



Protein for Muscle Development



Not just for body
builders

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Horses are natural pasture grazers, why do they need protein?



Adult horses 40-50% of bodyweight is protein

- 55% is muscle
- 30% connective tissue

Lush Spring grass high in protein
Autumn/Winter grass low protein

Protein content and quality of
hay/haylage variable

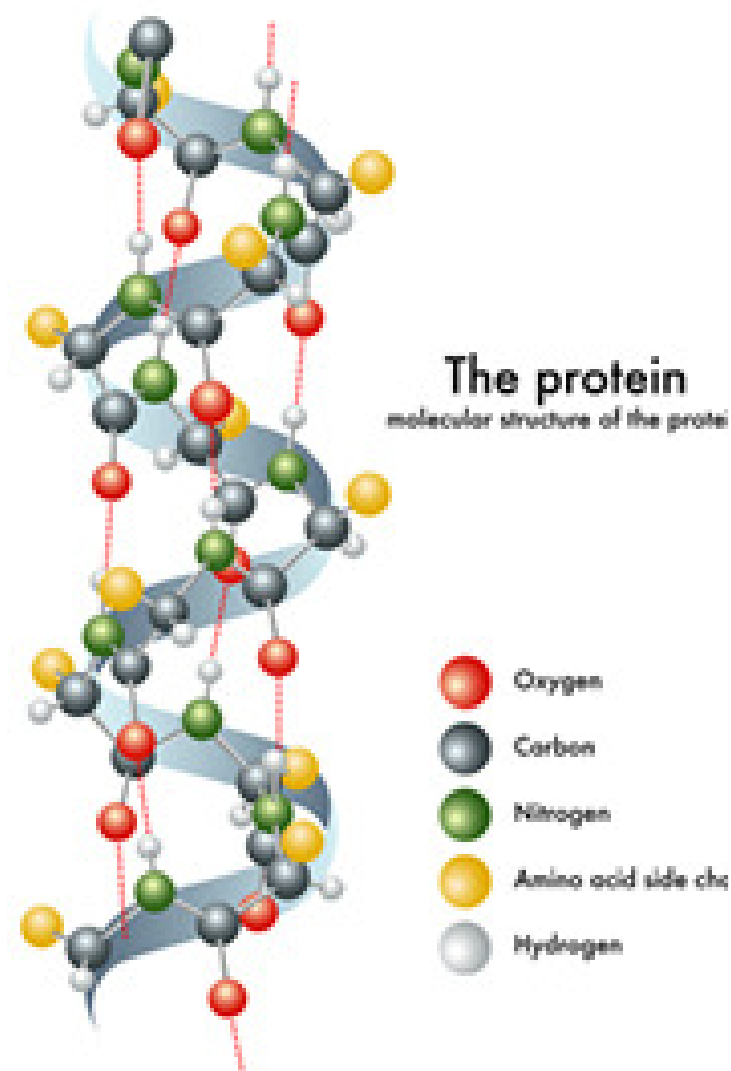


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What are proteins?

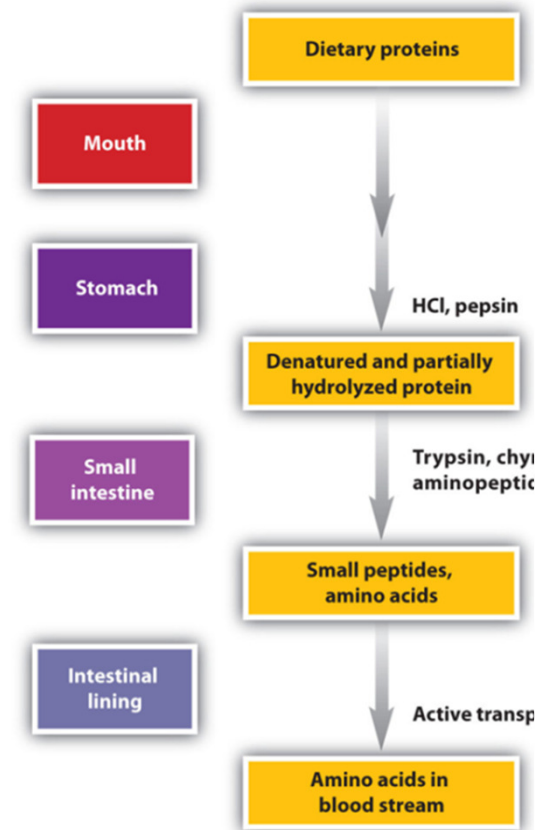
- Complex long molecules
- Chains of amino acids
- Amino acids arranged according to genetic code



How are proteins used by the body?



- **Digestion**
 - Protein broken down to constituent amino acids
- **Absorption**
 - Amino acids absorbed in small intestine
- **Utilization**
 - Amino acid build blocks used to create
 - Muscle fibres
- **Catabolism**
 - Body protein broken down for use as energy source





Amino acids aren't all equal

20 amino acid types.

- **Non Essential Amino Acids**
 - Can be made by the body
- **Essential Amino Acids**
 - Cannot be made by the body
 - Must be supplied in sufficient quantity by the diet
- **Limiting Amino Acids**
 - An amino acid, when deficient, even if other amino acids are adequate, limits the proteins production
 - Lysine
 - Threonine
 - Methionine



Proteins aren't all equal

Protein Quality

- Proteins have different amino acid make ups
- High in limiting amino acids = high quality protein
 - Soybean meal 3.13% lysine

Protein Digestibility

- Not all proteins are easily digested
- Only proteins digestible in small intestine can be used
- Pre-caecal protein digestibility
 - 14% pellets 60%
 - Soybean meal 53%
 - Hay 9.6%





Protein for growth

‘It is easy to demonstrate that a horse may irrecoverably suffer in his shape (sic) as well as in strength by being underfed while he is young’

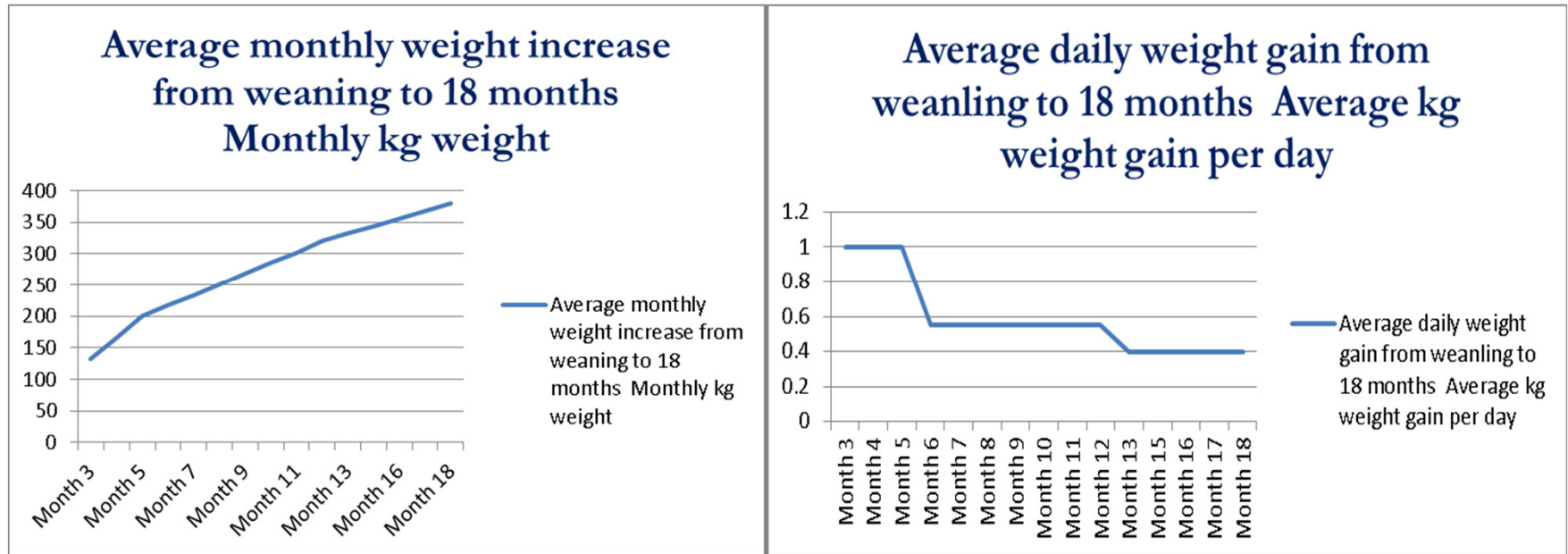
William Gibson 1726



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Growth Rates in Young Horses



Decreasing average weight gain as animal ages

- 60% mature weight at 12 months
- 90% mature weight at 18 months



Growth of Thoroughbreds fed a low-protein supplement fortified with lysine and threonine¹

W. B. Staniar^{*2}, D. S. Kronfeld^{*}, J. A. Wilson[†], L. A. Lawrence^{*},
W. L. Cooper^{*}, and P. A. Harris[‡]

Growth rate for foals fed 9% ration fortified with

- 6g/kg Lysine &
- 4g/kg Threonine

higher than growth rate for foals fed 14% ration

The Effect of Supplemental Lysine and Threonine on Growth and Development of Yearling Horses^{1,2,3}

P. M. Graham⁴, E. A. Ott⁵, J. H. Brendemuhl, and S. H. TenBroeck

Department of Animal Science, University of Florida, Gainesville 32611-0910



Compared the effects of feeding a typical 12% ration on yearling growth rates with same ration supplemented with lysine or lysine & threonine

Feed	Weight gain grams/day	Girth gain cm
12% Crude Protein Pellets	570g	9.7cm
12% CP Pellets + Lysine	640g	10.1 cm
12% CP Pellets + Lysine + Threonine	670g	11.3 cm

Threonine increase in muscle gain without an increased in rump fat

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Growth and calcium metabolism in horses fed varying levels of protein.

H. F. SCHRYVER, D. W. MEAKIM, J. E. LOWE, J. WILLIAMS, L. V. SODERHOLM and H. F. HINTZ
Equine Research Program, Cornell University, Ithaca, New York 14853, USA

Compared growth rates of weanlings on different diets of

- 9% crude protein (2.8g lysine/kg)
- 14% crude protein (7g lysine/kg)
- 20% crude protein (12.6g lysine/kg)

9% crude protein diet significantly reduced:

- Daily weight gain
- Height gain
- Forecannon circumference
- 4.5 months to catch up after diets changed.



Protein for Growth

Potential to achieve 90% of mature weight at 18 months

Significant delay in reaching it if feeding rate is reduced.

- Research suggests limiting amino acid content just as crucial as crude protein amount in achieving mature weight



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Protein for exercise

With training muscular hypertrophy occurs

- Higher maintenance requirement for protein
- Exercising horses that are still growing even greater protein requirement



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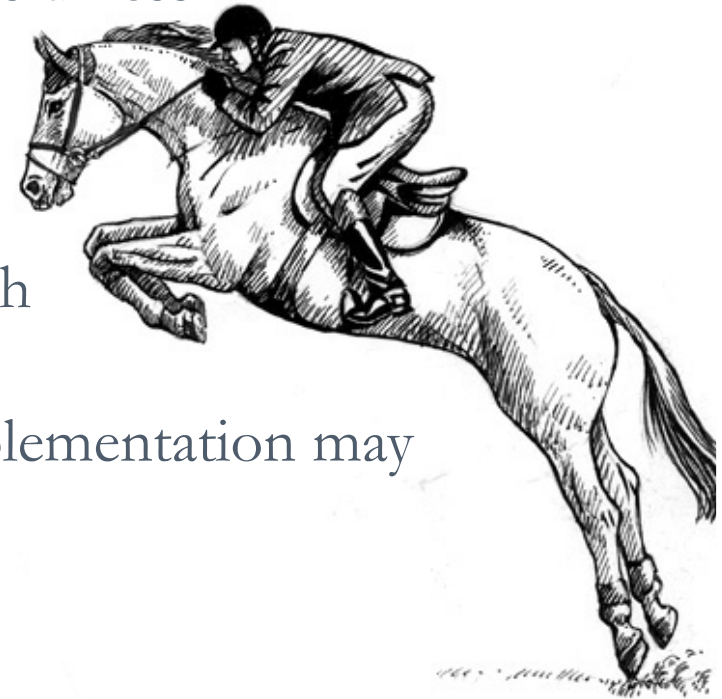


Protein for Exercising Horses

Increased requirement for energy and protein

Generally met by increasing feeding rates unless

- Horse goes off it's feed
- Poor doer when competing
- Long campaign season
- Immature/backward to begin with



High quality & digestibility protein supplementation may benefit



Additional Protein & Performance

Providing dietary protein in excess of the need for protein balance can have some metabolic advantages

- Reduced lactate concentration post-exercise

Branched Chain Amino Acid Supplementation

- Gluconeogenic amino acids
- Reduced plasma lactate levels
- Reduced heart rate

No improvement in performance



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Effect of feeding a high-protein diet following an 18-hour period of feed withholding on mammalian target of rapamycin-dependent signaling in skeletal muscle of mature horses

Kristine L. Urschel, PhD; Jeffery Escobar, PhD; L. Jill McCutcheon, DVM, PhD; Raymond J. Geor, BVSc, PhD

- Horses consuming high protein diet had higher amino acid levels in muscle biopsies and blood
- Adult horses may be able to increase rates of muscle protein synthesis in response to feeding & that dietary amino acids are the main mediators of this effect



Protein for Performance

- Muscle growth follows exercise & requires protein
- Supplementing protein helps maintain muscle integrity
- Supplementing protein can improve post exercise recovery



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Take home tips

- Chose feeds with high quality protein sources
- Chose highly digestible protein
- Consider limiting amino acids for growing horses
- Separate time for hay and concentrate feeding
- Consider protein supplementation in performance horses
 - Young horses competing
 - Horses competing in multiple classes
 - Horses towards end of busy competition season



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