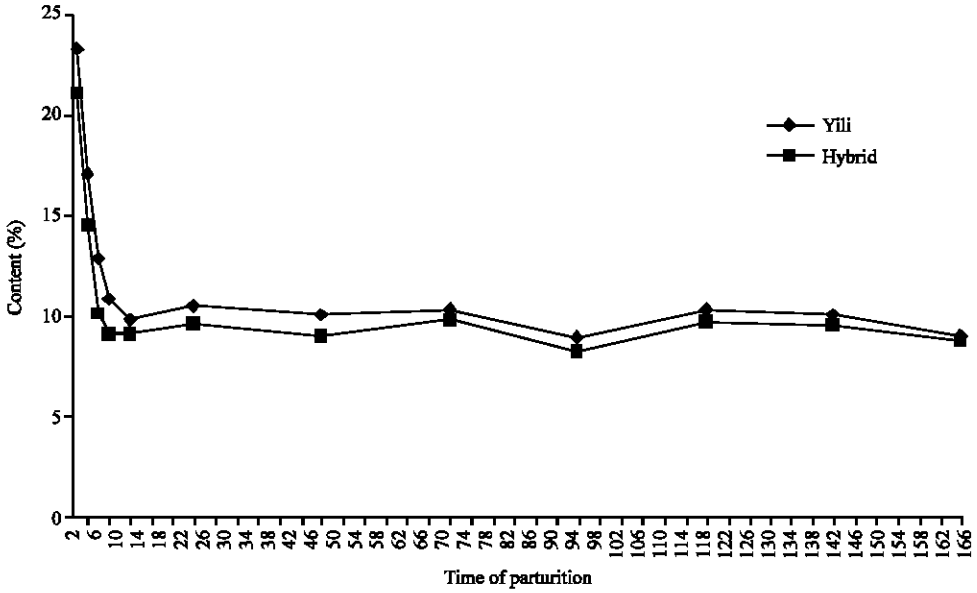

Fig. 6: The change of NFS level of colostrums in Yili mares and hybrid mares

DISCUSSION

The content of protein, ash and non-fat solids in colostrum of Yili horses and hybrid horse were decreased dramatically in 12 h after foaling. This conclusion is similar to the study of Haflinger, Breton, Boulonnais, Hungarian Draught breeds and Wielkopolska horse(Csapo *et al*., 1995; Csapo-Kiss *et al*., 1995; Pikul and Wojtowski, 2008).

As the main energy-saving and nourishing component in colostrums, fat, which is precursor of some bioactive substances, directly influences the metabolism of newly born foals (Yusong *et al*., 1995). In general, the more those breeds of mares have body fat, the more they have fat in their colostrums. The fat in colostrums is mostly used in the storage of body fat for foals, but it not very important for metabolism (Yongjiang *et al*., 2005). Although the fat content of colostrum in Yili

horse and hybrid horse colostrum were both changed irregularly, they were up to the highest value (3.71 and 2.91%) at 24 h after foaling, which was consistent with the conclusions on Arabian horse, Wielkopolka breed, Haflinger, Breton, Boulonnais and Hungarian Draught breeds (Pieszka, 2001; Pikul and Wojtowski, 2008; Csapo *et al*., 1995; Csapo-Kiss *et al*., 1995).

Protein, is one of the most important components of colostrums, mainly are immunoglobulin (Ig)(Yufen and Jianguo, 2002; Yide *et al*., 2000). Within 24 h after parturition (i.e., the first five times), protein content in colostrums of both breeds of mares decreased dramatically. The reason may be related with Ig decreasing fast. For all the samples collected in 144 h after parturition, the protein in colostrums of Yili mares was more than that of in hybrid mares; the difference was extremely significant in 4 h after parturition ($p<0.01$) and significantly more from 6 to 96 h after parturition ($p<0.05$). Due to the special structure of placenta of mares, Ig in the blood of mare is unable to be directly transported to the blood of equine fetal, resulting in the shortage of Ig in the blood of newly born foals. Therefore, in order to obtain passive immunity, colostrums are necessary for newly born foals. Protein in colostrums of mares not only fulfills the requirements of survival and growth for foals, but also enhance capacity of disease resistance(Yusong *et al*., 1995). This indicates that Yili foals perform probably better in disease resistance than hybrid foals.

The density of colostrums refers to the ratio of mass of colostrums at 20°C Vs the mass of water at 4°C, as shown in the stat. result, for all the samples the density of colostrums of Yili mares was higher than that of hybrid mares. Density is positively correlated with the content of dry matter in colostrums. Therefore, with the same colostrums intake, Yili foals take in more dry matter than that of hybrid foals. Whether such difference in dry matters can lead to more advantages in adapting environment for Yili foals than hybrid foals, it still needs to be studied.

In generally, the change of components in colostrums is the integrated reflection of heritage and environment (Teles *et al*., 1978; Xiaoyu *et al*., 2006). As shown the indicators in colostrum change in the stat. result, (including protein, density, crude ash and NFS), the difference between colostrums of Yili mares and hybrid mares narrows gradually as time goes by. The reason still needs to be studied.

Due to the special structure of placenta of mares, antibody level in the blood of newly born foals is mainly depends on the amount of colostrums intake and efficiency of antibody intake from colostrums. It's reported that intestinal permeability for protein is time-dependent (Rina *et al*., 2005). The curves of protein in colostrums of both mares breeds decreased dramatically in 12 h after parturition and became stable to ordinary index until 96h. Other indicators, also decreased in 12 h after parturition. Therefore, colostrums of mares, especially the colostrums in 12 h after parturition, not only influence the ability of disease resistance of newly born foals, but also influence it's the speed of its growth and development.

CONCLUSION

The content of protein, non-fat solids, density, ash, electrical conductivity in colostrum of Yili horses and hybrid horse were all higher than that in milk and gradually close to milk with the extension of lactation.

The content of protein, ash and non-fat solids in colostrum of Yili horses and hybrid horse were decreased dramatically in 12 h after foaling and the decline rate was up to the half of full extent. Therefore, let the new born foal eat colostrum in time, especially the colostrum in 12 h after foaling, it was very important to improve the feeding and management level.

The content of protein, density, ash, electrical conductivity and non-fat solids in Yili horse colostrum were different with hybrid horse at the same lactation period, as most measured values of Yili horse were higher than hybrid horse and the difference was gradually narrowing with extended lactation period. It needs to be further studied whether this difference will affect the growth and development of new born foals.

The protein content in colostrum of Yili horses was extremely significantly higher than that of hybrid horses after foaling in 4 h ($p<0.01$).

The content of protein, density, ash in colostrum of Yili horses was significantly higher than that in hybrid horses after foaling with 72 h ($p<0.05$).

The content of non-fat solids in colostrum of Yili horses was significantly higher than that in hybrid horses after foaling with 8 h ($p<0.05$).

ACKNOWLEDGMENTS

This study was supported by the project of The Ministry of Science and Technology of the People`s Republic of China (NO. 2005DFA30760). This study was supported by The Ministry of Λ agriculture of the Peoples Republic of China (NO. nyhyzx07-036-10). This study was supported by the project of The Bureau of Science and Technology of Xinjiang (NO. 200731134-3).

REFERENCES

Csapo, J., J. Stefler, T.G. Martin, S. Makray and Z. Csap-Kiss, 1995. Composition of mares colostrum and milk. Fat content, fatty acid composition and vitamin content. Int. Dairy J., 5: 393-402.

Csapo-Kiss, Z., J. Stefler, T.G. Martin, S. Makray and J. Csapo, 1995. Composition of mares colostrum and milk. Protein content, amino acid composition and contents of macroand micro-elements. Int. Dairy J., 5: 403-415.

Jirong, Z., O. Yangwen, Y. Xinkui, T. Xiaohai, X. Suyu, L. Heng and L. Lei, 2007. Study on alcohol content variation in fermentative koumiss. J. Xinjiang Agric. Univ., 30: 67-70.

Pieszka, M., 2001. The Composition of Arabian Mares Milk. Horse Breeding Department, Agricultural University, Al. Mickiewicza, Poland.

Pikul, J. and J.Wojtowski, 2008. Fat and cholesterol content and fatty acid composition of mares'colostrums and milk during five lactation months. Livestock Sci., 113: 285-290.

Rina, N., Z. Zejun, S. Jianhua, D. lai Li feng and B. Yin, 2005. Dynamic change of colostrum component of ewe. Contemporary Animal Husbandry,

Suyu, X., Y. Xinkui, T. Xiaohai, L. Heng, Z. Jirong, M. Ji and X. Peng, 2007. Study on the ability of producing acid by lactic acid bacteria in koumiss. J. Xinjiang Agric. Univ., 30: 98-101.

Teles, F.F., C.K. Young and J.W. Stull, 1978. A method for rapid determination of lactose. J. Dairy Sci., 61: 506-508.

Xiaoyu, Y., C. Jingping, Z. Fuxin, D. Huihuang and Y. Hua, 2006. Nutritional composition of shaneng goat colostrum. J. Shenyang Agr. Uni., 37: 454-456.

Xinkui, Y. and P. Hong-luo, 2004a. Relationdhip between competitive of Yili horse and its body measurement and age. Anim. Husbandry Vet. Med., 36: 6-8.

Xinkui, Y. and P. Hongluo, 2004b. Selecting yili racehorse by subsection physical measurements (SPMs). Anim. Husbandry Vet. Med., 36: 8-10.

Xinkui, Y. and H. Guocai, 2008. Horse Production and Management. China Agricultural University Press, Beijing, pp: 46-48.

Yide, Q., Z. Sixiang, X. Yinxue and X. Xueqing, 2000. Comparative study of some colostric components and reproductive performances between erhualian and yorkshire sows. J. Anhui Agric. Sci., 1: 99-100.

Yongjiang, M., Y. Zhangping, W. Xinglong, W. Zhiguo and L. Shuchun, 2005. Change of the milk components during the early lactating period for Chinese Holstein. China Dairy Cattle, 1: 55-57.

Yufen, Y. and Q. Jianguo, 2002. Import of colostrums. Livest. Poul. Ind., 3: 10-11.

Yusong, W., Z. Sixiang and Z. Yucai, 1995. Milk Biology. Jilin University Press, Changcun, Jilin, pp: 33-34.