

A SURVEY ON GROWING FOALS FEEDING MANAGEMENT

INDAGINE SULLA GESTIONE ALIMENTARE DEL PULEDRO IN ACCRESCIMENTO

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PAROLE CHIAVE:

cavallo, accrescimento, piani alimentari.

KEY WORDS:

horse, growth, feeding management.

Riassunto

L'indagine ha riguardato la gestione alimentare di tre allevamenti i cui puledri (n.74) sono stati destinati alla disciplina americana del reining oppure a gare di modello o di valutazione morfologica, con lo scopo di verificare la corrispondenza degli apporti alimentari forniti alle giumente a fine gestazione e lattazione e ai puledri fino ai due anni di età ai fabbisogni e di mettere in evidenza se eventuali eccessi o carenze alimentari si accompagnassero a patologie ossee da accrescimento. L'alimentazione delle giumente è risultata, in linea di massima, rispondente ai fabbisogni. L'incidenza di lesioni tipiche dell'accrescimento è stata più elevata nell'allevamento in cui i puledri hanno assunto, da 7 a 12 mesi di età, diete caratterizzate da un eccessivo apporto di sostanze azotate e di minerali, con particolare riferimento, allo zinco.

Summary

The trial concerned the study of the feeding management of three stud farms in which the foals were destined to the American discipline reining or bred for showing or morphological evaluation. The aim of the research was to examine the correspondence of nutrients intakes in mares at the end of their gestation and during lactation, and in foals up to two years of age, with animals requirements and then to point out if low or excessive feeding could be responsible for bone growth pathologies. Mares feeding met, in general, the requirements. The incidence of the typical lesions accompanying growth was higher in the stud farm where foals from 7 to 12 months of age assumed diets with excessive nitrogen and mineral content, with particular reference to zinc.

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Introduction

The disturbances of locomotor apparatus in the horse during its growth can preclude its career and cause economic damage to the stud farm.

Amongst the factors that play a role in these pathologies, other than the quick growth, the genetic attitude and the excessive physical exercise, we find unbalanced diets that involve excess as much as the lack of one or more main nutritional elements (1).

When we talk about feeding in foals we have to consider that their growth is conditioned by the nutritional elements that they assume daily and by the influence of mares diets during the last third of pregnancy and during lactation.

Considering all of these factors, we wanted to examine some diets used in mares at the end of their gestation and during lactation, and in foals up to two years of age, with the purpose of verifying first of all the correspondence with animals requirements and then to point out if possible conditions of low or excessive feeding could be responsible for bone growth pathologies.

Material and methods

Three stud farms were taken into account, all in the province of Verona; horses were destined to the American discipline reining (stud farm A) or bred for showing or morphological evaluation in the category of “weanling” (stud farms B and C).

- Stud farm A

The group was composed of 40 Quarter Horse mares, ranging from 5 to 20 years old.

Between the last phase of gestation (8- 9 months) and the end of lactation, the mares were fed with a “dry diet”, consisting of hay and concentrate (specifically formulated for mares). The foals were suddenly weaned at six months of age and fed with hay and concentrate (containing different nutrients in relation to the production period of the foals) (table 1). Even if the animals were kept in paddocks all day long, they never had the possibility to assume significant quantities of fresh grass due to lack of fodder in the fields.

The daily ration of feed was divided in two meals, at 08.00 and at 17.00.

Table 1: Feeding management used in stud farm A.

	Mare in gestation (9-11 months)	Mare in lactation (1-3 months)	Mare in lactation (4-6 months) and foal	Foal (7-12 months)	Growing foal (13-24 months)
Concentrate kg “mare”	4	4	4		
Grass hay kg	10		12		

Alfa alfa hay kg (2° cut)		12		5	8
Concentrate kg “weaning”				2	
Concentrate kg “yearling”					4
Vitamin and kg trace elements integration				0.05	0.05

- Stud farms B and C

In both stud farms there were 20 mares, from different breeds such as Quarter Horse, Appaloosa and Paint Horse, ranging from 3 to 16 years old.

As in stud farm A, the fodder covering the paddocks was negligible so the mares and the foals couldn't take advantage of great quantities of fresh grass.

Regardless of the category of the animal the same concentrate was used according to the ration schemes in tables 2 and 3.

Foals were suddenly weaned at the age of 4-5 months.

In the stud farm B hay was given to the mares and the foals at the morning meal (08.00); the concentrate was supplied to the mare only at the evening meal (17.00), whereas foals were given concentrate at both meals.

Table 2: Feeding management used in stud farm B.

	Mare in gestation (9-11 months)	Mare in lactation (1-3 months)	Mare in lactation (4-6 months) and foal	Foal (7-12 months)	Growing foal (13-24 months)
Concentrate kg	4	5	8	7	8
Alfa alfa hay kg	10	10	10	2.5	6

In the stud farm C the ration schedule provided both mares and foals with hay during the morning meal (08.00) together with the supply of half of the total quantity of cereals; mineral, protein and vitamin premix were provided at 12.00, as the remaining part of cereals at 18.00.

Table 3: Feeding management used in stud farm C.

	Mare in gestation (9-11 months)	Mare in lactation (1-3 months)	Mare in lactation (4-6 months) and foal	Foal (7-12 months)	Growing foal (13-24 months)
Oats 34% + barley 33% + maize 33%	3	5	6	4	4

Premix	kg	1	1.5	1.5	1.5	1.5
Grass hay	kg	10	10	10	4	4

None of the stud farms herds used the technique of creep feeding for the foals.

Samples of each component of the rations were taken for proximate analysis (2) and phosphorus, calcium, copper and zinc contents with an atomic absorption spectrophotometer.

On the basis of these results the nutritive value was calculated and expressed in UFC (Horse Feed Units) and MADC (Horse Digestible Crude Protein) (3).

The daily intake of nutrients were compared to the requirements of the animals, as suggested by Martin-Rosset (4) and Martin-Rosset et al. (5).

Results and discussion

From the analysis of the daily nutrients intake in each herd, it's possible to make some considerations:

- Mares in Gestation (9-11 months)

As daily d.m. intake was similar (12.4 -13 kg) in the three stud farms (table 4), nutrient intake of UFC were in excess (20-30%) than requirements; the excess for MADC was highest for stud farm B (159%).

Table 4: Daily intake and percentage differences with requirements (within brackets).

	UFC	MADC g	Ca g	P g	Cu g	Zn g	Dry matter intake kg
Stud farm A <i>Requirements = 100</i>	7 (+21)	876 (+81)	101 (+159)	51 (+82)	87 (-27)	936 (+70)	12.4
Stud farm B <i>Requirements = 100</i>	6.8 (+19)	1260 (+159)	192 (+392)	51 (+82)	137 (+25)	856 (+56)	12.5
Stud farm C <i>Requirements = 100</i>	7.5 (+29)	1077 (+122)	107 (+174)	49 (+75)	184 (+67)	521 (-5)	13

Meyer (6) reports that food energy, influencing the production of hormones involved in the resumption of cyclic activity, assumes an important role in the reproductive activity, as it doesn't seem to be a determining factor in the growth of the foal.

It has actually been seen that over-fed mares in this phase encounter easier in the next oestrus cycle an embryonic reabsorption (7)

The supply of nitrogenous supplements in the last month of pregnancy would affect the development of the foal, at least for the first five weeks of life, but it doesn't influence the weight of the foal at birth (8).

The effects of an energetic and nitrogenous over feeding in this phase, even though nowadays more frequent than we expect, have been not well studied. It's possible that unbalanced diets can cause metabolic disorders (acidosis), with negative recoil on the absorption and utilization of nutrients, that in this way become less available for the embryo.

In the present study, the intake of calcium and phosphorus were higher than requirements of the horse, especially in stud farm B (392% for Ca); Ca/P ratio was about 2/1 in stud farms A and C while in stud farm B it was about 3/1.

The excess of calcium, in addition to a rise of the losses of phosphorus in the faeces, can reduce the absorption of magnesium, manganese and iron by means of insoluble salt formations or a competitive mechanism in the absorption sites (7). This could affect the vitality of the foals at birth and, like in other species, the formation of bones and the neuro-muscular transmission (9).

Better in line with the nutrient requirements of the horse are the results of copper and zinc; the most evident unbalances were found in stud farm A, in which a lack of copper (-21%) and an excess of zinc (70%) were found.

- Mares in lactation (1-3 months)

In this phase of the productive cycle, the rations (table 5) were quite balanced both under energetic and nitrogenous aspects. In the stud farms A and B a slight lack of UFC (-13%) and an excess of MADC (70-78%) were found.

Table 5: Daily intake and percentage differences with requirements (within brackets).

	UFC	MADC	Ca	P	Cu	Zn	Dry matter intake kg
		g	g	g	g	g	
Stud farm A <i>Requirements = 100</i>	8 (-13)	1307 (+70)	208 (+343)	50 (+25)	171 (+14)	876 (+17)	14.3
Stud farm B <i>Requirements = 100</i>	8 (-13)	1372 (+78)	203 (+332)	56 (+40)	144 (-4)	1015 (+35)	13.4
Stud farm C <i>Requirements = 100</i>	9.4 (+2)	1236 (+61)	108 (+130)	56 (+40)	196 (+31)	567 (-24)	14.5

The physiological needs of the mare in this period reach their highest levels and the nutritional contribution is not only capable of affecting the animals health but also their reproductive abilities, their weight, and the growth of foal throughout the milk production.

Jarrige and Martin-Rosset (10) refer that a moderate energetic undernourishment at the beginning of lactation (80% of requirements), reduces no more than 10% the daily increase of foal. In the instances of slight low feeding the mare uses her own lipid reserves to prevent a drastic drop of milk production.

With reference to the nitrogenous supply it has been observed that the addition of urea in diets for mares with low proteic value negatively affects the growth of the foal (11) and that the blood concentration of limiting aminoacids, such as lysine

and methionine, results higher in foals from mares receiving soybean meal as proteic source in the diets (7).

Among minerals and trace elements the most important variations involved the intake of calcium that in stud farms A and B exceeded by 300% the requirements, with possible negative repercussions on the production of the parathyroid hormone and consequently on the kidney synthesis of 1,25-(OH)₂-vitamin D and on the intestinal absorption of calcium.

Similarly to what happens in other species, also in the horse it has been studied that the absorption of calcium varies in the opposite way respect to the quantity taken daily (10).

At a daily intake of calcium of 27 g/kg d.m., near to that found in stud farms A and B, it has been observed a rise in the bone density and a decrease of the cortical zone of the long bones (7).

The Ca/P ratio was equal to 4.6/1, 3.6/1 and 1.9/1 for stud farms A, B and C, respectively.

With reference to the intake of copper and zinc, the highest variations interested the stud farm B (-4% for copper and +35% for zinc) and C (+31% for copper and -24% for zinc).

- Mares in lactation and foals (4-6 months)

Only with limits arriving from a complicated valuation of the nutritional principles made without taking count of how much milk is actually consumed by the foals or how much food does the mares consume, we can say that, the stud farms taken in consideration, do respect the nutritional needs in most ways (table 6).

Table 6: Daily intake and percentage differences with requirements (within brackets).

	UFC	MADC g	Ca g	P g	Cu g	Zn g	Dry matter intake kg
Stud farm A <i>Requirements = 100</i>	8 (-33)	1300 (+9)	113 (+45)	56 (-10)	99 (-43)	996 (+14)	14
Stud farm B <i>Requirements = 100</i>	10 (-17)	1710 (+44)	234 (+200)	77 (+24)	164 (-6)	1492 (+71)	16
Stud farm C <i>Requirements = 100</i>	10 (-17)	1316 (+11)	109 (+40)	60 (-3)	202 (+15)	590 (-33)	15.5

The most significant changes in comparison to the actual needs were found in herd B and regard calcium and zinc values.

- Foals 7-12 months

In the stud farm A where the fodder/concentrates ratio was 71/29 a slight lack of energy (UFC -27%) was noted, while in stud farms B and C, where the same ratio was, respectively, 26/74 and 42/58, the UFC resulted higher than the needs by 9% (table 7). The intake of MADC, always in excess, resulted higher in stud farm B

(102%) than in A and C.

Table 7: Daily intake and percentage differences with requirements (within brackets).

	UFC	MADC g	Ca g	P g	Cu g	Zn g	Dry matter intake kg
Stud farm A <i>Requirements = 100</i>	4 (-27)	629 (+28)	105 (+218)	24 (0)	175 (+109)	875 (+119)	6.2
Stud farm B <i>Requirements = 100</i>	6 (-17)	990 (+44)	111 (+200)	52 (+24)	75 (-6)	1168 (+71)	8
Stud farm C <i>Requirements = 100</i>	6 (+9)	881 (+80)	70 (+112)	40 (+67)	148 (+85)	432 (+8)	8.5

The highest Ca/P ratio (4.3/1) was found in stud farm A, even though the intake of phosphorous was adequate to the requirements.

Savage et al. (12) while operating on foals in growth observed that the inversion of the Ca/P ratio determined a higher possibility of osteochondrosis with regards to a diet in which an excess of calcium comes together with the correct of phosphorous.

In this instance Cooper (13), reported that the excess of phosphorous, reducing the dietary cation/anion difference (DCAD), can determine acidosis and, consequently, an increase in the plasmatic level of parathyroid hormone which stimulates the intestinal absorption of calcium that would compensate the loss of urine elements.

Excepting for stud farm B, where there was a lack of copper (-6%), the levels of this element and zinc resulted correct or in excess to requirements.

The competition between copper and zinc observed in man and in different farm animals, hasn't yet been completely ascertained in the horse.

Hoyt et al (14), observed that the consumption in the diet of zinc oxide in dosages between 73 and 580 mg/kg, didn't influence the absorption and retention of copper if the latter is present in quantities equal to 12 mg/kg. The lack of Zn increases the loss of copper in faeces and reduces by 10% the blood copper level.

- Foals (13 - 24 months)

As reported in table 8, in the stud farm B the fodder/concentrates ratio was 42/58 and the resulting level in UFC was particularly high (32%).

The MADC have overcome in every case the needs foreseen for this animal category; the most significant changes were found in stud farm B (183%).

The levels of calcium and phosphorous, always with high values, are translated in Ca/P ratios of 3.7/1 (stud farm A) of 2.1/1 (stud farm B) and 1.9/1 (stud farm C). The contents of zinc more responding to the needs were found in stud farm C.

Table 8: Daily intake and percentage differences with requirements (within brackets).

	UFC	MADC	Ca	P	Cu	Zn	Dry matter intake kg
		g	g	g	g	g	
Stud farm A <i>Requirements = 100</i>	7 (+3)	1025 (+109)	140 (+367)	38 (+90)	203 (+103)	859 (+72)	10.5
Stud farm B <i>Requirements = 100</i>	9 (+32)	1386 (+183)	174 (+480)	67 (+235)	120 (+20)	1404 (+181)	12.4
Stud farm C <i>Requirements = 100</i>	7 (+3)	970 (+98)	82 (+173)	44 (+120)	162 (+62)	496 (-1)	10.2

Some considerations can be formulated referring to the lack or excess of nutrients previously discussed with the appearance of bone pathologies in the three stud farms (table 9).

Above all, the onset of the lesions were found for the most part in the period following the weaning and this brings one to assume that the unbalanced feeding registered in the diets of the mares at the end of gestation and during lactation didn't influence, at least not directly, the appearance of the above mentioned pathologies.

Table 9: Number and type of lesions examined in the stud farms.

	Phyinitis	Osteochondrosis	Angular deformities
Stud farm A <i>(foal born n. 37)</i>	0	0	0
Stud farm B <i>(foal born n. 19)</i>	3	2	2
Stud farm C <i>(foal born n. 18)</i>	1	1	1

In stud farm A the lack of energy associated with a moderate excess of MADC, in the phase after weaning, contributed to reduce the incidences of lesions since it permitted the animals to express a slower growth rate compared to the other subjects from the stud farms B and C.

When the improvement of the growth and the body conditions become the first priority, we find protein excesses, that in our case have overcome the needs by 102% (stud farm B) and 80% (stud farm C).

The most lesions were found in stud farm B in which two foals were inflicted, one with lameness, and the other with rigidity; for both their sport career was lost.

A part calcium excess found in all three herds and not always accompanied by a correct phosphorous level, the highest unbalances were found in stud farm B, where the lack of copper was associated with an excess of zinc that was exceeded by 67% of the known dosage responsible for symptoms recognisable of developmental orthopedic illnesses (15).

Conclusions

The feeding management of mares at the end of gestation, representing a critical aspect of the herd for the reflects that it had on the initial growth of the young, hasn't given any particular information on which to discuss.

To prevent the appearance of orthopaedic illnesses in foals after the weaning it's correct to avoid the nutritional gap between the period that precedes and that follows the lactation. It's right that the foals should be able to assume a creep feed since a few months old, i.e. a food that not only integrates eventual lack in the mothers milk but it is also capable of stimulating enzymes and to make easier the consumption of heterogeneous foods in the subsequent period. That could prevent the onset of endocrine variations and, consequently, of such lesions.

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