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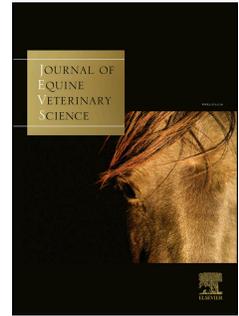
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**FEEDING AND MANAGEMENT PRACTICES FOR RACEHORSES IN TURKEY**

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**Abstract**

The aim of this study was to gather information on feeding practices, and to identify nutrient imbalances of racehorses in Turkey. 134 racehorses who visited the TJK (Turkish Jockey Club) Racecourse Equine Hospital in Istanbul were referred for professional nutritional advice in 2013. Each horse was examined and body weight (BW), body condition score, exercise level, feeding practices, reasons for the veterinary visit as well as feed and supplement intake were recorded. Intakes of energy, starch, crude nutrients, and minerals were calculated and compared with NRC [15] recommendations. Descriptive data were calculated using commercial statistical software (IBM SPSS Statistics 24, Chicago, IL). The median age of the population was 3 years. The mean BW of the horses was  $423.7 \pm 38.4$  kg and BCS was  $4.4/9 \pm 0.7$ . Nearly all (99.2 %) horses were fed grass hay and 61 % of the horses received alfalfa as well. The average forage intake was  $1.08 \pm 0.42$  % of BW/d. The average intake of concentrate was  $1.2 \pm 0.46$  % of BW. Forty nine percent of the horses were fed supplements and only 12 % received oil. The mean DE intake was  $1.03 \pm 0.26$  MJ DE/kg BW<sup>0.75</sup> for thoroughbreds and  $0.97 \pm 0.19$  MJ DE/kg BW<sup>0.75</sup> for Arabians. The calculated mean starch intake was  $5.0 \pm 2.2$  g/kg BW and the sugar intake was  $1.2 \pm 0.4$  g/kg BW. Communication between horse owners/trainers and the equine nutritionists is needed with regard to formulating a proper diet for each horse.

**Keywords**

Race horse; Equine Nutrition; Feeding Practices; Survey

**Introduction**

Nutrition is an important aspect of health in all species. In horses, nutritional imbalances can contribute to various disease conditions such as gastric ulcer, colic, musculoskeletal problems and obesity [9].

A number of studies have been published related to feeding and management practices of horses in other countries [4,5,7,9,11,16,17]. Common feeding practices range from feeding traditional home cereal-based mixes to various forms of manufactured feeds. Common additions include various types of vegetable oil, succulents, one or more vitamin and mineral mixes, herbal mixes, joint supplements and certain ergogenic agents with performance-enhancing claims. Many horse products are available on the market, with promises ranging from behavioral modification to increasing athletic performance. Dietary supplementation information also is available from several studies [2,3,10] and overall it

would appear that more than 60 % of horses receive a dietary supplement in the form of commercial vitamins or mineral mixtures.

The interest in the optimal feeding of race horses has increased in recent years, with some evaluation of the dietary management of racehorses in Turkey available [3]. However, research in this area is extremely limited and consequently the aim of this study was to gather information on feeding practices and dietary supplement use, and to identify nutrient imbalances and relationships with nutritional diseases and management conditions of racehorses in Turkey.

## Methods

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This study was conducted between April and October 2013 at the TJK (Turkish Jockey Club) Racecourse Equine Hospital, Istanbul, Turkey. One hundred and thirty-four Arab or Thoroughbred patients referred for professional nutritional advice were involved in the study. The most common breed represented were thoroughbreds (73.8 %), with the remainder being Arabians. Trainers/owners were interviewed to gather information on their horse(s): 1- breed, age, sex; 2- training schedule; 3- feeding regime (type and amount of roughage and concentrates, supplements, succulents, oils and water consumption); 4- general management (bedding material, deworming); 5- fecal appearance; 6- abnormal behaviors and 7- reason for veterinary visit. Body weight (BW) was measured using a weight scale and body condition score (BCS) was based on the 1-9 point system by Henneke et al. [8].

All horses were fed with the same hay, alfalfa, oat, barley, soybean meal, and samples were taken to evaluate the nutrient contents of the feedstuffs. The feed samples (n=5) for forages and concentrates were analyzed at the governmental laboratory (Tubitak Mam) in Turkey to determine moisture, crude protein, crude fat, crude fiber, and ash. The digestible energy (DE) value of the feedstuffs was calculated according to Zeyner and Kienzle [18]. The mineral and vitamin levels in forages and concentrates were estimated from the 'Nutrient Requirement of Horses' tables [15]. When commercial products were fed, the values on the declaration were used. Two calculations were made for each horse; firstly the current and secondly the required nutrient intakes were calculated for energy, starch, crude fat, crude protein, macro and micro minerals, and vitamins. Each patient was re-examined two weeks after the new feeding program was introduced. The DE requirements for horses were calculated using the following equations:  $DE \text{ (Mcal/d)} = 1.4 \pm (0.03 \times BW)$  for horses weighing 600 kg or less [15]. The energy requirement calculation included an adjustment for activity level. The assignment of the DE increments above maintenance (20, 40, 60, 90 percent) to the arbitrary classifications "light", "moderate", "heavy" and "very heavy" was used. The provision of nutrients was classified as very low (0-50 %), low (50-80 %), normal (80-150 %), high (150-250 % of the requirement compared to the NRC recommendations).

The SPSS 16.0 (IBM SPSS Statistics 24, Chicago, IL) was used to perform descriptive statistics. Normally distributed data are presented as mean  $\pm$  standard deviation, whereas skewed data are presented as median.

## Results

Reasons for visiting the hospital varied, with the most common being internal medicine (n=94) and orthopedic problems (n=40). The reported reasons for diet modification were weight loss or poor body condition (n=37), gastric ulcers (n=36), hard feces (n=11), developmental orthopedic disease (n= 9), myopathies (n= 7), synovitis (n=7), osteopenia (n=6), soft feces (n=5), continuous colic (n=4), sore shins (n=3), exostosis (n=3), coprophagy (n=2), laminitis (n=2), hoof problems (n=2), bone spavin (n=1) and behavioral abnormalities (n=1). Some horses were given a modified diet for more than one reason. The median number of visits to the hospital for nutrition consulting was 1 (range 1 to 9).

The median age of the population was 3, varying from 2 to 7 years. The majority of the horses were geldings (52 %). The mean BW for Arabians was  $404 \pm 40.4$  kg, for thoroughbreds  $430.4 \pm 35.43$  kg, with an overall mean BW  $423.7 \pm 38.3$  kg. The median body weight of these horses was 408 kg for Arabians (range, 303-461 kg) and 430 kg (range, 345-505 kg) for thoroughbreds. The mean BCS was  $4.4 \pm 0.7$  (range, 3 - 6/9).

The majority of the horses had a good appetite (79 %), a few horses had excessive appetite (2 %), and 19 % had a poor appetite. The most of the horses had moderate levels of water consumption (85 %), few had polydipsia (2 %) and the rest had low water intake. With regards to deworming during the last 3 months, most of the horses were dewormed (57 %), with a few horses definitely not dewormed (4 %) and 39 % of the horse owners/trainers reporting to not know whether their horse had been dewormed or not. Ivermectin and fenbendazole were the most common deworming ingredients. Sixty-eight % of the horses had normal feces quality, whereas 8 % of the horses had hard or dry feces. In this study, straw was the most frequently used bedding material (88 %), although shavings (7 %) and grass hay (5 %) were also used. The chemical compositions of the feedstuffs are shown in Table 1.

Table 1. The nutrient content of feedstuff on as fed basis

	Hay	Alfalfa	Oat	Barley	Soybean meal
Moisture %	8.1	9.1	9.3	9.4	8.7
DE MJ/kg	6.3	7.1	12.8	12.6	13
Crude protein %	3.6	16.4	8.5	8.4	46.7
Crude fat %	1.1	2.4	4.0	1.9	1.6
Crude fiber %	37.2	29.5	15.4	5.6	4.0
Ash%	8.2	9.2	2.9	2.2	6.7

#### Forage and concentrate consumption:

None of the racing stables has access to any pasture. Grass (meadow) hay is the most common hay fed to horses, followed by alfalfa. Grass hay is grown in all regions and is widely available in Turkey. The use of grass hay in the diet was 99.2 % and only 2.2 % of the horses were fed ad libitum. A total of 61 % of the horses consumed alfalfa hay together with grass hay in the ration. Three horses did not consume any concentrate feed and were only fed forage. The median number of concentrates fed was 2, but ranged from 1 to 5. The estimated amounts of forages and concentrates fed are provided in Table 2. The feeding schedule did not show variations for the majority of horses, with hay (97 %), alfalfa (90 %) and concentrates (92 %) being fed 2 times daily. The percentage of concentrate feeds consumed by racehorses is shown in Table 3. Seventy nine percent of the horses' diets contained grain, with 30 % fed only oats, 22 % only barley, 45 % oats and barley together and 3 % linseed, soybean meal, rice bran meal and cracked corn in addition to oats and barley. Oats were by far the most common grain fed and the mean oat intake was  $3.5 \pm 1.5$  kg/d. Only 3.6 % of the horses' diet contained commercial feed balancer providing essential nutrients like protein, vitamins, minerals and trace elements.

Table 2. The mean amount of forages and concentrate fed (% of BW/d)

Feed intakes (Mean $\pm$ sd)	All horses	Thoroughbreds	Arabians
Total forage	$1.09 \pm 0.42$	$1.06 \pm 0.44$	$1.17 \pm 0.35$
Alfalfa	$0.3 \pm 0.30$	$0.29 \pm 0.30$	$0.32 \pm 0.30$
Grass hay	$0.79 \pm 0.31$	$0.77 \pm 0.32$	$0.85 \pm 0.28$
Total concentrate	$1.20 \pm 0.46$	$1.23 \pm 0.48$	$1.09 \pm 0.38$
Grain	$0.80 \pm 0.55$	$0.81 \pm 0.57$	$0.79 \pm 0.50$

## Supplements:

Forty nine % of the horses were fed supplements, with 35 % of them fed one supplement, 32 % two supplements, 14 % three supplements, 18 % more than three supplements and 1 % received seven supplements. The mean number of supplements used was  $2.3 \pm 1.5$  and the median was 2 (range 0–7). The supplement use percentages are summarized in Table 3. The most commonly used supplements were chondroprotectives, multivitamins and gastro-intestinal protectives. The most commonly used vitamin-mineral mixtures were calcium, phosphorus and complete premixes.

Table 3. Concentrate feed intakes and combination with supplements

Concentrate	Horses %	Supplement use %	Vitamin and mineral %	Other supplements %
Grain	38	47	79	21
Commercial feed	19	56	50	50
Grain and commercial feed	41	56	42	58

2 % of the horses consumed only forage.

Oil was also used as a supplementary energy source but only 12 % of the horses were supplemented with oil, mostly corn oil or sunflower oil and the average amount of oil fed was 90 ml/day. Salt was often available as free-choice salt blocks containing trace minerals in many horses' stalls and was useful to provide the Na and Cl needs of the horse, especially those which sweat extensively and regularly. All horses were fed succulents, and 92 % of these were carrots, apples and parsley. Garlic powder, molasses, dried grapes, honey and mint were also used as treats.

## Nutrient Analyses:

Thoroughbred horse trainers fed an average of  $97.9 \pm 25.3$  MJ/day. The energy intakes were variable in comparison to NRC recommendations [15], 33 % of thoroughbreds had higher intakes than required with a further 33 % of thoroughbreds fed under the recommended energy levels. Arabian trainers fed an average of  $87.2 \pm 16.9$  MJ/. For 40 % of the Arabians the energy intake was within the range of NRC recommendations [15], with 37 % fed less and 33 % fed higher than the recommended energy levels.

Eighty eight percent of the horses were fed normal levels of crude protein and the intake was  $2.29 \pm 0.68$  g/kg BW, which was within the range of NRC recommendations [15]. The crude protein intake was higher in 7.4 % of the cases and lower in 4 % of the horses [15]. The estimated lysine intake was within the normal range for 91 % of the horses, with the remaining horses receiving less than recommended [15].

Mean crude fiber intake was  $3.1 \pm 1.5$  g/kg BW and crude fat intake was  $0.7 \pm 0.3$  g/kg BW, both being within NRC recommendations [15]. However, average starch intake was  $5.0 \pm 2.1$  g/kg BW and sugar intake was  $1.2 \pm 0.4$  g/kg BW, both of which were high compared to the NRC recommendations [15].

The comparison of macro and micro mineral intakes with the NRC recommendations is shown in table 4. In addition to the mineral contents of the diets, some of the mineral ratios are also important. The mean calcium:phosphorus ratio was  $1.6:1 \pm 0.8$  and the zinc : copper ratio was  $4.2:1 \pm 1.0$ . Forty two percent of the horses were fed with either calcium or phosphorus deficient, or both deficient diets and 53 % of the horses were fed with either zinc or copper deficient diets. Fifty eight percent of the horses were fed Ca, P, Zn, Cu, Se, I or Mg deficient diets.

The horses were fed with acceptable vitamin levels except Vitamin E. The vitamin E intake was less than the NRC recommendations for 54.4 % of the horses. However, in 71.4 % of the horses at least one of the vitamins or macro or micro minerals intakes was outside of the NRC recommendations [15].

Table 4. The macro and micro minerals intake (% of horses) compared to NRC recommendations

	Very low	Low	Normal	High
Ca	18.6	11.1	69.4	0.9
P	0.9	15.6	83.5	
Mg	2.7	5.9	90	1.4
Fe			100	
Cu	35.2	11.9	52.9	
Mn	4.4	23.1	72.5	
Zn	34.3	14.1	50.7	0.9
Se	38.2	11.1	50.7	
Co		0.8	99.2	
I	30.7	32.8	36.5	
Vit A	12.8	5.2	82	
Vit D	2.9	10.4	85	1.7
Vit E	37.3	17.1	45.6	
Vit B1	11.9	26.8	61.3	
Vit B2			100	

\*very low 0-50 %, low 50-80 %, normal 80-150 %, high 150-250 % of the requirement compared to NRC recommendations

## Discussion

Equine nutrition plays a critical role in equine health. However, many owners have an inaccurate understanding of equine nutrition [9] and decisions regarding nutrition are often based on “folklore, tradition and misinformation” [13].

## Forage

Grass (meadow) hay is the most common hay fed to horses in Turkey, which is similar to other European countries. Laboratory analysis of grass hay revealed a lower crude protein (3.6 %) and a higher crude fiber content (37.2 %) compared to NRC levels provided for this feedstuff. The DE content of the hay was low (6.3 MJ/kg) in comparison to NRC data provided for this forage, which is likely due to the maturity of the forage. The digestibility of hay depends on maturity at harvest, leaves to stem ratio, crude fiber content and storage conditions. As hay matures, leaves to stem ratio declines and neutral detergent fiber (NDF) in stem tissue increases, although the NDF in grass leaves is more digestible than the NDF in stem tissue [15]. By way of the relationship between NDF and energy supply, mature hay provides less energy than immature hay. Consequently, a hay-only diet of this nature would not meet the energy requirements of a racehorse. The inclusion of alfalfa did increase the protein content of the ration; however, alfalfa hay is not as commonly fed in Turkey as in countries such as the United States [7], Australia [11] and UK [7], because it is generally more expensive to feed.

The average grass hay intake was higher (3.4 kg) and alfalfa hay intake was lower (1.27 kg) in Turkey compared to Australia (2.5 kg grass or alfalfa hay, [11]). However, the average daily forage intake was higher (4.7 kg) for thoroughbreds in Turkey than in Australia (3.3 kg) [11] but was lower than in many other countries. However, it is approximately 1 % of the BW on a DM basis which is the NRC absolute minimum intake. Furthermore, 10 % of the trainers feed less than 2 kg forage per day and it should not be surprising that many of these trainers complain about the difficulties in getting horses to eat well enough. This could relate to gastric ulcers, hind gut disturbances or B vitamin deficiencies due to abnormal hind gut function when low forage diets are fed.

In this study, straw was the most frequently used bedding material (88 %). The preference of straw may be attributed to its availability, relative low cost, and relative ease of disposal, as well as providing a deep, warm and comfortable bed. However, straw is believed to increase the risk of

impactions and inflammatory airway disease in horses [7]. On the other hand, straw can replace hay when it is fed by the horses and the low hay provision could be balanced by the intake of straw.

### **Concentrate:**

Turkish trainers have traditionally fed more “straights” than premixed feeds, although this pattern appears to have changed since 60 % of the horses in this study were fed a ration that contained a commercial feed preparation. This study illustrated that 41 % commercial feeds were not used according to instructions, but are diluted with other grains, which diminishes the value of the vitamin and mineral premixes in the feeds. These feeds are a simple and economic method of feeding but still gives the user control over grain and energy intakes. Unfortunately, most horse owners ignore the feeding instructions and feed these products at lower than recommended levels, so they do not provide an adequate diet. In contrast to our study, Huntington [11] showed that the average amount of concentrate fed was 7.8 kg by Thoroughbred and 7.7 kg by Standardbred trainers, whereas 5 kg by Thoroughbreds and 4.3 kg/by Arabians was fed in Turkey. This might be due to the smaller size, higher forage intakes and lower training loads in Turkey. Small amounts of other straight grains or grain by products and proteins are also fed in Turkey like in other countries [4]. The oat, barley and soybean meal fed in this study had typical nutrient profiles for these feed types, albeit the protein levels for oats and barley were slightly lower than the NRC values [15]. The range and quality of commercial feeds available in Turkey have increased dramatically in recent years. However, there is still a substantial prejudice against pellets by trainers.

### **Supplements:**

The results of this study also demonstrated the widespread use of supplements. A large amount of supplementation can sometimes lead to increased costs of feeding and oversupply of certain vitamins and minerals, with possible interactions and interferences.

Various feed additives and supplements can be given to horses. In accordance with our study, approximately 84 % of owners reported to include at least one dietary supplement in their performance horse’s daily feed in New England [9]. The most commonly used supplements were chondroprotectives, electrolytes, and multivitamins.

Despite widespread use of fortified commercial feed and supplements our study has shown that 71 % of the horses had at least one of the vitamin, macro or micro mineral intakes lower than recommended by the NRC [15], copper, zinc, selenium, iodine and Vitamin E deficiencies were the most common. In contrast Honore [10] reported that horses receiving some type of nutritional supplements were twice as likely to have excessive dietary levels in at least one nutritional category compared with non-supplemented horses, increasing the likelihood of an improperly balanced ration. Most trainers have little concept of the mineral and vitamin needs of their horses and what is supplied by commercial feeds and supplements, hence the choice of supplements becomes difficult. Causes of deficiencies can include low specifications of certain nutrients in feeds and supplements, and lower supply of commercial feeds and supplements than recommended. In particular dilution of commercial feeds with straight grains leads to lower nutrient intakes than the nutritionist intended when the feed was designed. Trainers and owners need to use a commercial feed at recommended amounts, otherwise if they feed lower amounts they should use a more concentrated commercial feed such as a semi-concentrate or a ration balancer. Therefore, the use of feed supplements without proper guidance and education could prove detrimental to the horse. This demonstrates the importance of a careful diet history and in-depth communication between the equine nutritionist and the client regarding the horse’s diet in relation to any medical problems and the concurrent use of any form of nutritional supplement.

Carrots and apples are the most commonly given succulents in Turkey as in the UK and Germany [7] and other countries. Supplemental vegetable oil is often fed as an alternative or additional energy source [6]. The average amount of oil fed was less than 100 ml (3.5 MJ energy) in our study while it was less than 125 ml in the study of Huntington [11]. However, the fat addition as an oil should not be

taken into account as a single parameter since some high energy supplements and the new premixed feeds for racehorses also contain considerable quantities of added fat.

### **Nutrition analyses and diseases**

Thoroughbred trainers fed an average of 22 MJ/100 kg BW which is a lower energy intake than the energy intakes (26 MJ/100 kg BW) of horses in Australia [11] and many other countries. The size and body weight of the horses is in Turkey smaller than in Australia and some other countries thus, the lower energy intake is acceptable. Furthermore, there is a significant variation in daily intake that presumably relates to workload and individual metabolism.

The racehorses are performance horses and most are not growing thus they do not need a high protein level. In our study most of the trainers fed a normal amount of crude protein with an average intake of 969 g, however, in Australia most of the trainers fed more crude protein than recommended by the NRC with an average of 1450 g. The low protein grass hay and low concentrate amounts led to this overall lower intake.

The starch (mean 5 g/kg) and sugar intake (2 g/kg) were higher than the NRC 2007 recommendations [15]. And this may be correlated with the most commonly reported diseases of internal medicine. This group included gastric ulcers (EGUS), poor body condition or weight loss, and was similar to the study of Hoffman [9]. Additionally, the trainers often complain about lower performance than the horse's ability or capacity. EGUS has a multifactorial etiology with several potential risk factors. High starch intake of > 2 g/kg BW/feeding time was associated with an approximately twofold increase in the likelihood of EGUS in Denmark [12].

In 71 % of the horses at least one of the vitamin, macro or micro minerals intakes, particularly Ca, P, Zn, Cu, Se, I, Mg and vitamin E intake, were deficient. In contrast Harris [7] showed that most of the horses were being fed very high amounts of Ca, P, Mg, K, Cu, Fe, I, Co and vitamin A and D in the UK and Germany. Orthopedic problems were the second most common disease group in this study, and that might be related to deficiencies of calcium and phosphorus which constitute the major part of the mineral content of the bone.

As in Australia [11], UK and Germany [7], a Thoroughbred in race training is likely to be kept in an individual stall over 20 hours per day and there was no access to grazing in Turkey. Previous studies have found correlations between increased visual horizons, social contact, and reductions in stereotypic behavior (McGreevy et al, 1995; [2]). The occurrence of stereotypies or other unusual behaviors in this survey is similar compared to previous surveys [14,16]. The most common abnormal behavior was wood-chewing was 8.2 % in the present survey while it was reported as 0.9 % by Sondergaard [16], and 11.8 % by Nicol [14]. However, in our experience, stereotypic behavior is more common than it was reported here. The low percentage recorded in this study might be due to Turkish trainers or owners may not be aware that their horse is performing a stereotypy or that they do not want to admit behavioral problems in their stable.

Consequently, nutrition is a critical component of equine health. Although there is considerable variation in the management and feeding practices of the domestic horse across the world, feeding practices of race horses in Turkey were consistent with the feeding practices across the world apart from lower intake of DE and lower quality ingredients. Horse trainers lack of knowledge and decisions regarding nutrition often are based on tradition. It is difficult to understand that more feed does not necessarily mean horses will run faster [11]. Proper communication between horse owners and equine nutritionist is needed with regard to formulating a proper diet for each patient. This is also true for supplement use and how it may interact with other medications being administered to an individual animal. Thus, the equine veterinarians and horse trainers need to be prepared to discuss ideal nutritional practices with an equine nutritionist.

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## Highlights:

- Feeding practices of racehorses in Turkey were evaluated via professional nutritional services.
- Nearly all horses were fed grass hay and some of the horses received alfalfa as well.
- Grass hay quality was particularly poor on protein level.
- Lack of roughage and excess of concentrates are the most important faults and imperfections.
- In the majority of the diets at least one of the vitamins, macro or micro minerals content was highly deficient.
- Horse trainers lack of knowledge and decisions regarding nutrition often are based on tradition.
- Feeding practices of race horses in Turkey were consistent with the feeding practices across the world apart from lower intake of DE and lower quality ingredients.