Kanatlı Beslemede Yemler

Antibesinsel Ögeler ve Etkileri

2017-2018

ZZT424-Kanatlı Hayvan Besleme Ders Notları

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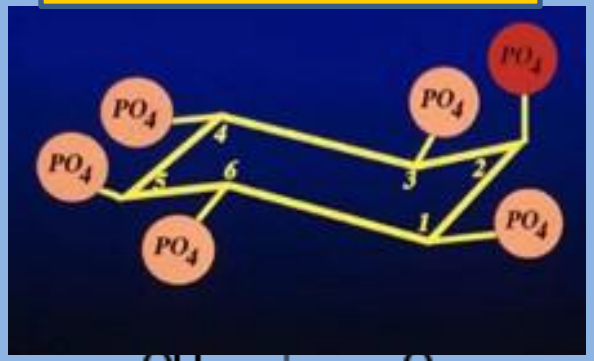
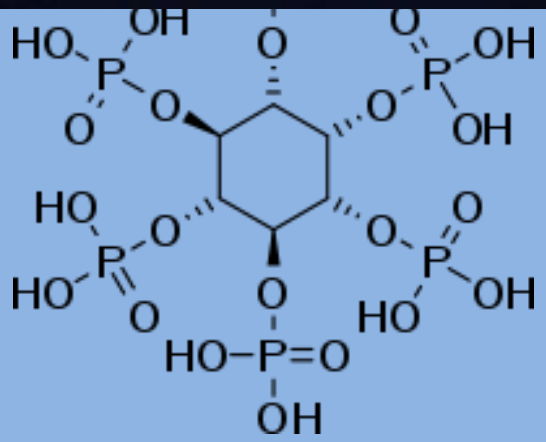
Ankara Üniversitesi-Ziraat Fakültesi-Zootekni Bölümü

Fitik Asit, Fitin ve Fitat P

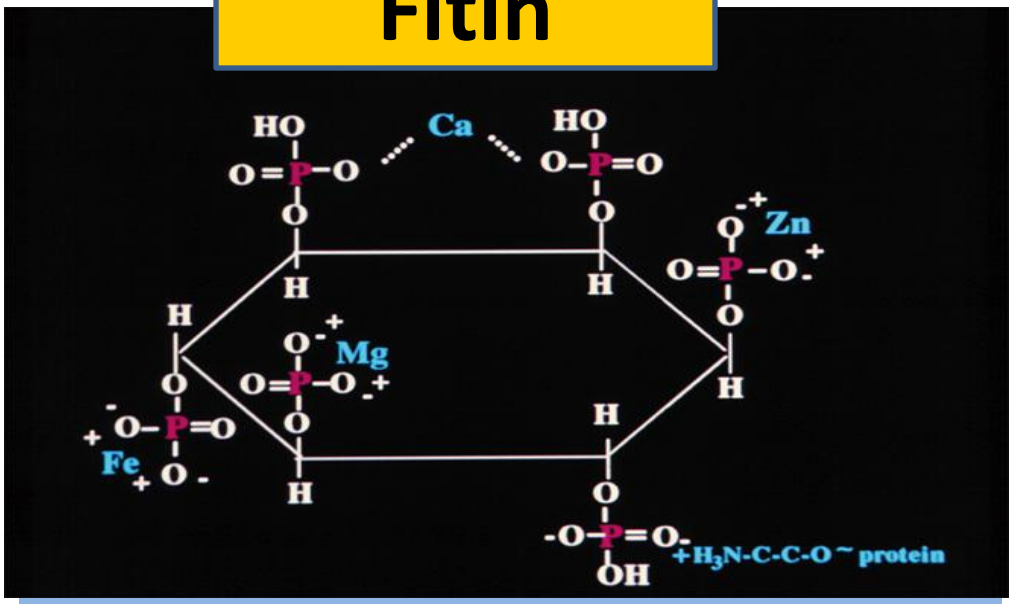
Fitat:IP6





***Bitkilerde P'un depo formu=myo*-inositol-1,2,3,4,5,6-hexakis dihydrogen phosphate**

Fitin



Bitkilerde IP6'nın K, Mg ve Ca ile oluşan depolanmış kompleksi. Fitatın şelat formu

Bitkisel Yemler, P İçerikleri ve Sindirilebilirlik

Yem Hammaddesi	Toplam P (g kg^{-1})	Fitat-P (g kg^{-1})	Oran (%)
Tahıllar			
Arpa	3.21 (2.73–3.70)a	1.96 (1.86–2.20)a	61.0 (59–68)
Mısır	2.62 (2.30–2.90)	1.88 (1.70–2.20)	71.6 (66–85)
Sorgum	3.01 (2.60–3.09)	2.18 (1.70–2.46)	72.6 (65–83)
Buğday	3.07 (2.90–4.09)	2.19 (1.80–2.89)	71.6 (55–79)
Yağlı Tohum Küspeleri			
Kanola Küspesi	9.72 (8.79–11.50)	6.45 (4.00–7.78)	66.4 (36–76)
Pamuk Toh. Küspesi	10.02 (6.40–11.36)	7.72(4.9–9.11)	77.1 (70–80)
Soya Tohumu Küspesi	6.49 (5.70–6.94)	3.88 (3.54–4.53)	59.9 (53–68)
Yan Ürünler			
Pirinç Kepeği	17.82 (13.40–27.19)	14.17 (7.90–24.20)	79.5 (42–90)
Buğday Kepeği	10.96 (8.02–13.71)	8.36 (7.00–9.60)	76.3 (50–87)

Yem	P içeriği, %	Sindirilebilirlik, %	
		Ortalama	Değişim
Mısır	0.23	17	12-26
Buğday	0.41	47	45-51
Razmol	1.20	28	18-35
Mısır Gluteni	0.98	20	12-32
Soya Küspesi	0.73	38	33-41

Arpa-Barley

Commercial Poultry Nutrition, Third Edition
I. Leeson, S., Summers, J.D.
ISBN 978-1-904761-78-5

Barley is a cereal with medium content of both energy and protein, and while it can be used in poultry feeds, most is used in swine diets. Young birds are less able to digest barley, although this may be a consequence of ß-glucan content, and so this effect may relate to variety and growing conditions. The protein content of barley is usually around 11 – 12%, although much higher levels to 14 – 16% are sometimes encountered. These high-protein varieties are often little changed in content of essential amino acids. The lysine content of barley, within the range of 10 – 14% CP, is described by the equa-

Most varieties of barley will contain 4 – 7% ß-glucan, although with dry growing conditions that involve rapid maturation and early harvest, the content can increase to 12 – 15%. As previously described for wheat, the main problem of these ß-glucans is the bird's inability to digest the structure, resulting in the formation of a more viscous digesta. This increased viscosity slows the rate of mixing with digestive enzymes and also adversely affects the transport of digested nutrients to the absorptive mucosal surface. The rate of diffusion to the intestinal microvilli is a function of the thickness of the unstirred boundary layer, and this increases with increased digesta viscosity. Motility of the digesta will also indirectly affect the thickness of the unstirred boundary layer, which will also affect rate of absorption of all nutrients. The adverse effect of ß-glucan is most pronounced with nutrients such as fats and fat-soluble compounds. Adding synthetic ß-glucanase enzymes to diets containing more than 15 – 20% barley seems to resolve many of

Early studies show that any product should provide at least 120 units ß-glucanase/kg diet.

Nutrient Profile: (%)

Dry Matter	*85.0*	*Methionine*	*0.21*
Crude Protein	*11.5*	*Methionine + Cystine*	*0.42*
Metabolizable Energy:		*Lysine*	*0.39*
(kcal/kg)	*2780*	*Tryptophan*	*0.19*
(MJ/kg)	*11.63*	*Threonine*	*0.40*
Calcium	*0.10*	*Arginine*	*0.51*
Av. Phosphorus	*0.20*	*Dig Methionine*	*0.16*
Sodium	*0.08*	*Dig Meth + Cys*	*0.32*
Chloride	*0.18*	*Dig Lysine*	*0.31*
Potassium	*0.48*	*Dig Tryptophan*	*0.15*
Selenium (ppm)	*0.30*	*Dig Threonine*	*0.29*
Fat	*2.10*	*Dig Arginine*	*0.41*
Linoleic acid	*0.80*		
Crude Fiber	*7.50*		

Formulation Constraints:

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Bird age	*Min.*	*Max.*	*Comments*
0-4 wk	*-*	*10 (30)%[1]*	*ß-glucan content usually dictates maximum inclusion level*
4-18 wk	*-*	*15 (40)%*	
Adult layer	*-*	*15 (30)%*	

[1] with ß-glucanase enzyme

Önemli Protein Kaynağı Yemler ve Kanatlı Beslemede Kullanımları

Soya Küspesi-Soybean Meal

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I. Leeson, S., Summers, J.D.
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Soybean meal has become the worldwide standard against which other protein sources are compared. Its amino acid profile is excellent for most types of poultry, and when combined with corn or sorghum, methionine is usually the only limiting amino acid.

The protein level in soybean meal can be variable, and this may be a reflection of seed variety and/or processing conditions involved in fat extraction. Traditionally the higher protein meals are produced from de-hulled beans, whereas the lower protein (44% CP) meals invariably contain the seed hulls, and are higher in fiber and lower in metabolizable energy. There is some variation in seed type used and this

noticed by severe and sudden liver failure in birds. Soybean meals tend to be very dusty, and in mash diets, soy is responsible for some of the dust found in controlled environment poultry houses. Soybean meal is also notorious for its poor flow characteristics and for bridging in storage bins.

Soybeans contain a number of natural toxins for poultry, the most problematic being trypsin inhibitor. As with most types of beans, the trypsin inhibitors will disrupt protein digestion, and their presence is characterized by compensatory hypertrophy of the pancreas. Apart from reduced growth rate and egg production, presence of inhibitors is therefore diagnosed by a 50-100% increase in size of the pancreas. Fortunately, the heat treatment soybean meal has therefore become the standard in quality control programs. Urease is assessed in terms of change in pH during the assay, where acceptance values range between 0.05 and 0.15. Higher values mean there is still residual urease (trypsin inhibitor) and so the test is useful to indicate undercooked meal. However,

inhibitor. The other antinutrients of importance are isoflavones, lectins and oligosaccharides. Lectins are antinutritional glycoproteins that bind to the intestinal epithelium resulting in impaired brush border function. Such 'thickening' of the epithelium results in reduced efficiency of absorption. There are strains of soybeans

Oligosakkaritler ve Potasyum İçeriğine Dikkat, Metiyonin Sınırlayıcı

Nutrient Profile: (%)

Dry Matter	*90.0*	*Methionine*	*0.72*
Crude Protein	*48.0*	*Methionine + Cystine*	*1.51*
Metabolizable Energy:		*Lysine*	*3.22*
(kcal/kg)	*2550*	*Tryptophan*	*0.71*
(MJ/kg)	*10.67*	*Threonine*	*1.96*
Calcium	*0.20*	*Arginine*	*3.60*
Av. Phosphorus	*0.37*		
Sodium	*0.05*	*Dig Methionine*	*0.64*
Chloride	*0.05*	*Dig Meth + Cys*	*1.27*
Potassium	*2.55*	*Dig Lysine*	*2.87*
	0.11	*Dig Tryptophan*	*0.53*
	0.5	*Dig Threonine*	*1.75*
	0.3	*Dig Arginine*	*3.20*
	3.0		

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Over the last few years there has been growing concern about some of the less digestible carbohydrates in soybean meal. The α-galactoside family of oligosaccharides cause a reduction in metabolizable energy with reduced fiber digestion and quicker digesta transit time. Birds do not have an α1:6 galactosidase enzyme in the intestinal mucosa. Apart from reduced digestibility, there is concern about the consistency of excreta and its involvement in footpad lesions in both young turkeys and broiler breeders. Soybean meal usually contains about 6% sucrose, 1% raffinose and 5% stachyose, all of which are poorly digested by the bird. Adding

Soybean meal is also very high in potassium. In regions where animal proteins are not used, then necessarily high levels of soybean meal can lead to enteritis, wet litter, and food pad lesions.

Soya Küspesi Kısıtlamalar

Formulation Constraints:

Bird age	*Min.*	*Max.*	*Comments*
0-4 wk		*30%*	*Higher levels may lead to wet litter due to high K intake*
4-8 wk		*30%*	
Adult		*30%*	

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Tam Yağlı Soya-Full Fat Soybean

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Nutrient Profile: (%)

Dry Matter	90.0	Methionine	0.49
Crude Protein	38.0	Methionine + Cystine	1.12
Metabolizable Energy:		Lysine	2.41
(kcal/kg)	3880	Tryptophan	0.49
(MJ/kg)	16.23	Threonine	1.53
Calcium	0.15	Arginine	
Av. Phosphorus	0.28		
Sodium	0.05	Dig Methionine	
Chloride	0.04	Dig Meth + Cys	
Potassium	1.50	Dig Lysine	
Selenium (ppm)	0.10	Dig Tryptophan	
Fat	20.0	Dig Threonine	
Linoleic acid	9.0	Dig Arginine	
Crude Fiber	2.0		

times. Because both expanders and extruders are fast throughput, the beans have a relatively short dwell time in the conditioning chamber. Consequently, slightly higher temperatures are necessary, and depending upon design, such machines are best operated at 140-155°C. Again, the effectiveness of expanding and extrusion can be measured by tests for urease and available lysine content.

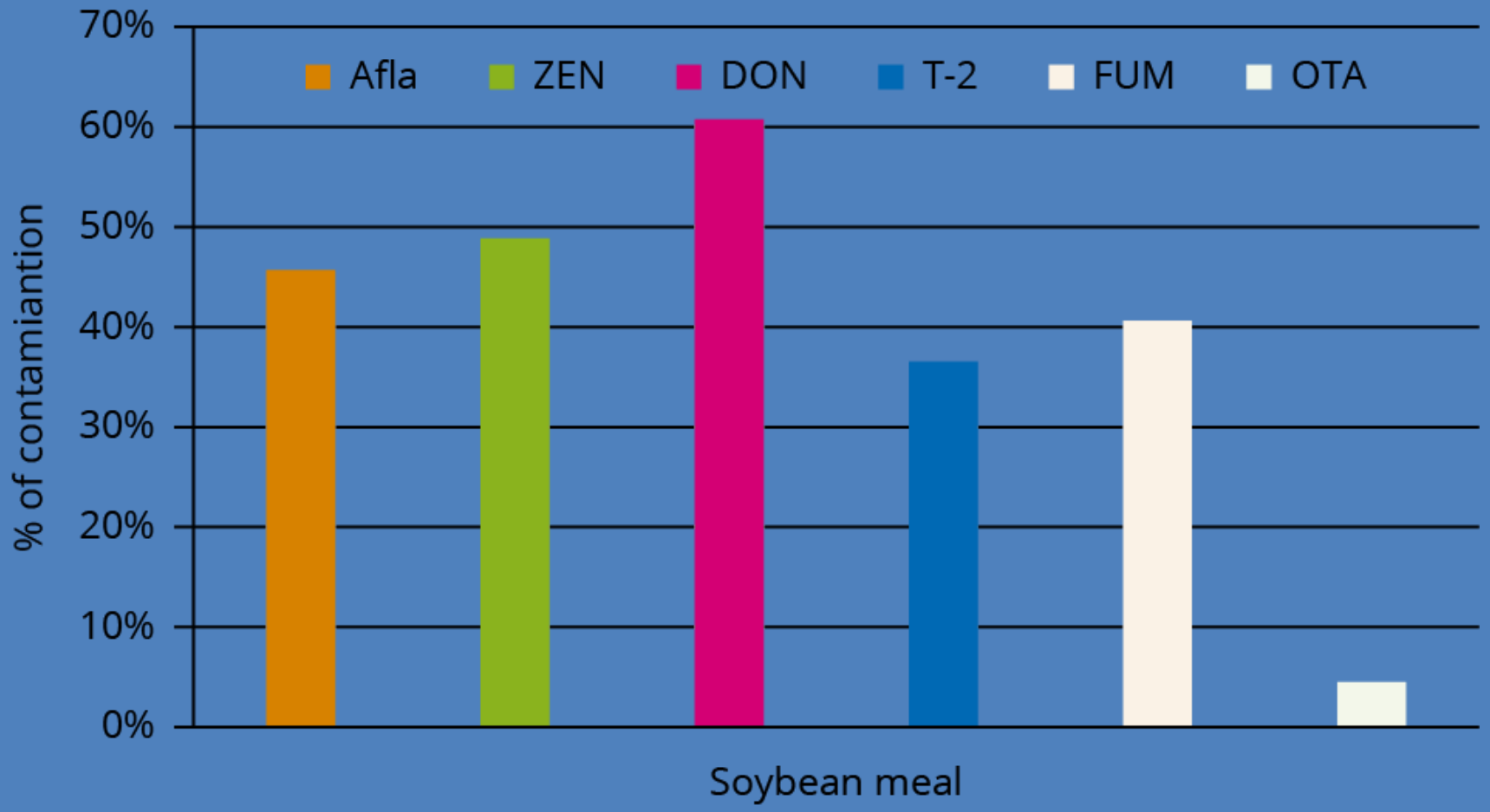
Formulation Constraints:

Bird age	Min.	Max.	Comments
0-4 wk		15	In broiler finisher diets, > 30% may cause 'oily' fat depots.
4-8 wk		20	
Adult		30	

Potential Problems:

Under-heating of soybeans is detected as a high urease or KOH protein solubility. If broiler finisher diets contain > 30% soybeans, then their body fat will become less saturated and more prone to oxidative rancidity. This latter problem can be resolved to some extent by using higher levels of vitamin E (75-100 IU/kg).

Soya ve Mikotoksin Kontaminasyonu(Ocak-Temmuz 2016 Avrupa Birliği)



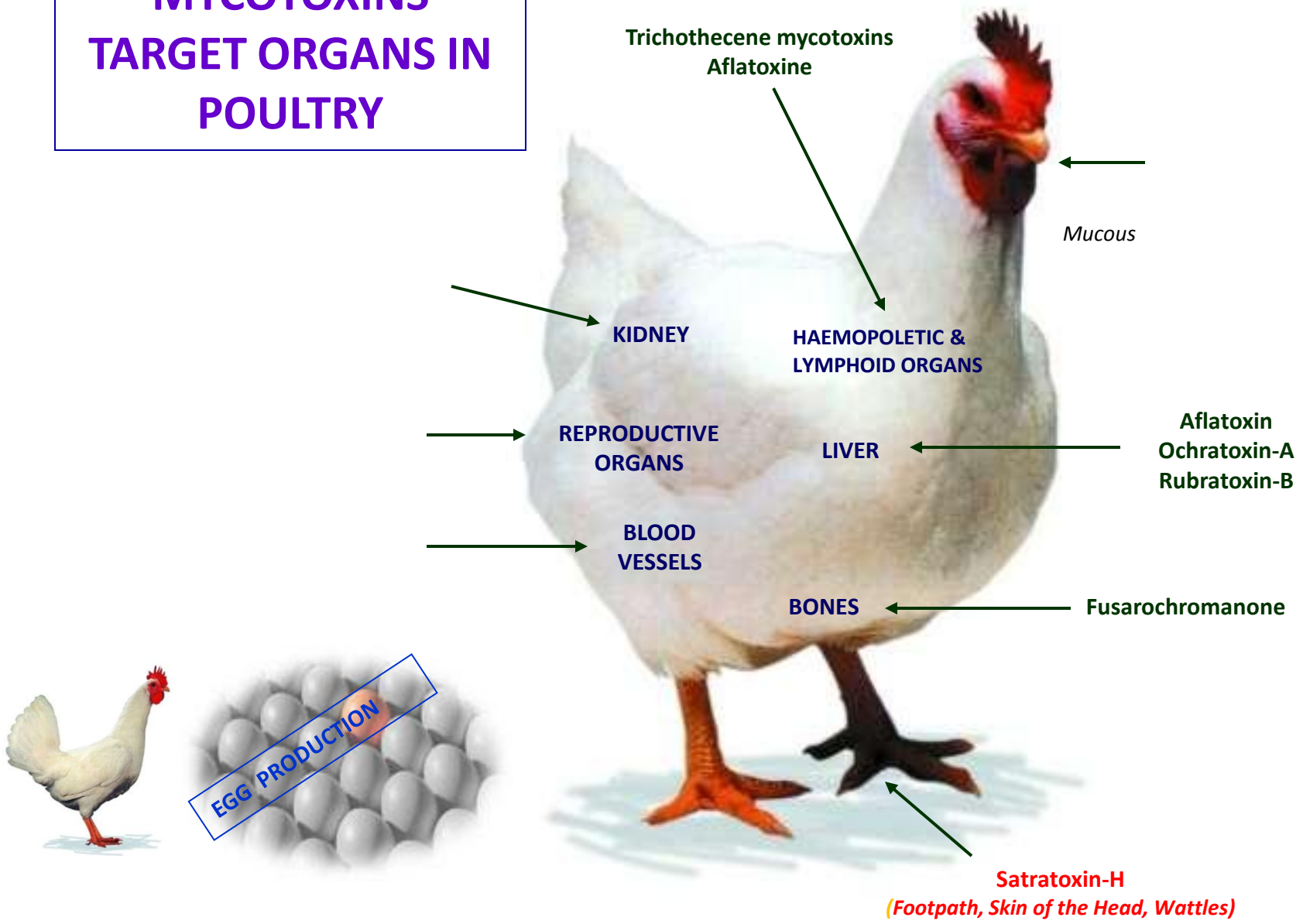
Test edilen 298 soya örneğinden %61 deoxynivalenol, %49 zearalenone ve %46 sı **aflatoxins** bulaşması olduğu tespit edildi.

Mikotoksinler ve Etkileri

Mikotoksin	Etkisi	
Trichothecenes	Tüylenmede bozulma, barsak lezyonları, bağışıklığın baskılanması, protein sentezinde bozulma	Temperature control, inflammatory responses, reduced lymphocytes and antibodies
Fumonisin	Bağışıklığın baskılanması	Reduced macrophage activity
Ochratoxin A	Bağışıklığın baskılanması	Reduced macrophage activity, reduction of lymphocytes, inflammatory responses
Aflatoxin	Karaciğer tümörü, Tüylenmede bozulma, bağışıklığın baskılanması	Temperature control

- **Besin maddesi kaybı (enerji, vitaminler, amino asitler)**
- **Lezzetsizlik (yem tüketimi)**
- **Mikotoksin mevcudiyeti (bütün performansın etkilenmesi)**
- **Misel oluşumu (kötü görünüm ve kekleşme)**

MYCOTOXINS TARGET ORGANS IN POULTRY



Mikotoksinler Barsak Hasarına ve Buna Bağlı Yem Atmaya ve Protein ve Eneji Sindirilebilirliğin Azalmaya Yol Açar

Feed Passage-Yem Atma

Feed Passage-Yem Atma

12. *Corn gluten meal*

Nutritional Characteristics:

Corn gluten meal contains around 60% CP and is a by-product of wet milling of corn, most of which is for manufacture of high-fructose corn syrup. Being high in protein, it is often compared to animal protein ingredients during formulation. The protein is merely a concentration of the original corn protein component brought about by removal of the starch in the endosperm. There are, in fact, two products often manufactured during wet milling, the alternate being corn gluten feed which contains only 20% CP, due to dilution with various hull material. In certain regions of the world, the two products are merely called 'corn gluten' and so this must be differentiated based on protein content. Corn gluten meal is very deficient in lysine, although with appropriate use of synthetic lysine sources, the product is very attractive where high nutrient density is required. Gluten meal is also very high in xanthophylls pigments (up to 300 mg/g) and is a very common ingredient where there is a need to pigment poultry products.

Potential Problems:

Periodically corn gluten feed (20% CP) is inadvertently formulated as corn gluten meal (60% CP). Using much more than 10% corn gluten meal will produce a visible increase in pigmentation of broilers and egg yolks.

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Nutrient Profile: (%)

Dry Matter	*90.0*	*Methionine*	*1.61*
Crude Protein	*60.0*	*Methionine + Cystine*	*2.52*
Metabolizable Energy:		*Lysine*	*0.90*
(kcal/kg)	*3750*	*Tryptophan*	*0.30*
(MJ/kg)	*15.70*	*Threonine*	*1.70*
Calcium	*0.10*	*Arginine*	*2.20*
Av. Phosphorus	*0.21*		
Sodium	*0.10*	*Dig Methionine*	*1.44*
Chloride	*0.06*	*Dig Meth + Cys*	*2.22*
Potassium	*0.04*	*Dig Lysine*	*0.81*
Selenium (ppm)	*0.30*	*Dig Tryptophan*	*0.21*
Fat	*2.51*	*Dig Threonine*	*1.58*
Linoleic acid	*1.22*	*Dig Arginine*	*2.07*
Crude Fiber	*2.48*		

Formulation Constraints:

Bird age	*Min.*	*Max.*	*Comments*
0-4 wk		*15%*	*Pigmentations increases with*
4-8 wk		*20%*	*> 10% inclusion.*
8 wk+		*20%*	

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Diğer Önemli Bitkisel Protein Kaynakları

- Ayçiçeği Küspesi
- Pamuk Tohumu Küspesi
- Kanola küspesi
- Keten Tohumu Küspesi

Hayvansal Protein Kaynakları

Tavuk Unu

Dry Matter	*90.0*	*Methionine*	*1.3*
Crude Protein	*60.0*	*Methionine + Cystine*	*3.3*
Metabolizable Energy:		*Lysine*	*3.4*
(kcal/kg)	*2950*	*Tryptophan*	*0.4*
(MJ/kg)	*12.34*	*Threonine*	*2.2*
Calcium	*3.60*	*Arginine*	*3.5*
Av. Phosphorus	*2.10*		
Sodium	*0.36*	*Dig Methionine*	*1.1*
Chloride	*0.40*	*Dig Meth + Cys*	*2.3*
Potassium	*0.28*	*Dig Lysine*	*2.7*
Selenium (ppm)	*0.90*	*Dig Tryptophan*	*0.3*
Fat	*8.50*	*Dig Threonine*	*1.8*
Linoleic acid	*2.50*	*Dig Arginine*	*3.0*
Crude Fiber	*1.9*		

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lower. Variability in composition relates to whether or not feathers are added during processing or kept separate to produce feather meal. PBM and feathers are best treated using different conditions, because feathers require more extreme heat in order to hydrolyze the keratin proteins. PBM with feathers may therefore mean that either the feather proteins are under-cooked or that the offal proteins are overcooked. Overcooking usually results in a much darker colored product. PBM contains more unsaturated

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Because of problems of disposal of spent layers, there is now some production of 'spent hen meal' which is essentially produced by rendering the whole body, including feathers. Such spent hen meal contains around 11% fat and 20% ash, with 70% crude protein. Methionine, TSAA and lysine in such samples are around 1.2%, 2.5% and 3.5% respectively, with digestibility of methionine and lysine at 85%, while cystine is closer to 60% digestible. As with poultry by-product meal, the ME of spent hen meal is influenced by content of ash, fat and protein, with a mean value around 2,800 kcal/kg.

Potential problems:

Nutritive value will be positively correlated with protein and fat content and negatively correlated with ash. Cystine content will give an indication if feathers were included during processing, which will detract from amino acid

Bird age	*Min.*	*Max.*	*Comme*
0-4 wk		*8%*	*No majo*
4-8 wk		*10%*	*than fat*
> 8 wk		*10%*	

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Tüy Unu

Dry Matter	*90.0*	*Methionine*	*0.60*
Crude Protein	*85.0*	*Methionine + Cystine*	*6.10*
Metabolizable Energy:		*Lysine*	*1.72*
(kcal/kg)	*3000*	*Tryptophan*	*0.60*
(MJ/kg)	*12.55*	*Threonine*	*4.51*
Calcium	*0.20*	*Arginine*	*6.42*
Av. Phosphorus	*0.70*		
Sodium	*0.70*	*Dig Methionine*	*0.47*
Chloride	*0.40*	*Dig Meth + Cys*	*2.85*
Potassium	*0.30*	*Dig Lysine*	*1.10*
Selenium (ppm)	*0.72*	*Dig Tryptophan*	*0.41*
Fat	*2.50*	*Dig Threonine*	*3.15*
Linoleic acid	*0.10*	*Dig Arginine*	*5.05*
Crude Fiber	*1.50*		

regulatory requirements. However, its use is severely limited by deficiencies of several amino acids, including methionine, lysine and histidine. Feather meal usually contains about 4.5 – 5.0% cystine, and this should be around 60% digestible. The energy value of feather meal is quite high, being around 3300 kcal ME/kg, and Dale and co-workers at the University of Georgia suggests TMEn of feather meal is highly correlated with its fat content (2860 + 77 x % fat, kcal/kg). temperatures for longer durations. Because feather meal is an important contributor to TSAA in the diet, the level of digestible cystine is a critical factor in evaluating nutritive value.

High pressure, unless for a short duration, seems to reduce amino acid digestibility, and again this is especially critical for cystine. Under extreme processing conditions it seems as though sulfur can be volatilized, likely as hydrogen sulfide, and so another simple test f[illegible] quality, is total sulfur content. Su[illegible]

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Feather meal also contains an amino acid called lanthionine, which is not normally found in animal tissue. Total lanthionine levels can therefore be used in assaying meat meal products for potential contamination with feathers. Lanthionine can occur as a breakdown product of cystine, and there are some research results which indicate a very good correlation between high lanthionine levels and poor digestibility of most other amino acids. In most feather meal samples, lanthionine levels should be at 20 – 30% of total cystine levels. A

Bird age	*Min.*	*Max.*	*Comments*
0-4 wk		*2%*	*Amino acid*
4-8 wk		*3%*	*digestibility the*
> 8 wk		*3%*	*main concern*

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Balık Unu

Dry Matter	90.0	Methionine	1.82
Crude Protein	60.0	Methionine + Cystine	2.92
Metabolizable Energy:		Lysine	5.28
(kcal/kg)	2750	Tryptophan	0.58
(MJ/kg)	11.51	Threonine	3.01
Calcium	6.50	Arginine	4.05
Av. Phosphorus	3.50		
Sodium	0.47	Dig Methionine	1.62
Chloride	0.55	Dig Meth + Cys	2.42
Potassium	0.32	Dig Lysine	4.72
Selenium (ppm)	1.85	Dig Tryptophan	0.48
Fat	2.0	Dig Threonine	2.50
Linoleic acid	0.3	Dig Arginine	3.62
Crude Fiber	1.0		

manufacture. Menhaden and anchovy are the main fish species used for meal manufacture, with lesser quantities of herring meal produced in Europe. Fish meal is usually an excellent source of essential amino acids, while energy level is largely dependent upon residual oil content. Because of variable oil and protein content, expected ME value can be calculated based on knowledge of their composition in the meal.

ME (kcal/kg) = 3000 ± (Deviation in % fat x 3600) ± (Deviation in % CP x 3900)
Where standard fat content is 2%, and CP is 60%.

Therefore, a 4% fat, 63% CP sample is expected to have an ME of 3289 kcal/kg, while a 1% fat, 58% CP sample will have ME closer to 2836 kcal/kg. The ash content of fishmeal will be predominantly calcium and phosphorus and the latter can be around 90% available, as

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Potential problems in feeding fish meal are taint of both eggs and meat, and gizzard erosion in young birds. With inadequately heat-treated fishmeal, especially from fresh water fish, there is also the potential problem of excessive thiaminase activity. Depending upon geographical location, taint in eggs and meat can be detected by consumers when birds are fed much more than 4 – 5% fish meal. Problems of taint will be more acute with high fat samples, and of course, the problems are most acute if fish oil *per se* is used. Even at levels as low as 2.5% fish meal, some brown egg birds produce tainted eggs which may be related to the trimethylamine content of fish meal, and meal). The trimethylamine content of fish meal is around 50 – 60 mg/kg, and assuming a 2.5% inclusion level, and feed intake of such brown egg layers of 115 g/day, means that the bird is taking in about 0.2 mg/day. Each affected egg contains around 0.8 mg, and so, it is obvious that the diet contains sources of trimethylamine other than fish meal, or that there is microbial synthe-

For young chicks, and especially the b
er chicken, a major concern with feeding fish
is gizzard erosion. A proportion of chick
almost any level of fish meal develop giz
lesions, although there is a strong dose-respo
Affected birds have signs ranging from s
localized cracks in the gizzard lining, thr
to severe erosion and hemorrhage which ultim
leads to total destruction of the lining.
thick lining is required for preventing degra
effects of acid and pepsin produced by
proventriculus. Because of disrupted pr

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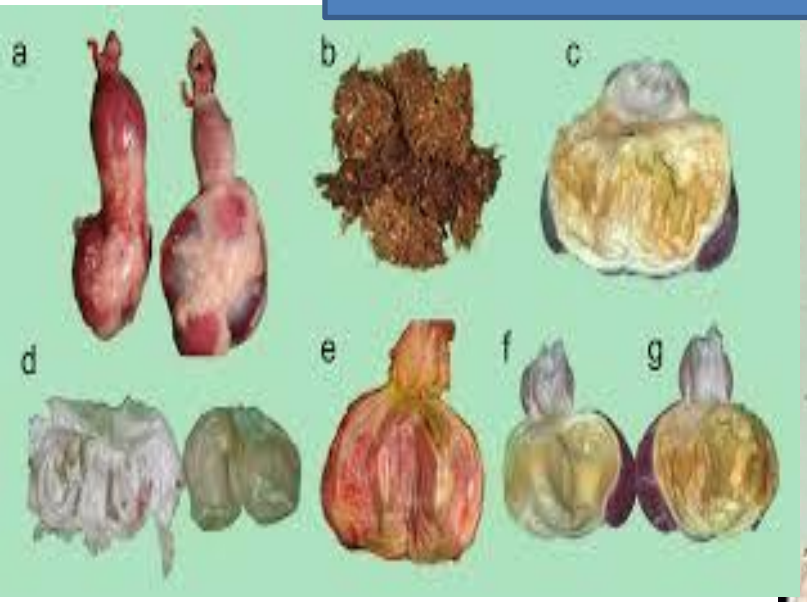

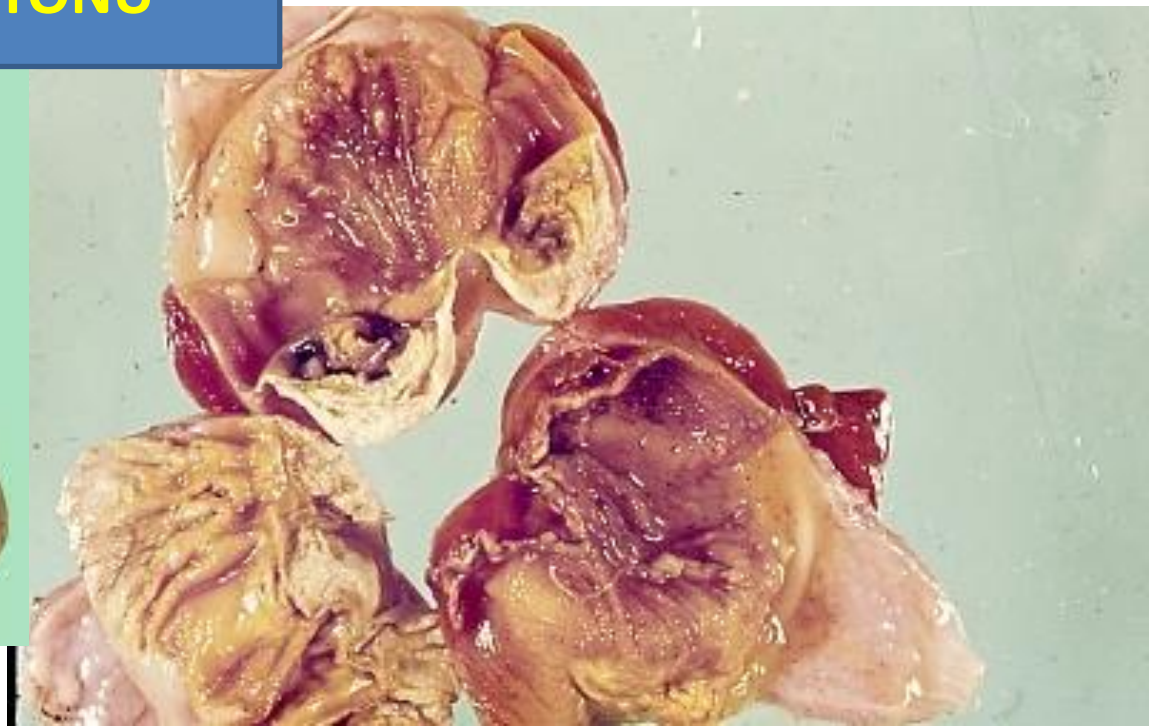

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similar signs are seen with birds fed a high level of copper (250 ppm) or vitamin K deficient diets, or simply induced by starvation. Gizzard erosion was initially thought to be associated with histamine levels in fish meal. Feeding histamine to birds simulates the condition, as does feeding a heated semi-purified diet containing histidine. Fish meals contain histamine, and following microbial degradation during pre-cooking storage, bacteria possessing histidine decarboxylase will convert variable quantities from histidine to histamine. Histamine has the effect of stimulating excessive acid production by the proventriculus, and it is this acid environment that initiates breakdown of the gizzard lining. A product known as gizzerosine has been isolated from fish meal, and this has ulating acid secretion. Gizzerosine is formed by heating histidine and a protein during manufacture of fish meal. The most common components are lysine and histidine. Gizzerosine is almost 10x as potent as is histamine in stimulating proven-

Because the mode of action of gizzerosin is via acid production and a change in gizzar pH, there have been attempts at adding buffer to prevent the problem. For example addin sodium bicarbonate has been reported to lesse the severity of gizzard erosion. Howeve levels as high as 10 kg/tonne are required to chang

Bird age	*Min.*	*Max.*	*Com*
0-4 wk		*8%*	*Tain*
4-8 wk		*10%*	*mark*
> 8 wk		*10%*	*of 2%*

Bira Mayası

Bira Mayası Besin Değeri ve Katkısı

- **Protein kaynağı olarak kuru maddesinde %50 HP ((40-56) içerir. Ancak protein kalitesine dikkat edilmelidir. Proteinin yaklaşık 1/3'ü RNA nitrojenidir. Üretim teknolojsine bağlı olarak az da olsa selüloz ve nişasta da içerebilir. Bazı B-glukanlar ve mannan oligosakkaritler gibi bir kısım bağışıklık destekleyici unsurlar içerir.**
- **RNA nitrojenine bağlı olarak içerdiği yüksek miktar nükleik asitler kanda fazla miktarda ürük asitle sonuçlanabilir. Kanda Ürik asit fazlalığı yağ ve karbonhidrat metabolizmasını olumsuz etkileyebilir. Ürik asit nedeniyle böbreklerde sıkıntı ve gut oluşumunu teşvik edebilir.**
- **Önemli miktarda Ca ve P içeriği dikkate alınmalıdır.**
- **Amino asit yapısı özellikle Glutamik asit gibi esansiyel olmayan amino asitlerde zengindir.**
- **Bu özellikleri dikkate alınarak kanatlı beslemede kullanılabilir. Gumboro vb veya beslemeye bağlı hastalıklarla böbreklerin zorlandığı durumlarda dikkatli olunmalı ve %1-2 den fazla kullanılmamalıdır**

Bitkisel ve Hayvansal Yağlar

Fats provide a concentrated source of energy, and so relatively small changes in inclusion levels can have significant effects on diet ME. Most fats are handled as liquids, and this means heating of most fats and fat blends that contain appreciable quantities of saturated fatty acids.

Depending upon the demands for pellet durability, 3 – 4% is the maximum level of fat that can be mixed with the other diet ingredients. To this, up to 2 – 3% can be added as a spray-on coat to the formed pellet. Alternate technology

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		Metabolizable energy (kcal/kg)		Fat	M.I.U.[5]
	Ingredient	1[1]	2[2]	%	%
19a	Tallow	7400	8000	98	2
19b	Poultry fat	8200	9000	98	2
19c	Fish oil	8600	9000	99	1
19d	Vegetable oil	8800	9200	99	1
19e	Coconut oil	7000	8000	99	1
19f	Palm oil	7200	8000	99	1
19g	Vegetable soapstock	7800	8100	98	2
19h	Animal-Vegetable blend	8200	8600	98	2
19i	Restaurant grease	8100	8900	98	2

[1]ME for young birds up to 3 weeks of age; [2]ME for birds after 3 weeks of age; [3]Conta acids □10:0; [5]Moisture, impurities, unsaponifiables.

The feeding value of fats can obviously be affected by oxidative rancidity that occurs prior to, or after feed preparation. Rancidity can influence the organoleptic qualities of fat, as well as color and 'texture' and can cause destruction of other fat soluble nutrients, such as vitamins, both in the diet and the bird's body stores. Oxidation is essentially a degradation occurs at the double-bond in the structure. Because presence of double-unsaturation, then naturally the more a fat, the greater the chance of ran initial step is the formation of a fatty when hydrogen leaves the α-methy the unsaturated group of the fat. Th free radical then becomes very susceptible to attack by atmospheric oxygen (or mineral oxides) to form unstable peroxide free radicals. These peroxide free radicals are themselves potent catalysts, and so the process becomes autocatalytic and rancidity can develop quickly. Breakdown products include ketones, aldehydes and short chain fatty acids which give the fat its characteristic 'rancid' odour. Animal fats develop a slight rancid odour when peroxide levels reach 20 meq/kg while for vegetable oils problems start at around 80 meq/kg.

Oxidative rancidity leads to a loss in energy value, together with the potential degradation of the bird's lipid stores and reserves of fat-soluble vitamins. Fortunately we have some

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Fat composition will influence overall fat utilization because different components are digested with varying efficiency. It is generally recognized that following digestion, micelle formation is an important prerequisite to absorption. Micelles are complexes of bile salts, fatty acids, some monoglycerides and perhaps glycerol. The conjugation of bile salts with fatty acids is an essential prerequisite for transportation to and absorption through the microvilli of the small intestine. Polar unsaturated fatty acids and monoglycerides readily form this important association. However, micelles themselves have the ability to solubilize non-polar compounds such as saturated fatty acids. Fat absorption is, therefore, dependent upon there being an adequate supply of bile salts and an appropriate balance of unsaturates:saturates.

Table 2.9 Metabolizable energy of layer diets containing various fatty acids

	Determined	*Expected*
	ME (kcal/kg)	
Oleic	*2920*	
Palmitic	*2500*	
50:50 mixture	*2850 (+5%)*	*2710*

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saturation of the basal diet

Basal diet	*Corn oil ME (kcal/kg)*
Predominantly unsaturated	*8390[a]*
Predominantly saturated	*9380[b]*
Corn-soy diet	*8510[a]*

When the basal diet contains saturated fatty acids, there is an apparent increase in the ME of corn oil. This effect is possibly due to the unsaturates in corn oil aiding in utilization of the basal diet saturates. However, because of methods of diet substitution and final ingredient ME calculation, any such synergism is attributed to the test ingredient (corn oil).

ME values of fats will therefore vary with inclusion level, although this effect will be influenced by degree of fat saturation. A ratio of 3:1, unsaturates:saturates is a good compromise for optimum fat digestibility for all ages of bird. However, this ratio may not be the most economical type of fat to use, because of the

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d. Level of Free Fatty Acids and Fatty Acid Hydrogenation

Concern is often raised about the level of free fatty acids in a fat, because it is assumed these are more prone to peroxidation. Acidulated soapstocks of various vegetable oils contain the highest levels of free fatty acids, which can reach 80 – 90% of the lipid material. For young birds there is an indication that absorption of fatty acids is highest in birds fed triglycerides rather than free fatty acids and this may relate to less efficient micelle formation or simply to less bile production. Wiseman and Salvadore (1991) demonstrated this effect in studying the ME value of tallow, palm oil and soy oil that contained

Table 2.11 Effect of level of free fatty acid and bird age on fat ME value (kcal/kg)

		Age	
		10 d	*54 d*
Tallow	*13% FFA*	*7460*	*7940*
	95% FFA	*4920*	*6830*
Palm	*6% FFA*	*6690*	*7800*
	92% FFA	*3570*	*6640*
Soy	*14% FFA*	*9290*	*9300*
	68% FFA	*8000*	*8480*

Adapted from Wiseman and Salvador (1991)

These data suggest that free fatty acids are more problematic when the fat is predominantly saturated and this is fed to young birds. Contrary

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e. Bird Age and Bird Type

Young birds are less able to digest saturated fats, and this concept has been known for som time. With tallow, for example, palmitic aci digestibility increases from 50 to 85% throug 14 to 56 d of age, which together with corre sponding changes for other fatty acids means tha tallow ME will increase by about 10% over th time period. The reason why young birds are les able to digest saturated fats is not well understoo although it may relate to less bile salt productior less efficient recirculation of bile salt or les production of fatty acid binding protein.

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f. Soap Formation

When fats have been digested, free fatty acids have the opportunity of reacting with other nutrients. One such possible association is with minerals to form soaps that may or may not be soluble. If insoluble soaps are formed, there is the possibility that both the fatty acid and the mineral will be unavailable to the bird. There is substantial soap formation in the digesta of broiler chicks and this is most pronounced with saturated fatty acids, and with increased levels of diet minerals. Such increased soap production is associated with reduced bone ash and bone calcium content of broilers. Soap production seems to be less of a problem with older birds. This is of importance to laying hens that are fed high levels of calcium. In addition to calcium, other minerals such as magnesium can form soaps with saturated fatty acids. In older birds and some other animals, there is an indication that while soaps form in the upper digestive tract, they are subsequently solubilized in the lower tract due to changes in pH. Under these conditions both the fatty acid and mineral are available to the bird

Table 2.12 Factors affecting fat ME values

		Relative fat ME
Bird age:	*28 d+*	*100%*
	7 - 28 d	*95%*
	1 – 7 d	*88%*
		(esp. for saturates)
Free fatty acids:	*0 – 10%*	*102%*
	10 – 20%	*100%*
	20 – 30%	*96%*
	30%+	*92%*
		(esp. for saturates)
Inclusion level:	*1%*	*100%*
	2%	*100%*
	3%	*98%*
	4%	*96%*
	5%+	*94%*
Calcium level:	*<1%*	*100%*
	>1%	*96%*
		(esp. for birds <56 d of age)

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Etlik Civciv-Piliç Karma Yemleri Hazırlanırken Hammadde Kullanımı ve Dikkat Edilmesi Gereken Hususlar

Hammaddeler	Rasyonda Kullanım (%)		Açıklama
	En az	En çok	
Yüksek Enerjili Tahıllar Mısır Buğday Sorgum	40	65	Mısır, mikotoksin açısından sorunlu olabilir, kullanım öncesi dikkatli olunmalıdır. Aşırı kullanımı vücut yağında yumuşamaya neden olur. Buğdayın %10 civarında kullanılması pelet kalitesini iyileştirmek için önerilir. Sorgum tanen içeriği (yem tüketimini düşürür) nedeniyle civciv yemlerinde kullanılmamalı, piliç yeminde en fazla %30 kullanılmalıdır.
Orta Enerjili Tahıllar Arpa Çavdar, Tritikale Yulaf		40	Beta glukan ve arabinoksilanlar nedeniyle yapışkan dışkıya neden olabilir. Yüksek selüloz içerikleri nedeniyle kaba yapılıdırlar, yem tüketiminde fiziksel sınırlamaya neden olabilirler. Çavdar, arpa, yulaf, tritikale civciv yemlerinde kullanılmamalıdır. Piliç yemlerinde %30'dan fazla kullanılmamalı; ancak rasyona enzim ilavesiyle piliç yemlerinde %40'a kadar kullanılabilir.
Değirmencilik artıkları Buğday kepeği, bonkalite, razmol vb.		8	Buğday kepeği civciv ve piliç yemlerinde kullanılmamalıdır. Kullanılacak olursa rasyonun dengelenmesinde sorun yaratacağı gibi yem yapısında kabalaşmaya ve yem tüketiminde soruna neden olabilir. Bonkalite veya Tip 5 un pelet kalitesini iyileştirmek amacıyla %5-7 kullanılabilir. Razmol ve bonkalite gibi unlu yapıya sahip bu ürünlerin toz yemde aşırı kullanımı tozumaya neden olur
Bitkisel Protein Kaynakları Yağlı tohumlar ve küspeleri Mısır gluten unu	5	35	Soya küspesi en az %5 kullanılmalıdır. %30'dan fazlası aşırı potasyum alımına bağlı olarak elektrolit dengesizliğine yol açabilir. Ayçiçeği ve Pamuk tohumu küspeleri civciv yemlerinde kullanılmamalı, yüksek proteinli ektraksiyon küspe piliç yeminde en fazla %10 kullanılmalıdır. Kanola küspesi erüsik asit ve glikosinolat içeriği nedeniyle civciv yeminde en fazla %5, piliç yeminde en fazla %10 oranında kullanılmalıdır. Soya tanesi ısıl işlem görmeden doğrudan kullanılamaz. Yağlı tohumlar (soya, kanola gibi) yüksek yağ içerikleri nedeniyle yemde acılaşmaya neden olabilir, dikkat edilmelidir. Rasyonda kullanılacak soya ürünlerinin toplamı %40'ı geçmemeli, potasyum seviyesi kontrol edilmelidir. Mısır gluten unu, protein kaynağı olarak ve uygun deri rengi oluşumu için %10-15'e varan oranlarda kullanılabilir
Hayvansal Protein kaynakları Balık unu, et-kemik unu, tavuk unu	2	15	Civciv yemlerinde balık unu en az %2 kullanılmalı, amino asit dengesinin sağlanmasına katkıda bulunur. %7'den fazla kullanılırsa ette koku problemi görülebilir. Et-kemik unu %10'na varan oranlarda kullanılabilir. Tavuk unu yüksek yağ içeriği nedeniyle yemde açılaşmaya neden olabilir en fazla %7 kullanılmalıdır.
Yemlik Yağlar Bitkisel yağ Hayvansal yağ Asit yağ		5	Rasyonda en fazla %8 oranında kullanılabilir. Fazla yağ pelet kalitesini ve karmanın hammadde dağılımını bozar, minerallerin yarayışlılığını düşürür. Pamuk yağı et kalitesini bozar, haşlanmış piliç etinde hoş olmayan kokuya neden olur. Hayvansal yağların enerji içeriği bitkisel yağlara göre düşüktür; ancak karkas yağında istenilen sertliği sağlar. Homojen karışıma dikkat edilmelidir. Asit yağın peroksit değerine dikkat edilmelidir, kalite özellikleri için yemlik yağlar ve kalite bölümü okunmalıdır.
Melas		3	Yemin formunu iyileştirir, lezzet verir, %3'e kadar kullanılabilir. Ancak aşırı kullanımı yemde topaklanmaya neden olabilir. Yüksek potasyum içeriği problem yaratabilir. %'3ten fazlası su tüketimini artırır.
Mineral yemler Mermer tozu, kireç taşı, DCP, Tuz, Soda	1	3	Mineral yemlerin toplamı rasyonda en fazla %3 olmalıdır. Mermer tozu veya kireç taşının asit sindirilebilirliği en az %70 olmalı ve flordan arındırılmış olmalıdır. Soda, sodyum kaynağı olarak veya tamponlayıcı olarak rasyona %0.2 oranında katılabilir.
Vitamin ve İz Mineral Premiksleri	Prospektüsüne göre		Yasa gereği katılmalıdır, üretici firmaların bildirişleri dikkate alınarak kullanılmalıdır.
Yem Katkı Maddeleri	Prospektüsüne göre		Yemin korunması, pelet kalitesinin artırılması, sindirilebilirliğinin iyileştirilmesi, hayvan sağlığının korunması, ürün kalitesinin artırılması vb amaçlarla farklı yem katkıları kullanılabilir. Kullanımda üretici firmaların bildirişleri dikkate alınmalıdır.