

UNIVERSITÀ DEGLI STUDI DI PADOVA

DIPARTIMENTO DI AGRONOMIA ANIMALI ALIMENTI RISORSE
NATURALI E AMBIENTE

Corso di laurea Scienze e tecnologie animali

**FEEDING AND ATHLETIC PERFORMANCES OF
STANDARD BRED HORSES UNDER AGONISTIC ACTIVITY**

ALIMENTAZIONE E PERFORMANCE ATLETICHE DI CAVALLI
TROTTATORI IN ATTIVITÀ AGONISTICA

Relatore Prof. **Roberto Mantovani**

Laureanda **Irene Fernandez Biolo**

Matricola n. **1026257**

ANNO ACCADEMICO **2013-2014**

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Summary

This thesis has wanted to describe the feeding of standardbred horses in agonistic activity. The aim of this study was to accurately describe all food used to balance a proper diet for horses who perform intense physical activity every day in preparation for the trotting races. I have examined the physiology of digestion, the digestibility and nutritive value of food, hygiene and athletic performance, the nutritional requirements, the main foods intended for feeding horses and rationing. At the Paolo Leoni's Stable located in Sant 'Angelo di Piove di Sacco, I place an analysis of the average time of the tests (on the track of 2000 meters), BPM (beats per minute) and finally an assessment based on visual and tactile softness and sheen of the coat of 10 horses; I have developed a score from 1 (lowest score) to 3 (highest) to objectively assess the feedback obtained. The data were collected in two different periods: October 2013 and February 2014. In the first period was given the complementary feed "Grigi-Cereali" and I could see that the average test time was 2,537, the average was 97.4 BPM and the score of the shine and softness of the coat was 2 . In the second period, however, was administered to the same horse feed supplement Purina Horse Starr: with this new feed, rich in vitamins (A, E, D3, B1, B2, B6, B12, PP) and pro-vitamins, I am treated to a marked improvement of 10 horses examined, in fact, the average BPM was 94.6, the score of the shine and softness of the coat had reached the highest score of 3, but the average test time has remained the same: 2,537. With the new feed, so I found less fatigue at the end of racing on horses that were less tired compared to the first period where they were sweating profusely and BPM were higher.

Riassunto

Questo lavoro di tesi ha voluto descrivere l'alimentazione dei cavalli trottatori in attività agonistica. L'obiettivo del lavoro è stato quello di descrivere con precisione tutti gli alimenti utilizzati per bilanciare una dieta corretta per cavalli che svolgono ogni giorno un'intensa attività fisica in preparazione alle gare di trotto. Ho preso in esame la fisiologia della digestione, la digeribilità e il valore nutritivo degli alimenti, l'igiene e le performance atletiche, i fabbisogni nutritivi, i principali alimenti destinati all'alimentazione equina e il razionamento. Presso della Scuderia di Paolo Leoni situata a Sant'Angelo di Piove di Sacco ho effettuato un'analisi dei tempi medi delle prove (su pista di 2000 metri), BPM (battiti per minuto) e per finire una valutazione su base visiva e tattile della lucentezza e morbidezza del mantello su 10 cavalli; ho elaborato uno score da 1 (voto più basso) a 3 (voto più alto) per valutare obiettivamente le valutazioni ricavate. I dati sono stati raccolti in due periodi differenti: ottobre 2013 e febbraio 2014. Nel primo periodo è stato somministrato il mangime complementare Grigi-Cereali ed ho potuto constatare che la media dei tempi di prova era di 2,537, la media dei BPM era di 97,4 e lo score della lucentezza e morbidezza del mantello era di 2. Nel secondo periodo, invece, è stato somministrato agli stessi cavalli il mangime complementare Horse Starr Purina: con questo nuovo mangime, ricco in vitamine (A, E, D3, B1, B2, B6, B12, PP) e pro-vitamine, ho potuto assistere ad un netto miglioramento dei 10 cavalli presi in esame, infatti, la media dei BPM era di 94,6, lo score della lucentezza e morbidezza del mantello era arrivata al punteggio più alto di 3 ma la media dei tempi di prova è rimasta invariata: 2,537. Con il nuovo mangime, quindi, ho rilevato un minor affaticamento sui cavalli che a fine corsa risultavano meno provati e stanchi rispetto al primo periodo dove sudavano abbondantemente e i loro BPM erano più elevati.

1. Introduction

The mechanism of nutrition is very complex and, in order to understand in a clear and concise, can not ignore some basic definitions. In particular, the foods of vegetable or animal origin are able to provide the animals with the nutrients (sugars, proteins, minerals, water) necessary to perform all biological processes. The nutrients, consisting of simpler compounds, the nutrients are transformed and absorbed by the body through metabolic processes. These are made possible by regulating action and catalytic other substances: enzymes, hormones, vitamins and ions of mineral elements. The diet of the horse is mainly characterized by plant foods, consisting of the following components: water, protein, fat, carbohydrates and minerals. Water is present 70-90% in all plant tissues, fresh 10-18% in the dry fodder, while it is about 10% in food concentrates. The components of food except water are the dry matter.

Athletic performance of a horse depends on many factors and there are many physiological mechanisms that interact to allow for proper muscle work and ensure high levels of performance. These mechanisms work together like links in a chain, you get the best performance that we must all work to the fullest. Power is certainly a crucial link in this chain. Each horse has its basic food needs required to meet the needs of its so-called maintenance.

A horse athlete who undergoes regular training and competition will, however, needs more to meet the energy demands and not just work-related muscle is subjected, ie, we can say that its needs for maintenance are to add it needs work. The power of the horse athlete must, therefore, to best meet these needs in order to allow the animal to develop in training, and to express in the race, its full potential, reaching the highest level of performance.

1.1. Outline of the physiology of digestion

A good food program depends, in the breeding of sport horses, by several factors: among these, the most important relate to the knowledge of the nutritional requirements and the characteristics of the food, as well as the ability of the coach or of breeder to follow the horses at the individual level through the appropriate use of balanced rations. Proper rationing can't transcend the knowledge of digestive physiology of the horse.

1.1.1. Administration of food

When speaking of physiology it can't be neglected the individual characteristics of the horses also in relation to other ways of administration of food; some horses eat slowly, others more quickly; in equal conditions, the reaction that gives the greatest performance in a subject may be insufficient or

excessive in another. Horses often ingest food concentrates too quickly: that also negatively affects digestion and thus their use. You can avoid that by using mangers very wide and flat, or you can put in the manger some smooth stones that prevent the animal from making large chunks. Regularity of mealtimes is very important, especially for those horses that can't enjoy the benefits of pasture. Even diet changes should be made gradually, avoiding stress that may damage the functionality of the digestive system. The horse has a relatively small stomach so a sudden build-up of food can cause colic or other serious disorders of digestive system, in addition to a limited digestion of foods; also the movement affects digestion.

1.1.2. Ingestion of food

a) outline of anatomy ingestive tract

The ingestive tract consists of the mouth, the pharynx and the esophagus. The mouth is a cavity bounded by the lips, cheeks, palate and floor of the mouth. Lips, furniture and subtle, are involved in the understanding of the foods and in fluid intake: therefore, it is easy to see how injury or inflammation of the lips can cause a serious injury on the horse's ingest ability. The lips are also tactile organs and therefore have a fundamental role in the recognition of food substances. Cheeks, long and not very mobile, are involved in the mixing of food during mastication. The palate is the ceiling of the oral cavity and is formed of two parts, one front and one rear, said the hard palate and soft palate respectively. The mouth is characterized by the presence of the two dental arches and tongue, elements of fundamental importance in the ingestion of food. In particular, the dental arches are very long and interrupted by a zone free of teeth. The teeth are divided into incisors, premolars and molars; among these, the incisors and the premolars are subject to two sets of teeth and the canines are almost always absent in females. The pharynx is the second part of the digestive tract. The anatomical features of this organ prevent from breathing and vomiting. The esophagus is the terminal part of the ingestive stretch: it is a muscle - a membranous that goes from the pharynx to the stomach.

b) prehension, mastication and insalivation of food

Prehension of food takes place through the upper lip, which also has an important function in both the recognition and in the choice of foods. The intake of liquids by suction is brought about by the movements of the tongue that determine, in the oral cavity, the vacuum necessary to intake the liquids. Flour foods are always to be discarded because they can irritate the upper respiratory tract, causing even chronic bronchitis. The next step to prehension food is chewing: it takes place through

a mechanical process during which the food is chopped and moistened; chewing is a reflex action caused by the presence of food in the mouth. In the horse chewing is prolonged and laborious (70/80 acts per minute) and is determined mainly by action of the molars. Shredding of the foods is made possible not only by action of the teeth, but also by the processes of insalivation. Saliva is secreted by the salivary gland: its main function is to moisten the food and dilute, allowing swallowing and a better gastric digestion. On average, in a horse, 40 liters per day are secreted. It has a pH of about 7.5 and is therefore slightly alkaline. For its characteristics, saliva also has an important buffer function in the stomach (it, has the ability to control the level of acidity of the stomach) and influences the intestinal absorption of foods. Ingestion of food ends with swallowing: it is an act only partially voluntary. The bolus into the esophagus to the stomach progresses through various contractions of the esophageal muscles. In the horse, contrary to what occurs in other species, the absence of ptyalin in the saliva prevents the initial degradation of the foods for which this first stage only has the ability to transform the food bolus, which can then more easily undergo the action of the gastric juices.

1.1.3. Gastric digestion

The stomach has a maximum capacity of 15-18 liters, very limited then. This feature is due to the fact that the horse was originally a migratory animal, that was accustomed to eating little and often, as a function of his shifts. The reduced capacitance of the stomach involves, therefore, a poor digestive activity, especially when the ration is concentrated in a few meals (1-2). The stomach has two sphincters that take the name of the cardia and pylorus. The first is located at the point where the esophagus flows into the stomach, and has the function of preventing the reflux of gastric contents in the esophagus itself; It is particularly well developed in the horse. The point of passage between the stomach and duodenum is marked by a slight shrinkage that takes the name of the pylorus; the pylorus allows rapid passage of food into the duodenum. The stomach walls are coated with different types of mucosa; the last secretes a mucus particularly dense intended to protect it from acidity of gastric contents. The acidity of the stomach is not the same in all its parts: the pH of the fundic region is about 5 to 4.5, while at the height of the pylorus it is lowered up to 2.6; these variations are of acidity due to the presence of hydrochloric acid. The mechanical action is due to several movements including the main ones that are the peristaltic contractions of the pyloric antrum; these carry forward the chyme from the stomach to the duodenum. The physiological characteristics of the stomach, allowing the use of only partial concentrated feed, requires the early administration in advance of roughage (hay, etc..), that will be digested mainly in the final stretch of

the digestive tract (caecum, colon) and only afterwards that of the concentrated feed, so that the latter can stay longer in the stomach and undergo degradation of some of their components.

1.1.4. Digestion in the small intestine

The small intestine is between the stomach and the large intestine. The length is 20-22 meters with a diameter of 3-5 cm. It is characterized by an average capacity of 64 liters.

	Length (m)	Capacity (l)
stomach		15-18
small intestine	22	64
caecum	1	30-35
large colon	3-4	80-90
small colon	3	
small colorectal		15
total	30	200-220

The small intestine is placed in the left lateral region of the abdominal cavity and is divided into two main parts: the duodenum and the ileum-fasting. The structural element characteristic of the small intestine is formed by the presence of many reliefs, the "villi" that increasing the surface area of contact with the products of enzymatic degradation facilitate the absorption of nutrients. The digestive process of the small intestine is made possible by the products produced by two glands attached to it: the liver and the pancreas. The wall of the small intestine has a number of nerve and muscle bundles that cause a variety of serial contractions. These determine four types of coordinated movements that promote rapid progression of intestinal contents. These movements are regulated by the autonomic nervous system (sympathetic and parasympathetic). Sudden variations in the speed of transit may determine occlusions or invaginations and, consequently, colic; violent contractions may also occur for changes in diet and / or for the amount of food intake. Diet changes promote intestinal motility for a limited period of time, and this can also cause a mild diarrheal state in the subject. The same can occur for intensive work done during digestion, especially after administration of concentrated feed.

Protein: the small intestine is the headquarters of protein digestion and absorption of amino acids: at least 60-70% of dietary protein can be digested before reaching the large intestine.

Fat: also fats are digested and absorbed in the small intestine in most; subsequently, they are mostly absorbed as fat reserves.

Minerals: are absorbed for the most part in the small intestine, with the exception of phosphorus. The absorption occurs by osmosis and in particular sodium and potassium ions exert a fundamental function in the osmotic balance of the intestinal wall.

Vitamins: they are absorbed mainly in the small intestine, in particular the fat-soluble vitamins (A, D, E, K), whose assimilation is accompanied by that of fats. The B-complex vitamins (water soluble) are only a small part absorbed in the small intestine; most of them is subsequently assimilated in the large intestine. From the above, it is clear that the small intestine in the horse has a fundamental role in the utilization of food. This is particularly important especially in the case of horse sports: In fact, the use of food is almost exclusively concentrated in the small intestine. Do not underestimate the splitting of the ration in most meals, as it favors the digestion of concentrated food in the stomach, increasing the digestibility and energy efficiency of the food itself.

1.1.5. Digestion in the large intestine

The large intestine of the horse makes up about 60% of the whole volume of the digestive tract and consists of three segments: the caecum, the large colon and small colon. Of these, the largest portion is given by the large colon, measuring 3-4 meters in length and 80-90 liters of average capacity. The numerous loops present in this part of the digestive tract considerably reduce the speed of transit of food. The large intestine is home to some of the most important transformations of foods: in fact, in it there are many micro-organisms, bacteria and protozoa, which degrade those substances that had not previously undergone the digestive process. These microorganisms originate from the fermentation, especially in the caecum and large colon, load by the fiber-rich foods and at the expense of the proteins that have escaped the enzymatic digestion of the small intestine. Overall, the micro population of the large intestine of the horse can be likened to that of the rumen of cattle, although in the equine effectiveness is less for both the limited residence time of food, and because the large intestine of the horse is found after the small intestine. The fermentation processes in the large intestine of the horse can be summarized as follows:

- a) degradation of carbohydrates membrane
- b) conversion of nitrogenous substances
- c) processing of the B-complex vitamins

1.2. Digestibility and nutritive value of food

1.2.1. Digestibility

The nutrients present in foods are not completely digested by the animal. The percentage ratio of absorbed nutrients and nutrients found in food is the coefficient of Use Digestive (CUD):

$$\text{CUD} = \frac{\text{substances ingested} - \text{substances excreted in the feces}}{\text{Substances ingested}} \times 100$$

This coefficient depends on the anatomic-physiological characteristic of each species, mainly by:

- characteristics of individuals and their health status;
- type and percentage of fiber contained in food;
- effectiveness of mastication, the presence of intestinal parasites, speed of transit of food.

Between these, it is of particular importance the percentage and the type of the fiber: reduced digestibility is in fact much more evident as the fiber content of the diet is high, and the more this is lignified. Therefore forages are less digestible than the concentrates. This aspect is of particular importance in equine nutrition since the fodder constitutes the fundamental element of the diet.

1.2.2. The nutritional value

From the physiological point of view the nutritional value is given by energy supplied from food; in practice, it represents the value of the transformation of food in a certain production. The energy contained in the food takes the name of *gross energy*: this suffers first loss as a result of incomplete digestion of the food itself; the difference between gross energy and energy contained in the faeces represents the *digestible energy*. It must be remembered that the fecal energy is also made from that contained in the residues of digestive juices (mucus, epithelial flaking, enzymes, bacteria). The subsequent loss of energy occurs with the elimination of urine and methane gas produced by the bacterial fermentation. The difference between these values and the digestible energy is *metabolizable energy*. A part of this will be lost to carry out the processes of digestion and assimilation, which is accompanied by a certain heat production: these energy losses represent the *energy cost* of food use and the difference with the metabolizable energy is the *net energy* that is necessary to ensure the maintenance of physiological conditions and various productions.

1.2.3. Main energy resources and balance the ration for the horse racing activities

The diet of a sport horse is mainly based on the use of rations with a high energy content that can cover the needs without unduly burdening the digestive tract.

- The *raw fiber* is a limited source of energy. Nevertheless, its presence in the ration of the athlete horse is important to facilitate the digestive transit in the large intestine by preventing the stagnation of the intestinal contents and dismicrobism, often at the origin of colic.

- The *amids or NSC* constitutes the main source of energy supply of the equine athlete. They are administered in the form of cereals (oats, barley, corn, etc.), whose proportion in the ration increases as a function of the work's intensity. However, their use has limitations, both from the digestive and metabolic point of view. In the former case, the excess starch is likely to stifle the enzymatic digestion in the small intestine, favoring the abnormal fermentation in the large intestine resulting in acidosis, digestive, intestinal inflammation and overproduction of endotoxin. From the metabolic point of view, the extraction of inazotati favors the excessive accumulation of glycogen in muscle, and hyper production of lactic acid which predisposes to myoglobinuria.

- *Fats* are the best energy source for testing background. They allow a saving of muscle glycogen and blood glucose greater stability.

- *Protein* needs are little affected by muscular work. An increase in these requirements could, however, occur at the beginning of training or in subjects engaged in endurance events. In this case it is convenient to improve the protein quality of the ration with alfalfa meal, soybean, and peanut.

- *Mineral elements*. Muscles are influence particularly by the needs of sodium chloride, calcium and magnesium as well as some trace elements. With regard to the trace elements it refers especially to iron, copper, zinc, iodine and the selenium, their requirements are increased considerably in function of the high energy content of the ration of increase in calcium and the same. When a horse undergoes an intense physical activity he needs the minerals following the general basic rules.

- *Vitamins*. The intense physical activity requires an increased vitamin ration. However, do not overdo because the doses can be dangerous for the horse's ration, resulting in serious cases of hyper vitaminosi, especially in the case of vitamins A, D, K.

1.3. Feeding, hygiene and performance

Feeding, hygiene and performance are closely linked to each other: any pathological states involve a reduction in performance of 15% or more. In horses, the disease states related to nutrition are among the most frequent and one can easily imagine the importance of proper nutrition in order not only to improve the performance as to prevent the onset of disease. A proper rationing prevents nutritional deficiencies, increases resistance to infection and pest attacks, and facilitates recovery from any disease as well as increase the efficiency, productivity and performance of the subjects: proper nutrition promotes the production of antibodies needed to fight off infections, facilitates the detoxification mechanisms of the body and increases the integrity and strength of the tissue. In the case of sport horse this aspect assumes great importance since it is delicate and easily susceptible animals to contracting diseases.

1.3.1. Major disorders of digestive system

The food-borne disorders range from mild illness to death of the animal: it is therefore important to know the type, causes and treatment of the most common digestive disorders. Almost always, eating disorders are accompanied by loss of appetite; it is therefore necessary to check:

- the presence of irregularities dental or oral lesions;
- intestinal noise (to verify the occurrence of colic);
- the possible difficulty with urination;
- the color and the smell of feces.

1.3.2. Intestinal parasites

All the horses, and among them especially the foals, are subject to more or less severe infestioni of internal parasites. You must know the type of parasite and its evolutionary cycle. Depending on the type, in fact, internal parasites can affect the stomach, the small intestine or the large intestine. The parasites are the most common strongyles and roundworms. The first, also known as red worms, attach themselves to the intestinal wall, especially at the level of the large intestine, where they absorb blood, sometimes causing a state of anemia in the subject; in severe cases, some larvae can cross the intestinal wall, enter the bloodstream and cause a partial or total occlusion of the mesenteric artery. Roundworms are found mainly in the small intestine: larvae migrate from the intestine to the liver and, from this, to the heart and lungs where they can cause disturbances to respiratory system. From the lungs the larvae make their way to the pharynx and from there descend into the stomach where they spend the adult stage: at this time they have already begun to produce eggs that are excreted in the feces. Other important parasites are pinworms and gasterofila fly.

Pinworms are found predominantly in the terminal portion of the large intestine and rectum. The eggs are laid in the anus, causing considerable irritation which leads the animal to scratch against any surface: consequently it occurs in the loss of hair at the top of the queue; after a few days the eggs will break off and fall to the ground. The gasterofila fly is present, as larva, in the stomach of the animal: it lays its eggs on the horse's coat, mainly at the ends of the front legs: the horse ingests by scratching or, licking, especially during the summer. The larvae stay for the whole winter in the stomach of the animal in danger of causing ulcers. With the beginning of summer they leave the stomach and are eliminated with feces, becoming young flies. The parasitized horse has a dull fur and gets tired easily; in the case of a strong infestation the horse is subject to weight loss, frequent digestive disorders and has a certain predisposition to colic. In the case of infestation by roundworms it may occurs disturbances to the nervous system due to a substance secreted by these parasites. The internal parasites of the horse can not be eliminated entirely, but they can be controlled. The control includes the stool analysis to identify the type of parasite and the degree of infestation, as well as the use of worms, specific to different types of pests. Another way to combat internal parasites consists in eliminating from the pastures. The control of the pastures is affected by:

- rest of the pasture
- rotation
- elimination of feces
- passage with chains or with a light harrow with articulated teeth

In conclusion, a heavily infested horse is not able to provide a good performance in sport; on the other hand, if it is well fed, it is also less sensitive to parasitic infestation compared to a subject receiving a deficient or unbalanced ration.

1.3.3. Colic

Colic is a manifestation of abdominal pain. The causes are many and some individuals are particularly prone to them. Colic is the most common food-borne, in particular due to:

- amount: too much or too little;
- quality: alfalfa too young that ferments easily, food poorly preserved or fermented, moldy hay or poor quality;
- percentage of fiber: the excess can cause colic obstruction; deficiency predisposes to stasis of intestinal contents in the large intestine fermentation giving rise to exaggerated pains and therefore spasms.
- irregularity of the time distribution of the meal;

- poor mastication: for rapid ingestion of poorly insalivated food or teething problems;
- sudden change of diet;
- watering: for dirty water or non-potable water; water at will when it's hot or when the horse is sweaty and tired; rapid intake of too cold water.

Other factors that may favor the onset of colic are:

- work started too early (after a meal), before digestion is complete;
- overwork and stress;
- irregular work: for example a period of inactivity followed by a rapid and intense effort;
- chills;
- abrupt change in atmospheric pressure;
- intestinal parasites;
- gastric and peritoneum's lesions.

The most important colics are of three types: spasmodic, gaseous obstruction, or overload of the colon. The first are the least dangerous and occur with intermittent spasms, sometimes very intense and painful. The spasmodic colic is only a type of colic, even if it is due to an excessive production of gas in the intestine, causing a certain expansion; it determines, therefore, the sensation of pain. Sometimes it is due to excessive ingestion of air by subjects suffering from tic support; excessive production of gas may also be due to ingestion of food easily fermentable. Colic obstruction is due to the formation of a mass of food or feces that prevent normal transit. A distinguishing characteristic of this type of colic is the absence of bowel sounds, being locked the intestinal transit; sometimes colic can determine the twist of the intestine, extremely serious phenomenon, which if not caught in time, leads to the death of the animal. In fact, the torsion leads to a stop of blood circulation and transit of food and can only be resolved through surgery. The symptoms of colic appear gradually. At the beginning the horse is agitated, that's when you have to look at his left side. When the pain increases, agitation grows: it lies down and rises continuously, sweats profusely, tries unsuccessfully to defecate or nearly so. In any case, you should call your veterinarian. The first thing to do is to prevent the horse hurting; you should not let it lie down and, if necessary, you can make him walk. Colic runs out normally within 24-48 hours. The severity of colic does not depend on intensity of pain but on heart rate: if the pulse is not accelerated compared to the norm, colic is not serious; in fact, the severity increases with the increase in heart rate. Colic is not only abdominal: kidney problems can in fact cause renal colic, moreover less frequent than in the intestine. They are often due to the presence of kidney stones or chills.

1.3.4. Laminitis

This disease affects the entire socket and is characterized by a dermo-osteitis nail. If not treated promptly, it leads to noticeable changes of the foot, namely the concavity of the wall to the tip with a convex bottom, flat sole, high heels with hypertrophy of the frog and bars. The laminitis is a fairly common disease of varying severity and because it can lead to death, to incurable lameness or complete recovery of the horse. The origin of the disease is a histamine-like reaction following a strong fermentation food or stress. The predisposing factors are: food overload, allergic reactions to certain foods, tiring travel, infections; in mares you can have the laminitis from birth, due to a uterine postpartum infection, or in case when the mare arrives at parturition under conditions of overnutrition. The laminitis manifests almost always on one or both of the front legs as they carry a higher weight than the rear: the subject shows a typical attitude, that is, the weight load on the rear and the front legs bend forward. The hooves are very hot and sensitive, body temperature increases as well as cardiac and respiratory frequencies. In cases of acute laminitis, congestion concerns throughout the body and, if not immediate veterinary attention, the death of the animal is almost certain. The first thing to do is to try to lighten the digestive system (if the cause is food grade) and, at the same time, it helps decongest the feet showering every day, as the case may be useful to strike the horse. Prevention is still the best treatment to combat this disease: a good food program prevents from overcharging and from laminitis, that is one of the commonest cause of death.

1.3.5. Myoglobinuria and lactic acidosis

Myoglobinuria is due to an abnormal accumulation of lactic intramuscular acid which in turn derives from the excess of muscle glycogen. This is also fueled by a lack of vitamin B, and the muscular deficit of calcium and potassium. Even the lack of vitamin E and selenium may contribute to the intramuscularity excess acidity. The myoglobinuria occurs in horses in work, after a rest day in which the ration was not appropriately reduced. Another cause may be a chill. The muscles become painful and ineffective, principally at the shoulder, the back and rump. The horse drags his feet, sweats profusely, pulse and breathing speed up, and the urine becomes dark. The most common treatment is the use of vitamin C, of products antihistamines and sodium bicarbonate. If the disease is caught in time, the horse heals quickly; if not, or if it is forced to walk during the acute phase of the attack, it can produce irreversible damage, until the death of the animal. The myoglobinuria can be avoided by limiting the accumulation of muscle glycogen, especially in the case of hypertensive patients undergoing stressful conditions related to transportation, to psychological environment, thermal, sound and the race itself.

1.4. Foodborne intoxications

The toxicological problem is of particular importance in the case of the horse sports because it is generally a very delicate and not very resistant to various types of poisoning. The food-borne intoxications are determined by different causes and can be distinguished as follows:

- poisoning by toxic plants;
- poisoning by organic and inorganic compounds;
- altered food poisoning.

The most common toxic plants in pastures are: horsetails, buttercups, the sorrel, mustards, the cicute etc., all very dangerous. Poisoning by organic compounds is due to use of products of different nature in cultural practices, especially with regard to insecticides, herbicides, pesticides, etc. In the case of poisoning by inorganic compounds it refers to the toxicity of some mineral elements; particularly serious result of poisoning by: lead, nitrates and nitrites, arsenic, barium, boron and fluorine. The altered food poisoning is much more frequent than the previous. They are due to poor preservation and / or food contamination. The latter may be endogenous or exogenous; the endogenous microflora is already in the ground, while the exogenous develops after flowering, carried by insects, excrement, from water and dust. Consequently, the degree of microbial infestation of fodder will depend largely on the conditions of collection, first, and conservation after. The water content, the relative humidity, the concentration of oxygen / carbon dioxide and the storage temperature of the fodder and food generally are the most important elements for a correct conservation and therefore to avoid the development of molds. The processes of deterioration of the forage due to this type of contamination can cause many different changes; regarding to the characteristics of proper food, you may experience a loss of nutritional value and energy content accompanied by changes in taste, color, texture, and germination capacity. Some molds cause allergic reactions and can cause respiratory infections. One of the worst consequences of such deterioration is the production of mycotoxins, particularly harmful to the health of the animals; the strong growth of bacteria in food can also lead to the production of exotoxins or endotoxins. The diagnosis of poisoning is always taken rather difficult as disorders ranging from gastrointestinal disorders, especially diarrhea and enteritis, nervous phenomena, respiratory and circulatory problems, etc. The intervention of the veterinarian or a specialist is therefore necessary.

1.5. Problems related to over / under nutrition and dietary imbalances

The dietary mistakes are a fairly common problem in the conditions of breeding and training racehorses. The phenomena of over / under nutrition is particularly damaging because it is related to the onset of pathological phenomena.

Over nutrition: the main problems that result from overeating is in the adult horse, the obesity and a predisposition to laminitis while, in foals, it is associated with some abnormalities of growth. The obesity is particularly serious in mares: the worst consequence of this phenomenon is reduced fertility as well as the predisposition to abortion. The obesity determines, in the case of stallions, reduced reproductive capacity. In any case, it can be eliminated or reduced to acceptable levels if the horse is often moved: overeating or lack of exercise is in fact the key factors to favor the emergence of nutritional problems of this kind. In the case of foals, it refers particularly to those of a year and over which are often overfed because of excessive use of cereals in the ration and, consequently, of the excess energy. The most common problems that arise from this overeating are related to skeletal development: the incidence of osteochondrosis, abnormalities of the flexor tendons and the distal epiphysis becomes much more frequent in hyper fed subjects, especially in the case of calcium deficiencies.

Under nutrition: manifests itself in foals with reduced growth and changes in body shape: these phenomena also imply a poor skeletal development and consequent susceptibility to bone and tendon problems. In mares under nutrition occurs almost always with an alteration of the estrous cycle and, at times, the absence of ovulation.

Dietary imbalances: it is often difficult to make a clear distinction between imbalances and nutritional deficiencies: for example, low levels of calcium and high levels of phosphorus lead to an increase in secondary hyperparathyroidism in horses in growth; high amounts of phosphorus impede the absorption of calcium, this phenomenon is known with the name of osteoporosis and often occurs following administration of diets rich in wheat bran (Ca/P=1/12). Even cereals and grass hays are deficient in calcium: therefore, in the case of administration of large quantities of these items, you need to balance your diet with appropriate additions of calcium. The deficiency of this mineral can result in not only the osteoporosis but also rib fractures, tooth loss, weakening of the maxilla and mandible. In any case, the recovery of balanced dietary conditions leads to a rapid recovery of the animals. Other types of dietary imbalances are mainly related to the lack or excess of selenium, to excess iodine, the lack of manganese deficiency and to excess vitamin D.

1.6. Environment, nutrition and stress

Many studies have highlighted the influence of environmental factors on the productivity of the animal and have showed how the modern criteria of breeding the animal are gradually moving away from its "natural state". The main consequence of this phenomenon is the increased importance of "environmental effect", especially the interaction of heredity and environment. The phenotypic manifestation of a certain genotype is significantly related to the microenvironment of farming, something that considerably influences the production performance. All animals are able to get into equilibrium with the physical environment through homeostatic mechanisms: disruption of this balance due to the "general stress syndrome," where the animal can adapt, restoring a new homeostatic balance or, if not, there is an alteration of homeostatic mechanisms with negative consequences on the health and performance. The selection made on athletes horses, especially those racing, while it has allowed us to achieve optimal sports performance, on the other hand has weakened their ability to adapt to environmental changes. In fact, the transition to a more sedentary lifestyle in the box, but with short, intense efforts, and a diet characterized by few and abundant meals, has altered food balance. The diets for sport horses, rich in concentrated foods, but with a limited percentage of fiber, have favored a lower activity of the digestive tract, especially the large intestine; the horse, adapting to the new situation, however, becomes much more delicate: the frequent occurrence of colic is one of the most serious consequences of this phenomenon, due to the protein deficiency that often affect foals and determines a change of the internal balance of the animal that often proves fatal, especially because in the adult it is not so deadly as in a foal and therefore can not provide a compensation effect. It may encounter stressful situations very variable and diverse ranging from hypo to hyper feeding, with a high frequency of imbalances and nutritional deficiencies, in relation to some correlated causes, including:

- frequent change of food quality employees because of the inability to make sufficient stocks for long periods: it is known that the characteristics of the intestinal microflora depend on the diet; the intestinal adaptation to new food requires an average of two weeks and, therefore, in the case of frequent supplies with different hays, you may experience a constant state of stress that in the long run may lead to pathological phenomena not only be borne by the digestive system, but affecting also health in the most general sense.
- environmental change: is related to the change of the ration, admissions, management techniques, etc.; This stress is particularly evident in foals, much more sensitive than the adult horses, physical and psychological stress, which also involves the digestive system.

- characteristics of feeding stuffs are important both to verify the possible presence of toxic varieties, but also to mold, dust, and to assess the quality of this fiber; also the appreciation of color and odor is important for judging the quality of a crop. The transition from poor hay, of low nutritional value, to one of the highest quality, and the reverse, can cause nutritional problems and manifestations of clinical symptoms. It is therefore advisable to periodically perform the chemical analysis of all the constituents of the diet.
- transition from box to the pasture and the inverse: in the first case many subjects react with digestive disorders and skin diseases, caused probably by very tender grass of high-protein, the sun and the continuous movement; otherwise, the transition from a forage-based diet to a rich concentrates, together with reduced physical activity can cause hygromas limbs: this phenomenon is found mainly in foals during weaning and foals at the time of start of tame.
- characteristics of the water to drink. The quality of water depends not only on its microbiological characteristics, but also on the amount of salts dissolved in it. The presence of salts and their concentration depends on the areas, the type of soil, the use of fertilizers, etc.; as the salts affect the biochemical and physical conditions of the digestive tract and the general state of health, knowledge of these characteristics is of fundamental importance. Therefore it is advisable to periodically perform the chemical analysis of the water to prevent the onset of disorders, sometimes quite severe.

1.7. Main foods intended for feeding horses

The main foods intended for equine supply essentially consist of forages and concentrated feed; to these must be added the by-products complementary fodder that, in the case of sport horse, have little importance except for the straw.

1.7.1. Fodder

The fodder can be eaten fresh (green fodder), dried (hay) or silage: the latter, however, are rarely used in the sport horse power, more frequently in the horse meat. The prevalent botanical varieties belong to the Poaceae and legumes. The first are herbaceous annuals, biennials or perennials and constitute the fundamental element of fodder; the second herbaceous plants are characterized by high protein content, a Ca / P ratio in favor of calcium. The forages have a variable percentage of crude fiber 18-35% of dry matter. These values are influenced not only by the botanical species, also the type of soil, from the vegetative stage, from time of cutting and climatic characteristics of the area, especially as regards the availability of water and light. The characteristics of the territory give a significant effect to the mineral composition of forages.

1.7.2. Green fodder

The green fodder foods are of fundamental importance for all farm animals that use them mainly through grazing or mowed and eaten fresh in the case of tethering. These forages are characterized by a high percentage in water (70-85%) and a low nutritional value. Particularly important is the mineral-vitamin's composition. The environmental factors are crucial to the nutritional characteristics of these forages. The grazing is essential for the proper nutrition of the sport horse: it, in addition to being a complete and balanced source of energy, protein, minerals and vitamins, for the variety of herbs that compose it, exerts a beneficial effect on the health of the animals as a result of sunlight and functional exercise. With regard to the botanical composition of the pasture, the meadows are widespread (or permanent), characterized by the presence of forage species adapted to conditions typical of the area. Besides, the intensive use of the pastures that you do today resulted in the need to periodically re-seed mixtures to ensure that the quality of the grass is considerably reduced. The mixtures for horses are made of Poaceae and legumes: the latter enrich the soil with nitrogen, promote the growth of plants and are rich in protein.

1.7.3. Dry forage or hay

Hays derive from herbs drying in the open field, for which the crop loses a lot of water that falls to values of 10-20%. Hay results in the loss of about 1/4 of organic substances contained in the fresh

forage. Hays are distinguished, depending on the origin and botanical composition, mainly in polifiti hays and legume hays; they are also distinct in function of time mowing (1st, 2nd, 3rd cutting etc.). Progress to the stage of maturation corresponds to a reduction of crude protein, nutritional value, and minerals, as well as to an increase in raw fiber. The date of haymaking also affects the voluntary consumption, which is significantly reduced with decreasing nutritional value: in fact, the digestibility tends to decrease with advancing stage of maturation. Normally, the crop should be cut at the beginning of the period of flowering: at this time it is higher in protein and more digestible. The conditions of collection and storage should be optimal to prevent the formation of dust and mildew. The drying must be rapid because its duration adversely affects the nutritive value of the hay. It is advisable, especially in the case of horse sports, that a periodical analysis of the hay be performed so you can be sure to make a proper rationing. In summary, a good hay must be free of dust, scented and without mold; the color is bright green, a sign that it was not overly annoyed in the field, or damaged by the rain; the stalks must be a little woody and leafy.

1.7.4. Straw

The straw used in feeding horses is made from the stems and leaves of cereals that have reached full maturity (wheat, barley, oats, etc.). Their nutritional value is very poor and therefore are used to complete a diet of fodder, in the case of agricultural horses, or as litter, in the case of sports horses. For the latter frequently use oat straw that, while it is the most nutritious, from another hand has a lower absorbent order and it is slippery. As regards the use of straw, there are advantages and disadvantages: in the first case it can complete the necessary intake of crude fiber, also to ensure proper bowel movements; in subjects particularly nervous, it can help to keep them busy avoiding excessive nervousness and the occurrence of tics. The disadvantages are related to misuse of this food that you can do: in fact, an excessive intake of straw can reduce the attitude to physical activity as well as the digestibility of the whole ration, without taking into account the higher incidence of intestinal parasites.

1.7.5. Concentrated feed

The concentrated foods are characterized by a high nutritional value, low fiber content and good digestibility. They come from crops of the farm or from the industrial processing of various agricultural products. Today they are fairly common compound feed supplemented, which consist of more concentrated foods simply integrated with adequate vitamin and mineral intake. This last category is of a paramount importance in the correct ration of sports horse, since the exclusive use of one cereal (oats), as is still done today in the majority of cases, can cause dietary imbalances that

are often the cause of the absence of calcium and phosphorus that predisposes the horse to the formation of boning, often very serious.

1.7.6. Cereal grains

Cereals are the simplest food concentrates used in animal feed in livestock production. They are characterized by a high nutritional value, by a protein content ranging from 9 to 13% on a dry basis and from a percentage of crude fiber rather low (from 2 to 6%) for barley, maize, wheat and higher for the oats (12-15%). As regards the content in mineral elements, all the seeds of cereals are characterized by an unbalanced Ca / P ratio due to the lack of calcium and of excessive phosphorus.

Oats

Oat is the typical food of the horse. Oats is administered mainly in grains. There are different types of oats on the market: in the supply of sport horses, especially the race, use is made of “Plata” oats, of Argentine origin. Other types of oats are the black oat, the Maremma, particularly demanded the market. Dusty and / or moldy oats is to be excluded from the ration. it is also important to keep good oats, away from humidity, in clean containers and inaccessible to other animals such as mice, rats, etc.: the presence of urine, feces and carcasses may in fact cause dangerous infectious diseases. Oats may also be administered in flakes or germinated: in the first case there is an increase in the nutritional value and digestibility; the oats flocked power can be useful in subjects in growth or for older horses who have chewing problems. Germinated oats, obtained by immersion in water up to the emergence of the radicle and stem thickness, appears to have an important role in the feeding of mares and stallions, increasing its fertility and the fertility rate: this improvement of reproductive performance is linked to the increase in the content of vitamin E that occurs with this process. Corn, barley and wheat are grains that are best suited to replace or supplement oats.

Corn

Corn has been used for long time in America, and only recently it has been introduced in Europe as food for horses. It is characterized by high energy content (higher than the oats’) and, therefore, can considerably improve sports performance: in the case of replacement of oats with corn, it is therefore advisable to check the nutritional value in order to avoid excess energy. Because of the hardness, the corn should be given coarsely crushed or flaked.

Barley

This cereal is the basic food, used most concentrated in the eastern countries. Barley has the ability to significantly improve the state of nutrition of the animal, favoring the rapid recovery of

debilitated horses (it is considered refreshing). Whole barley is indigestible because of excessive hardness: it is better to give it crushed or flaked. The barley can be administered whole after cooking, alone or together with other concentrates (mash). A certain percentage of barley should always be present in the feeding of the horse, even the sports one.

Wheat

Grain is little used in equine nutrition because most required for human nutrition. In addition, if badly used, may cause intestinal disorders because of the high content of gluten. Grain is used more often a byproduct, the bran, which has the ability to promote intestinal transit. This food should be used wet to prevent excessive increase in volume in the stomach.

1.7.7. Legume seeds and oleaginous

This food category is mainly characterized by high protein value, variable 20-38%. In equine nutrition mainly soybean, peanut, broad beans and field beans are used. The first two, used as flour extraction, have similar characteristics, with a protein content varying from 45% (soybean) to 50% (peanut); it is also of high nutritional value. These two kinds of food are often used in the diet of the horse in growth, or to recover the athletic conditions after periods of intense athletic activity. All these foods are often found in the composition of compound feed. Flax seeds are used for food, being characterized by dietary and laxative properties thanks to the action of the mucilage of which are particularly rich. Flax seeds are administered to the animal always after cooking.

1.7.8. Roots, tubers and fruits

These foods are used as a supplement to the diet of the horse, mainly for their dietetics action. Recall: among between these, carrots are rich in carotenes; fodder beet, to be used in the winter period, is characterized by a strong laxative and diuretic power; potatoes, starchy, are well appetizing, even if they require cooking to eliminate the toxic effect of solanine contained therein; pods, with a discrete energy value, are for the high sugar, value often used as palatants. As regards fruit, it is normally very much appreciated by horses, resulting refreshing and energy efficient because of the high sugar content. Apples are the most used, even if you do not have to overcome certain amount in order to avoid digestive disorders.

1.7.9. Compound feed supplemented

Today, they are quite common integrated feed made from more concentrated foods simple and integrated with adequate vitamin and mineral intake. This category of foods plays a fundamental

importance in the correct ration of horse sports, since the exclusive use of one cereal (oats), as it still occurs in most cases, can lead to dietary imbalances that are often the cause of calcium and phosphorus deficiencies that predispose the horse to the formation of bone ing, often very serious, such as ing hard, tiles, etc. These foods also help reduce the imprecision related to the traditional rationing ensuring a proper diet and regular insofar as they are known nutrient requirements of horses in different classes and different physiological states. Other advantages due to the use of these foods are made from less space required for storage and reduced dustiness of the product (in fact these foods are particularly suitable for horses with respiratory problems or emphysema). Currently there are many pet food companies that produce compound feed supplemented to horses even if you can manage to do a good mix directly procuring the raw material and integrating it appropriately with vitamins and minerals; this way one of the negative aspects of feed compounds, is avoided, namely the perishable nature of the product if not consumed quickly. The simple feed concentrates most frequently used in the preparation of those compounds are corn, oats, barley, wheat bran, soybean meal or peanut, field beans, etc.: these foods in the right proportions, are in fact the most suitable for horses feeding. Sometimes, the feed formulation can also include the dehydrated alfalfa that, for the high-protein, can balance rations deficient in protein. Feed used in practice are less than full ones and replace not only concentrated feed but hay. The need for the horse to spend time with some diversion is baffling about the use of these feedstuffs, possibly resulting in the appearance of nervous tics, to prevent the onset of which is often forced to give poor fodder, excessively increasing the percentage fiber of the ration and reducing the digestibility of the diet itself. Currently, there are compound feed integrated of all types: for horses in athletic activities, for mares in gestation, lactation, etc.; for foals during weaning, accretion, etc. with protein content varying from 10 to 18% depending on the case.

1.8. Practical rationing for sport horses

The success of breeding is linked to proper animal care and diet. The daily observation of individuals is used to check whether the rationing adopted is satisfactory, bearing in mind that the theoretical values of the nutritional requirements are only a guide. A good rationing must be accompanied by a regular breeding program, especially when the horses do not have their pasture. In this regard it should be noted, that horses have to play a bit of exercise on a daily basis in order to keep their body in a satisfactory condition. Therefore, the proper rationing depends not only on the application of certain food principles, but also on a deep knowledge of the behavior and needs of individuals.

1.8.1. Feeding behavior

Feeding behavior depends not only on the nutritional requirements of each individual, but also on his psychic equilibrium. In fact, the voluntary consumption of food varies depending on the weight, temperament, and physiological state of muscle activity and is often regulated by the state of the fat. Even the physical-chemical characteristics of foods, their palatability, the sealing system of the animal, have considerable importance in the success of a correct rationing. Feeding behavior depends on whether the horse is grazing or stable: in fact, in the first case it regulates its eating habits depending on the availability of grass; in the second case, however, the ration is variable and depends on the man's decisions: therefore in this case the horse does not own eating habits. It arises various tics of which horses in the stable are susceptible, especially related to leisure: there is the tick of support, the dance of the bear and of the habit of biting and chewing the wood of the box. Although there are several tricks to prevent trade in these vices, the horse can almost always find a way to nullify their effect. The equine species is one of those most affected by the individual variability, making it difficult, and sometimes problematic, to determine a proper rationing as in the case of sport horses, a suitable program of training and racing activities.

1.8.2. Feeding the foal from birth to two years

The weight of the foal at birth varies depending on the breed and the genetic type. It should be an average of 9-12% of the weight of the mother and depends on both the growth capacity, linked to adult weight and the genetic type, and environmental conditions, especially nutrition. In the first month of life the foal usually doubles its weight; development is very pushed up to the fourth month or so. From this it follows that it is important that the mother is a good producer of milk. The composition of mare's milk differs from that of cows':

	Water %	Fat %	Protein %	Lactose %	Ashes %
mare	89,0	1,6	2,7	6,1	0,51
cow	87,2	3,5	3,7	4,9	0,71

The rapid growth of long bones of the foal highlights the need for an adequate supply, especially with regard to the mineral elements, especially if one takes into account the shortcomings of some of them in milk (iron, copper, etc.): administration of a complete food, specially prepared for the colts in this first phase of activity, is the ideal solution to address these problems, especially when it comes to foals for athletic activities. In any case it is good that the foal will start to familiarize itself with the dry foods in the first weeks of life: from the second third month of life, the integration becomes absolutely necessary and some techniques, such as "creep feeding", which serves to

provide a separate supply between mother and son, are advisable.

In the rationing of the foal at this stage, particular attention must be paid to the content of protein (high biological value) and mineral elements, especially calcium and phosphorus. Please note that the foal will start spontaneously, that is, according to its needs and in relation to physiological adaptation of the intestinal tract, eating hay and pasture, following what the mother does. Causes of a different nature may require the artificial feeding. Weaning takes place in the case of horse sports, from four to six months, depending on whether the mare has been impregnated or not. The foal should get to this stage already accustomed to consume a certain amount of dry food (at least 2 kg / head / day, depending on the age). The weaning stage is a very delicate and, if neglected, can lead to pathological phenomena. It is advisable to keep the foals in pairs in the box, so that you keep him in company; it is also good that the pesticide treatments have already been taken: normally they must be performed for the first time towards the two three months and repeated every 30-45 days. Any other medical treatment must be made before weaning to avoid additional stress at this stage. In case the mare has not enough milk, it can be administered not only an integration based on milk powder but also of cow's milk, diluted with water and glucose. When the foal reaches the year of age, we must gradually change the characteristics of its ration, especially with regard to concentrates food. In particular, you will begin to reduce slightly the protein level: in fact, now the horse will be quite capable of using the resources of pasture, on the one hand, and the more fibrous foods, such as hay, on the other. Along with the concentrated feed the foal will have 4-6 kg of good quality hay. At this point it is important to mention the significance of the relationship forage / concentrate and the role of forages in general. The latter in fact provide a good transit of food and encourage the development of microbial activity. On the other hand, in the case of horses for all sports, it is necessary to avoid overloading the gut that could limit the effectiveness of muscular effort.

The following values of the ratio forage / concentrate are recommended for horses in growth:

Horses	Consumption / kg / head / day	Report% of the ration: Concentrate	Report% of the ration: Fodder
Foals 3 months	4,0	75-80	20-25
Foals at weaning	5,0	65-70	30-35
Foals 12 months	6.0	45-55	45-55
Foals 18 months	6,5	30-40	60-70
Colts 2 years in light training	6,5	30-40	60-70

The 18 months foal needs minor protein intakes than a year one, also because the first consumes greater amounts of forage that, if of good quality, has a discrete protein content. Foals of 18 months which do not have to be used for the early agonistic activity can be fed with large quantities of forage, but they have at least 12% protein. On the contrary, in the case of foals that will soon begin to run, it will be good to keep the relationship forage / concentrate at levels that allow an easy start of the workout. With regard to the fodder, it is advisable to administer to all the horses in training two types of hay, one of the stable or meadow, however, a good hay polifita, other alfalfa, first cut. The administration of alfalfa hay is especially important in winter, when there is not grazing; during the summer, however, it is advisable to reduce or eliminate it, either because the horse has pasture, or because it may cause the abnormal intestinal fermentation. Another element to be introduced into the ration is the mash: you should administer it 2-3 times a week in the cold period, abolishing it almost completely in the warmer months. The mash replaces half of the daily ration of concentrate.

1.8.3. Mare's supply

Requirements, and therefore, the supply of the bitch change much over the course of the year, being mainly related to changes in physiological state (pregnancy, lactation). The birth takes place in winter in the case of horse racing and in the spring in the case of riding horses or meat horses. The development of the foal is largely dependent on the date of birth. Because of that the mare should be fertilized in the first month after birth otherwise a delay could result in a decrease of the number of foals. But this period also corresponds to the ascending phase of milk production: consequently, the supply during this phase, as well as throughout the winter, it is of paramount importance as it affects the state of health of the dam, its production capacity, as well as the weight and the viability of the foal at birth and its growth. However, the dam has the ability to use their lipid reserves, especially towards the end of gestation and the beginning of lactation and avoid, to some extent, the decrease in milk production and reproductive ability of lowering linked to insufficient food intake: lack of food reduces the production activities in favor of the milky secretion that is a priority at this stage. From the middle of the lactation period the mare can, thanks to the exploitation of pasture, replenish the lipid body. The supply of the mare during gestation gains importance in the last ninety days of pregnancy, as the growing embryo is very thorough. Therefore, in the first phase there will not have to greatly increase the quantity of food concentrates, while the hay will, as usual, be given at will. The hyperalimentation in the period before the mount, where it is seen as a transitory phenomenon governed by the terms of the maintenance of the dam, is a positive influence on ovarian function and thus fertilization. However, in the case of mares who have just given birth, hardly incurs dietary excesses as the needs of early lactation are very high. The ration of the mare at

the beginning of gestation includes the administration of a small quantity of concentrate, about 1 kg. With the progress of pregnancy this quantity will increase slightly up to the 2.5-3 kg, but not more than 25-35% of the total ration. To this concentrated hay of excellent quality must be added and, if available, the pasture. The percentage of the protein content of the ration of a dam must be of 12-14%, in order to compensate the eventual low digestibility of the proteins themselves, linked to the type of pasture or hay, which is dependent on the stage of maturity and on vintage haymaking. About the system of keeping pregnant mares it should be noted that many veterinarians recommend, in the case of individuals racing covering mares during the workout, to keep them on the farm for the first sixty days of pregnancy, after removing them from races within the 6-7th month. The success of this practice is linked to the possibility of mares particularly nervous or that have suffered from an accident and / or in need of a rest anyway. It is sometimes used to cover the fillies also for two years, at the beginning of training to make them more calm; the production of foals is more frequent as well as an advantage if her pregnancy doesn't compromise her result in races. Even in the case of riding horses you can adopt this practice whereas, moreover it, has always been used in the past by the owners of working horses, saddle which is agricultural. The ration of concentrate in the lactation period varies depending on the month of lactation and the quantity of milk produced. In the first six months of lactation the consumption of the amount of concentrate should vary from 40 to 45% of the daily total, that is, from 4 to 6 kg in average, without forgetting the importance of the quantitative characteristics of the pasture and / or hay. The protein percentage of the entire ration in the first three months of lactation must be at least 13%, increasing to 14% in the case of high milk production. After the 3rd month of lactation, the foal begins to eat large quantities of dried foods, precisely at the moment when the milk production starts to drop (less than 9 kg per day, on average).

Lowers the consumption of the mare's milk up to 30% of the total; the protein of the ration should still remain at levels around 13%. Constituents of the mare's milk depending on the stage of lactation:

STAGE OF LACTATION	S.S %	Pg %	Fat %	Lactose %	Ashes %	Gross energy kcal/100g
Delivery	25,2	19,1	0,7	4,6	0,72	135
12 hours	11,5	3,8	2,4	4,8	0,50	64
24 hours	11,4	3,3	2,5	5,2	0,53	62
48 hours	12,0	3,3	2,5	5,8	0,54	62
5 days	11,6	3,1	2,1	5,9	0,54	59
8 days	11,5	3,1	2,0	5,9	0,55	59
3 weeks	11,3	2,7	2,0	6,1	0,50	56
5 weeks	11,2	2,7	2,3	5,7	0,43	59
2 months	10,3	2,2	1,6	6,1	0,47	52
3 months	10,4	2,0	1,4	6,6	0,32	52
4 months	10,0	2,0	1,3	6,5	0,27	49

STAGE OF LACTATION	Ca g/g	P g/g	Mg g/g	Na g/g	K g/g	Fe ppm	Zn ppm	Cu ppm
Delivery	847	389	473	524	1143	1,31	6,4	0,99
12 hours	782	399	138	364	965	0,95	2,8	0,83
24 hours	973	442	110	337	841	1,05	3,6	0,73
48 hours	1110	457	92	296	861	0,86	3,7	0,66
5 days	1199	444	101	265	846	0,88	3,5	0,44
8 days	1278	441	94	238	780	0,88	3,3	0,44
3 weeks	1261	391	68	185	606	0,83	2,8	0,29
5 weeks	1110	325	63	188	555	0,71	2,2	0,25
2 months	905	285	49	203	456	0,61	2,1	0,23
3 months	708	243	40	174	405	0,55	2,1	0,25
4 months	614	216	43	161	370	0,49	2,4	0,20

1.8.4. Stallion's supply

The supply of the stallion outside of the breeding season does not differ much from that of a normal horse of the same weight. At this stage it is important that the stallion has a pasture or hay of excellent quality. The concentrated feed should be given in small quantities, while you have to provide an adequate integration with vitamin-mineral complexes. The exercise of the stallion is very important as it avoids excessive fatness. Two or three weeks before the start of the breeding season it is good to gradually increase the amount of concentrate, up to approximately 4.5-5.5 kg in total, ie, in the case of a sport horse weighing 500 kg, equal to about 450 g/50 kg of live weight. As already noted in the case of mare, the amount of food concentrates depends on the quality of the

forage and the number of jumps performed weekly by the stallion. In case this has great hay and good pasture, especially as regards the digestibility and protein content, the ration of concentrate can also be constituted only by cereals:

Oat grains	30%
Crushed barley	30%
Corn flakes	15%
Bran	25%
Mineral-vitamin supplement	enough

1.8.5. Supply of the horse in work

In practical rationing of horse racing activities will have a tendency to overindulge in the administration both from the point of view of quality and quantity to prevent the onset of deficiency. However, the excess of food if it exceeds certain levels can cause significant disruption so to avoid it would be advisable to check the nutritional supplements for the entire ration comparing them with the theoretical requirements that, although indicative, are still a valid guide. The problems of rationing and identification of the actual needs of the racing horse result in two other factors: the first is related to the fact that at the beginning of the sport (about two years) the horse is still growing and therefore the needs of exercise are added those of growth; the second, automatically dependent on the first, is due to the fact that the horse carries the agonistic activity at a very early age, which subjects the body, not yet fully developed, to stress that often reflects on the general health, with a higher incidence of bone and tendon injuries. The racing horse, subject to short and intense efforts, needs to have high amounts of energy and oxygen deficiency of these two elements often causes a slowing of the pace in the closing stages of the race. A balanced diet is the basis for a better utilization by the horse, and its physical resources during the race. In this regard, it is recalled that vitamins and minerals are particularly important in the diet of a racing horse; vitamins promote the catabolism of oxidation reactions of carbohydrates, the muscle oxygenation and fatigue resistance, even if an excess of vitamin D can cause calcification of soft tissues and kidneys. The minerals affect energy metabolism, without saying that the Ca / P and K / Mg are of paramount importance; to this must be added that the massive sweat losses result in an increase of the needs of minerals (mainly NaCl) and protein. In conclusion, it can be proposed, as a food concentrate for full horse racing activities, the following mixture:

Oats	33%
Corn flakes	15%
Crushed barley	25%
Bran	17%
Dicalcium phosphate	enough
Mineral-vitamin supplement	enough

The quantity must be 40-50% of the total consumption of the daily ration (approximately 6 kg for a subject than 5 pounds of weight), a value which can be reduced when you lower the intensity of its workout. The importance of forage quality is still great; it must be presented with most of the leaves, few woody stems, without dust and mold. The poor quality of forage is a major problem in equine nutrition. The supply of the saddle horse poses fewer difficulties than that of the race horse, especially because the requirements are slightly higher, if not identical, to those of maintenance, especially because those have already completed their growth. Unfortunately the majority of the owners of saddle horses believe the opposite: it is in fact quite common the phenomenon of obesity in these subjects. The excess of food also causes a certain hyperexcitability of the horse that often hurts when you require a high concentration (and effort) to participate in horse shows, dressage, etc. A saddle horse which works for an hour 3-4 times a week has very modest needs that can be met from 6-7 kg of good hay and 2-3 kg of a food concentrate (also according to the weight of the horse): if you were to take the horse from time to time in horse shows, you can improve the quality of the ration without increasing much the quantity; it is important to remember that participation in an equestrian competition in a race of medium difficulty (obstacles of 1.20 meters) does not increase the nutritional needs of the horse, unless it agrees to jump excessively during the workout. The saddle horses used on an ongoing basis in athletic activities will have slightly higher needs, justified also by the stress due to frequent moves and, often, to the inadequacy of the admissions made available during the days of competition. The amount of concentrate to be administered varies from 4 to 5 kg per day depending on the weight of the animal. In the absence of legume, hay, soy flour or peanut oil or dehydrated alfalfa can be given. A ration of this kind is also suitable for horses used in full or riding in endurance races (endurance), bearing in mind that the amount of food concentrate will gradually increase with the intensity of the workout. For all horses racing activities the diet to be followed in the days of the race should be light, so that we need to reduce the level of the ration especially with regard to the hay without unduly unbalance the relationship forage / concentrate to avoid abnormal intestinal fermentation.

1.8.6. Food preparation

The most common treatments are:

- *smashing and crushing* : are the most frequent operations in the equine rationing. By smashing the grain is ground into pieces of varying sizes, while crushing it, remains whole with the exception of the outer part (glumes). The foods most susceptible to these two treatments are oats, barley and corn. The advantage of these operations is in a better digestibility and facility of chewing. When grains are subject to these treatments it must then be stored in not waterproof bags and consumed within a month of preparation, being more subject to alteration.
- *flaking*: also this is a system widely used in the horse's supply. The cereal flakes are obtained by action of steam at a temperature of 95 ° C for 10-15 minutes and subsequent crushing of the caryopses. This process involves a partial cooking of starch, which increases the digestibility in favor of the energy balance. The flaking of cereal, corn in particular is shown in mares and horses subject to intense sporting activity.
- *pelleting*: is a process by which simple food concentrates are compressed mechanically by special presses after moistening with steam. The final product is represented by "pellets", cylindrical in shape, that are cut by special knives. The use of pelleted feeds has many benefits, including: limited feed waste, elimination of dust, lack of choice between the components of the ration, greater precision in rationing. One of the few disadvantages is instead determined by the fact that the ration is consumed too quickly.
- *moistening and maceration*: the moistening of the cereal grains (approximately one hour), normally of oats, facilitates chewing avoiding also the dustiness of the product. If the corn is kept in water for a day or more, it has the maceration, which is more suitable for intestinal problems, especially in case of constipation.
- *cooking*: cooking increases the digestibility of foods, even if it destroys some vitamins from the 70 ° C. It is advisable to practice when the grain cereal is very hard (barley) or for sick or convalescent subjects.
- *mashes*: the mash is a kind of "soup" in which various foods are mixed with the addition of boiling water. The mash is administered mainly in horses fatigued, with no appetite or subject to intense sports activity; it is also suitable for mares. The mash, administered after a week of work, it is useful to ease the digestive system while avoiding the risk of myoglobinuria. The coke mash, although more digestible, loses most of the vitamins; moreover the cooking water can be recovered and used for both watering, and for the moistening of the bran.

- *germination*: the germination of grain (usually oats and barley) is obtained as a result of action of water (immersion for 24 hours) followed by the temperature (over 15 ° C) and the air. Generally 3-5 days are enough to germinate the grain of 2-3 times its length; if you are still waiting, the total nutritional value decreases. Germination, while lowering the protein content, increases the digestibility of the product and the percentage of vitamins: that is why this process was widely used in the past so there are no commercially available vitamin components.

2. Goals

The present work has wanted to highlight the main differences due to two different complementary feeds for standardbred trotters in sport activity: Grigi-Cereali and Purina Horse Starr. A Specific analysis changes in sport activity due to feeding have been analyzed in the study. Particularly, the the average time of the test on the a track of 2000 meters, the Heart Rate (HR or BMP) and coat's sheen grade have been measured twice:

- the first in October 2013 when all animal received Grigi-Cereali feed;
- the second one in February 2014 when all animal received Purina Horse Starr feed.

3. Materials and methods

The data used to develop this thesis were collected during the training at the Paolo Leoni's Stable, belonging to the Gardesana Stable located in Sant'Angelo di Piove di Sacco, rains in the province of Padua. The property consists of over 32 acres in one body, on which were built 24,500 cubic meters of construction including: two groups of teams of which is reserved for horse-breeding with box of stay for mares and foals, heated delivery rooms, first aid room, mounts, paddocks with sheds for mares and foals; the other at the training and of horses' training.

This last sector belong the three slopes which is fitted to the system and more precisely: round



track 200 meters of heating that allows access to the oval track development of 1100 meters with a width of 10 meters with slopes regulations; then the straight track of approximately 700 meters with a width of 8 meters. There are also two rides to cool down the horses and two large warehouses to use as shelter barn and farm machinery, as well as 35 boxes, store, tack room, wash room and office. In the area reserved for farming, are also reserved 65 boxes plus four others, far away from the complex, used as "insulation" in cases of necessity. The whole area is full of tall trees that line the internal roads thus contributing to good oxygenation of the whole environment. The stable, which specializes in "trotter", competes with its horses in a variety of race tracks in Italy and Europe, achieving many victories. Paolo Leoni's stable is a structure that includes within different environments for different uses, in fact, there is an office from which directs the administrative work, officers from local warehouses to keep the equipment required for training and races, such as the sulky, the farriery room where the farrier shoeing horses can act in a suitable space, since it requires a certain expertise in the manufacture of iron for the necessary adjustments that are being implemented in cold or warm with traditional tools blacksmith (forge, anvil, bat). Very important is also the phase of the draw, which consists in the excessive growth of the various parts of the base facing the ground (wall, frog, sole, bars). Inside there are also two upholstery with various harnesses, bridles and protections for the equine athlete, a lounge where you placed the oats and feed, 35 boxes used for the rest of the animals, a great room with washing three locations, two rooms to prepare for training horses on the track, there is a room used as a "pharmacy" and finally, a large shed where to place the straw and hay needed. All these structures are interconnected to each

other and they all have the same importance, because they enable the success of the company. The pharmacy room contains inside a refrigerator where medicines are stored and that must be stored at low temperatures and various cabinets where they are placed syringes, creams, ointments, gauze, multivitamins, specific pesticides and various equipment necessary for the administration of the latter. In the room there is a farrier location where to place the animal when it has to be shod, then: pincers, forge, anvil, horseshoes of various sizes, fat-nourishing for the horses' hooves and oil, as well as other tools for animal care such as hair clippers and brushes of various materials and shapes. In this room are also pinned many quilts fleece and cotton to cover the animals in the winter after being washed or after training, to protect against colds that can arise with the cold wind on its skin still wet from sweat or from water.

During the training period they were collected and organized in a table data for 10 horses taken into consideration

Horse name	Sex	Age
Sicuross	M	3
Raphael Ans	C	4
Senna	M	3
Selika	F	3
Rapido	G	4
Oceano	M	6
Tsunami	M	2
Pinki	M	5
Nancy	F	7
Racy	F	4

M= male; F= female; G= gelding

On this table shows data on the average time of the test carried out over a distance of 2000 meters, BPM, and luster of the coat, by administering the complementary feed Grigi-Cereali. These measurements were then repeated at a distance of about five months by changing the diet of horses with the complementary feed Purina Horse Starr.

The study carried out considered the use of two different commercial feeds given in two different periods to all horses used in the experiment.

The first complementary feed used was Grigi-Cereali for horses comprising: alfalfa flour, wheat bran, soybean hulls, wheat middlings, vegetable oils and fats, cane molasses (sugar), salts of fatty acids, calcium carbonate, baking soda, sodium chloride, magnesium oxide, dicalcium phosphate and sulfur flower.

Analytical constituents % as feed:

Crude protein	14,00%
Oils and fats	9,00%
Crude cellulose	16,80%
Crude ash	8,60%
Sodium	0,40%

This feed was administered twice a day (lunch / dinner), in an amount of about 0.6-0.7 kg per day per horse, mixed with 2.2 kg of oats and hay. Early in the morning the horses were having breakfast with 0.5 kg of oats of excellent quality.

The second commercial feed used was Purina Horse Starr comprising: wheat middlings, soybean hulls, corn, dried sugar beet pulp, wheat bran, rice husk, cane molasses and sugar beet, soybean oil, extruded linseed, calcium carbonate, sodium chloride, dicalcium phosphate, corn gluten, inactivated dried yeast.

Analytical constituents % as feed:

Crude protein	11,00%
Crude oils and fats	7,00%
Crude fiber	12,60%
Crude ash	7,95%
Sodium	0,52%
Lysine	0,59%
Methionine	0,19%
Omega 3	0,66%

Additives per kg: vitamins (A, D3, E, B1, B2, B6, B12, PP), pro-vitamins and substances having a similar effect, trace elements, antioxidants, amino acids, their salts and analogues.

Nutrients	Unit of misure	Amount
Vit.A	U.I.	4.534,0
Vit.D3	U.I.	7.700,0
Vit.E	mg	200,0
Vit.B1	mg	19,3
Vit.B2	mg	19,4
Vit.B6	mg	7,5
Vit.B12	mg	0,15
Vit.PP	mg	154
Pantothenic Acid	mg	77,0
Zinc oxide Zn	mg	300,0
Manganese	mg	240,0
Iron sulfate Fe	mg	90,0
Iodate Ca	mg	10,3
Selenium	mg	1,0
Copper chelate	mg	2,8
Manganese chelate	mg	16,0

This feed was administered twice a day (lunch / dinner), in an amount of about 0.6-0.7 kg per day per horse, mixed with 2.2 kg of oats and hay. Early in the morning the horses were having breakfast with 0.5 kg of oats of excellent quality.

Administering these two different complementary feed, I was able to observe the changes also on the condition of the coat. In fact, with the first feed Grigi-Cereali the ten horses examined, had a coat not very shiny and soft to the touch. In contrast, with the administration of the second complementary feed I could observe an improvement as regards the shine and softness of the hair. I have developed a score with respect to the shine and softness of the coat, with a score from 1 to 3 based simply on visual and tactile examination:

- 1 = matt coat and not soft to the touch
- 2 = shiny coat and soft to the touch
- 3 = very shiny coat and very soft to the touch

4. Results

I made three observations regarding the average time prepping in athletic training track (2 laps of the oval track of 2,000 meters) and heartbeats (BPM); with the two different diets I noted these values:

Horse name	Average time test October 2013	Time min. 2013	BPM 2013	Average time test February 2014	Time min. 2014	BPM 2014
Sicuross	02.31,0	2,52	102	02.31,0	2,52	97
Raphael	02.32,0	2,53	92	02.31,0	2,52	90
Senna	02.33,0	2,55	91	02.32,0	2,53	87
Selika	02.31,0	2,52	98	02.31,0	2,52	97
Rapido	02.30,0	2,5	103	02.30,0	2,5	100
Oceano	02.33,0	2,55	104	02.33,0	2,55	99
Tsunami	02.32,0	2,53	92	02.33,0	2,55	91
Pinki	02.34,0	2,57	102	02.34,0	2,57	98
Nancy	02.35,0	2,58	89	02.35,0	2,58	88
Racy	02.31,0	2,52	101	02.32,0	2,53	99

The horses analyzed in the first period, sweated a lot, thus losing a lot of minerals and calcium. Their efficiency was good, in fact, the heart rate was not excessively high, but average (85-115). During exercise the horse uses a number of muscles, which allow contracting movement. It implies, that is, as a real machine, converting one type of energy (chemical) in another (mechanical). The horse uses the energy obtained from food, either directly or by mobilization that stored in the body. Only a small part of this energy, however, is used to accomplish the task; most of it is lost in the form of heat. The animal is then the need to dissipate the heat generated during exercise to prevent serious damage to his body due to a rise in body temperature. To do this, the horse shall, as humans, several systems that are readily observable by all: for example, during exercise the nostrils of the animal appear strongly dilated, to allow the entrance into the respiratory tract of a greater quantity of air (and thus oxygen) required performing the exercise. The passage of air, which enters into the airways at room temperature then heated and humidified emerges from contact with the pulmonary alveoli, this represents a very effective system for the disposal of heat. Furthermore, at the level of the ends of the body, and particularly on the limbs, the most superficial blood vessels dilate precisely in order to circulate the blood close to the skin, in the colder areas of the body, to cool the blood through an irradiation mechanism. In addition to the mechanisms described, we can define the secondary; the primary system that facilitates the dissipation of heat is the sweating of the

animal. The amount of sweat produced depends not only on the physical condition of the horse but also the temperature and humidity of the environment at the time of labor. Although sweating is therefore an important mechanism and positive for the organism of our horse, sweat, however, are lost from the body water and electrolytes, in addition to the substances present in lesser amounts such as proteins. Electrolytes are minerals present in the organism, and in particular in the blood in the form of ions and are represented mainly by the sodium, chlorine and potassium, in addition to the calcium and magnesium; between proteins stands instead albumin, responsible for the appearance of the typical white and frothy sweat of the horse in the neck and chest, where the reins rub against the sweaty hair. The excessive loss of electrolytes following exercises very challenging, maybe run in less than ideal weather conditions, it can lead to muscle weakness and fatigue of the animal, tremors and muscle spasms or real diseases. For these reasons it is important the prevention of food losses of electrolytes keeping control supply. This gives the horse all the substances it needs to make physical activity and should be suitably modified for this exercise when we require the horse becomes more intense. In fact, through sweat the horse loses a great deal of salt, and it is our job to reintegrate them before its metabolism is affected. To do this, we can first use the simple kitchen salt or sodium chloride. A horse in normal needs about 10-15 grams of salt per day. The same subject, at a time of stressful work, comes to ask for up to 70-100 grams per day. For this reason the rollers of salt left at the disposal of the animal may not be sufficient, but it is necessary to add a few tablespoons of salt mixed into the concentrate. There is also commercially available pastes rehydration to be administered directly into the horse's mouth. These pastes contain about two thirds water and one-third of salts, and improve water intake, which is very important in horses fatigued that usually do not drink enough to an altered sense of thirst. These products are very useful as they provide the horse many of the substances lost with perspiration or that facilitate recovery, contain many salts of electrolytes (sodium phosphate, calcium chloride, sodium citrate, magnesium sulfate, calcium chloride, gluconate magnesium, sodium chloride), vitamins useful to the muscular work (mainly vitamin C), sometimes different substances such as glycine and palatants sugar (molasses, glucose). Note how these pastes do not ensure, by themselves, the reinstatement of all the sodium lost in sweat, so it is always advisable to follow the directions to add the salt to the ration, even when you use oral paste.

The ten horses examined showed a mantle from good features but not very well, as regards the shine and softness of their coat. Furthermore, administering the complementary feed Grigi-Cereali the horses were very thin and you could catch a glimpse of the ribs. The majority of them (nine out of ten) had a score 2, while only one of them had a score lower than 1.



Score 2: shiny coat and soft to the touch



Score 2: shiny coat and soft to the touch

With the passage of time it has been observed that the feed supplement, Grigi-Cereali was not suitable for our horses, subjected almost daily to a hard workout on the track in preparation for the trotting races. It was agreed at the rate of feed and feed supplement we opted for the Purina Horse Starr, with the following composition: wheat bran, soybean hulls (from genetically modified soya), corn (from genetically modified maize), dried sugar beet pulp, rice husk, cane molasses and sugar beet, soybean oil (from genetically modified soya), extruded linseed, calcium carbonate from minced limestone rocks, sodium chloride, dicalcium phosphate (from inorganic sources), corn gluten, inactivated dried yeast.

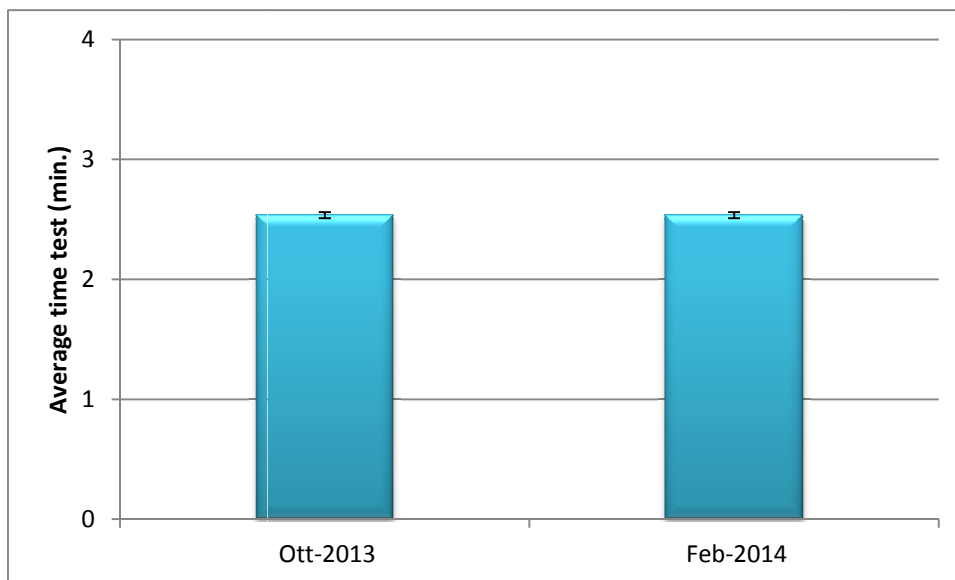
By administering this new feed we noticed substantial differences as regards efficiency, the heart beats and the sheen of the coat. The speed in track testing has not changed much but the horses were substantially less fatigued than normal.

The coat of each of them is improved with the passage of time, becoming shiny and silky. The score is increased in some specimens reaching a score of 3.

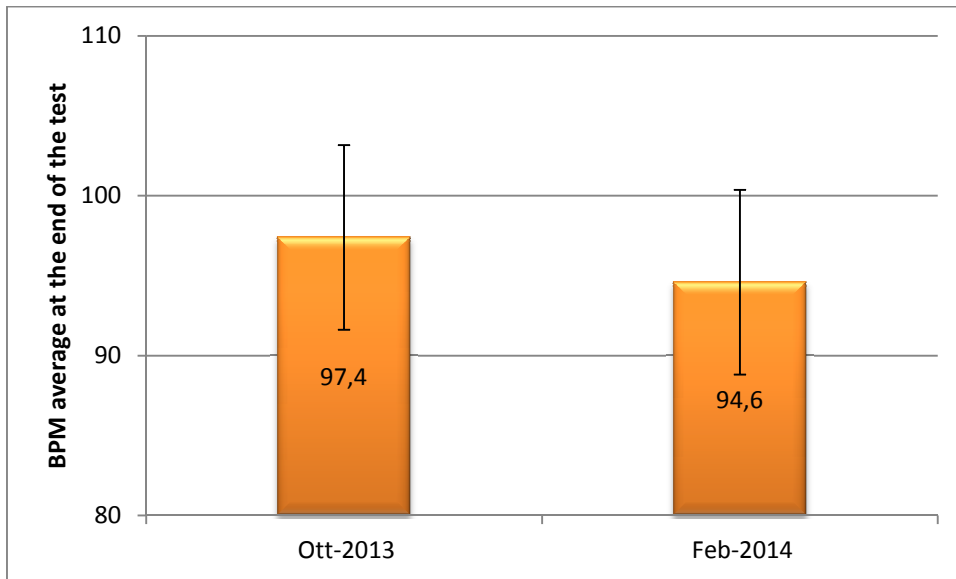


Score 3: very shiny coat and very soft to the touch

In this table we can observe that the standard deviation of the average speed of the ten trotters is not improved with the administration of the feed supplement of Purina.



While in this other table we see that there has been a significant change in the average beats per minute measured at the end of the test training.



5. Conclusions

The present work sought to show that the feeding of trotters in competitive activity plays a decisive role in athletic performance. In fact, the well-balanced diet allows the horse to be able to express all their power on the track. As we have seen from the analysis of the average time of the tests, the beats per minute (BPM) and visual and tactile examination of the shine and softness of the coat, the complementary feed from Purina (Horse Starr), seem better than the previous complementary feed Grigi-Cereali, as it is integrated with a higher dose of vitamins, pro-vitamins and substances having a similar effect, trace elements, antioxidants, amino acids and their salts and analogues. From this work it was found that:

- a) By changing the type of complementary feed the average time of the tests performed on a runway of 2,000 meters have not changed significantly
- b) The new feed formula has improved the BPM (beats per minute), thus decreasing the fatigue of each horse
- c) The new feed has significantly improved the coat of horses, making it much more shiny, silky and soft

6. Bibliography and sitography

- Nicoletta Miraglia e Antonio L. Catalano, (1987). *Alimentazione pratica del cavallo sportivo*. Edito dalle Associazioni Nazionali degli Allevatori di cavalli Purosangue e trottatore finanziato dall' Unire
- Lauralee Sherwood, Hillary Klandorf e Paul Yancey, (2006). *Fisiologia degli animali, dai geni agli organismi*. Zanichelli.
- Bryden W.L., (1991). Proc. Postgrad. Comm. In Vet. Sci. No. 191: *Equine Nutrition*
- Bryden W.L., (1995). *Nutrition of performance horses*. In: Equine nutrition and pastures for horses workshop 1995
- Evans D.L., (2000). *Training and fitness in athletic horses*. RIRDC Publication
- Frape D., (1986). *Equine nutrition and feeding*. Longman Group UK Limited
- Jackson S.G., Pagan J.D., (1991). *Equine nutrition: a practitioner's guide*. Proc Ann Conv Am Assoc Equine Pract
- NRC, (1989). *Nutrient Requirements of Horses*. 5th rev. edn. National Academy Press: Washington, DC
- Bittante G., Andrighetto I., Ramanzin M., (1999), *Fondamenti di zootecnica*, Liviana, Torino
- Breuer L.H., *Protein and Energy Requirements of Treatment of Growing Horses*, L.H.Breuer & Associates, Volume 5, Issue 1
- Cunha T.J., (1991), *Horse Feeding and Nutrition*, Academic Press Inc., S.Diego
- Duren S., *Dietary Fat and Equine Athlete*, Kentucky Equine Research, Inc.
- Jackson S.G., *The Performance Horse*, Kentucky Equine Research, Inc., Versailles, Kentucky
- Jackson S.G., *Practical Problems Related to Nutrition*, Kentucky Equine Research, Inc., Versailles, Kentucky
- Lewis L.D., (1998), *Alimentazione e Allevamento del Cavallo*, EMSI, Roma
- Frape D.L., (1996), *Equine Nutrition and Feeding*, Longman Scientific & Technical, Essex, England
- Frape D.L., *Dietary Requirements and Athletic Performance of Horses*, Equine Vet.J., 1998
- George D.M., (1992), *Meeting Nutritional Needs, in Proceedings*, Annu Conv Am Assoc Equine Practnr

- George D.M., (1993), Nutrient Requirements for Growing Horses, Annu Conv Am Assoc Equine Practnr
- Jones William E., (1997), *Note di Medicina Sportiva Equina*, Edizioni SCIVAC, Cremona
- Hintz H.F., Schryver H.F. (1997) *Digestive Physiology of the Horse*, Journal of Equine Medicine Surgery
- Larkins N., *Equine Feed Supplement Ingredients*, Nutrition Glossary
- Pagan J.D., *Energy and the Performance Horse*, Kentucky Equine Research , Inc.. Versailles, Kentucky
- Pagan J.D., *Feeding Forage*, Kentucky Equine Research , Inc.. Versailles, Kentucky
- Wilson R. G., Isler R. B., Thornton J. R., (1983). "Heart rate, lactic acid production and speed during a standardised exercise test in Standardbred horses." *Equine Exercise Physiology*, eds. Snow, D. H., Persson, S.G.B. and Rose, R. J., Granta Editions, Cambridge
- Trevor-Jones P.J., (1991). "Formulating for the performance horse." *Proc. Equine Nutrition Seminar, Proc 181 Postgraduate Foundation in Veterinary Science*
- Trevor-Jones P.J., (1991). "Need for Dietary Supplements." *Proc. Equine Nutrition Seminar, Proc 181 Postgraduate Foundation in Veterinary Science*
- Rowe J., Brown W., Bird S., (2001). "Safe and Effective Grain Feeding for Horses." RIRDC Publication No 01/148
- Persson S., (1999). "Effects of training of the Standardbred racehorse." *World Trotting Conf Papers*
- Pastorelli S., Gatta D., (1991). "L'utilizzazione dei principi nutritivi nell'alimentazione." *Il trottatore n°1-2*
- NRC, (1989). "Nutrient Requirements of Horses" 5th rev. edn. National Academy Press: Washington, DC.
- Pastorelli S., (1990). "Fisiologia digestiva del cavallo, ruminante atipico e complesso." *Il trottatore n° 1-2.*
- Duren S., Crandell K., (1998). "Feeding the endurance horse." *World Equine Vet. Rev*
- www.wikipedia.org
- www.veterinari.it
- www.ilpaddock.com
- www.rutgers.edu
- www.purinacavalli.it