Aviagen™ Turkeys

Revised Phosphorus and Calcium Guidelines for Turkeys

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B.U.T.

REVISED PHOSPHORUS AND CALCIUM GUIDELINES FOR TURKEYS

Following a review of current information relating to phosphorus and calcium requirements for turkeys new guidelines have been established for the B.U.T. and Nicholas lines from Aviagen Turkeys.

In the review it was established that current guidelines have a good level of protection built into them and that based on existing data there is the potential to reduce the recommended levels without increasing the risk to skeletal development.

These new guidelines have the following objectives:-

- **Good leg strength, without risks of skeletal issues**
- **Reduced phosphorus emissions in manure**
- **Improved economics of the diets**

Note has been taken of the consequences of reduced consumption of food and absorption of nutrients during health challenges that are seen in practical field situations. Producers should still be aware of health issues and pay full attention to supporting the turkeys nutritionally through the recovery period.

Phosphorus Description

The different systems for naming and describing phosphorus and its bioavailability have been taken into account.

The use of **Total Phosphorus** as a description of the turkey's phosphorus requirements has application in situations where the choice of ingredients is limited, but as a descriptor of biological utilisation of phosphorus can only be considered accurate based on stable formulas. It is however the simplest and cheapest measurement of phosphorus in the ration and can be determined in any laboratory. It allows comparison of rations between suppliers and systems.

The term **Available Phosphorus** is open to interpretation, because it is not an empirically measured value. There is the potential for the application of values to feed ingredients which could lead to the incorrect levels ofphosphorus being set in diet specifications.

The required phosphorus levels can be better described using either the **Digestible Phosphorus** system or by using **Non-Phytate Phosphorus (NPP)** values. In both systems measured values can be applied to the availability of the phosphorus in ingredients, the result of which is more accurate matching to the turkey's requirements.

A **Digestible Phosphorus** system best describes the phosphorus in feed ingredients based on measurements in the amount that can be utilised by the bird. In our opinion this system gives the most accurate phosphorus levels and should be used to achieve the optimum results. The Dutch system developed at CVB (CVB 1997) established a description based on work with broilers and with theoretical calculations for turkeys. Up to date values can be found in their publications. (CVB 2007)

Non-Phytate Phosphorus (NPP) is determined from the total phosphorus minus the amount of phosphorus bound up as phytate phosphorus (Bos 1993). This describes the bioavailability of the phosphorus and it gives a more accurate description of the phosphorus that is potentially utilisable by the turkey. Working with NPP means that feed companies can set up a routine of testing ingredients and base their phosphorus system on more supportable information, rather than applying an arbitrary availability when using Available or Total Phosphorus systems. Some of the phytate phosphorus can be digested by the turkey, but within a diet based mainly on cereals and vegetable proteins the difference between NPP and digestible values as a proportion of the total requirement for phosphorus in the diet is quite small, as can be seen in the following tables.

Phosphorus levels in feed ingredients

	Total Phosphorus %	Available Phosphorus %	NPP %	Digestible Phosphorus %
Wheat	0.30	0.10	0.10	0.081
Maize	0.25	0.083	0.11	0.043
Soyameal	0.70	0.23	0.21	0.15

Calculated Phosphorus levels in a diet

Diet type	Total Phosphorus %	Available Phosphorus %	NPP %	Digestible Phosphorus %
Wheat[1]	0.37	0.12	0.12	0.09
Maize[2]	0.34	0.11	0.12	0.07

[1]65% Wheat, 25% Soyameal
[2]65% Maize, 25% Soyameal

Inorganic Phosphorus

Inorganic Phosphorus sources of phosphates such as Dicalcium Phosphate and Mono Calcium Phosphate are key dietary ingredients. Compared to other ingredients inorganic phosphates supply the largest proportion of phosphorus in the diet. Using an Available Phosphorus system it is assumed that all of the phosphorus in these materials is available for the turkey to digest. In fact these materials have quite variable bioavailability and it is important that this is established and that the correct value is assigned to the material in the ingredient matrix.

Availability of Phosphorus in Inorganic Phosphorus Sources

	Phosphorus Level %	Bioavailability Range %
Dicalcium Phosphate	16-20	65-75
Mono Calcium Phosphate	19-24	75-85
Rock Phosphate	16-19	50-70

Apparent utilization of phosphorus from inorganic sources by broiler chickens as determined under deficiency conditions.

Reference	Inorganic phosphorus source	Apparent phosphorus retention, %
Van der Klis et al., 1994	Mono-calcium phosphate	87
Van der Klis and Versteegh, 1996	Mono-calcium phosphate	84
Van der Klis and Versteegh, 1996	Mono- / dicalcium phosphate	79
Leske and Coon, 2002	Mono- / dicalcium phosphate	77
Leske and Coon, 2002	Mono- / dicalcium phosphate	80
Leske and Coon, 2002	Mono- / dicalcium phosphate	81
Coon et al., 2007[1]	Dicalcium phosphate	83
Coon et al., 2007[1]	Defluorinated phosphate	86
Coon et al., 2007[1]	Defluorinated phosphate	76

[1]Retainable P determined through broken line slope response.

Animal protein meals are still used as sources of protein in turkey diets in many parts of the world and as these ingredients can contain high levels of Phosphorus it is important that the availability of this is considered. The Available Phosphorus system would rate all of the phosphorus as available, whereas measurements of bioavailability suggest this is not always the situation.

Calculated Phosphorus levels in a diet

	Phosphorus Level %	Bioavailability Range %
Fishmeal	1.5-3.0	85-100
Meat and Bone Meal	3.5-5.5	70-95

Dietary Phosphorus level and Diet Density

Adjustment of phosphorus values based on diet density has been a question that has sometimes been raised and in the new guidelines it has been established that the phosphorus level should be adjusted if energy level of the diet is altered. The principle followed is that the turkey may adjust its feed intake based on energy level in the diet, but its requirement for minerals does not alter as the size of the skeleton will not change.

Calcium

Calcium levels are as important as the phosphorus level and can be set as a ratio to the phosphorus requirement, and varies with age of the birds.

Vitamin D3

Vitamin D is an integral part of the phosphorus and calcium absorption and utilisation complex and as such must be supported by addition of sufficient levels to the diets. In practical situations the use of 25-Hydroxycolecalciferol has been shown to be of some benefit in supporting the Vitamin D requirement via different absorption routes and as such can be an aid in the development of strong bone structures especially in diets for young poults.

NEW GUIDELINES

In the following tables the new guidelines for Phosphorus and Calcium levels are shown.

These are shown by age and sex of the turkeys and are expressed per unit of energy so that users of the information can calculate requirements in their specific situation.

Because of the ongoing discussions about the system of description of phosphorus it has been decided to show the guidelines in terms of Available Phosphorus, Digestible Phosphorus and Non-phytate phosphorus. Also because the calculation of these phosphorus descriptive nutrient levels in feed ingredients are not standardise, a table of ingredient analysis has been included. From this users of these tables will be able to check their own system of phosphorus analysis against the guidelines and if necessary can make their own adjustments.

These tables are designed to improve the understanding and knowledge of the phosphorus requirements for turkeys. As described above and in previous publications this is a difficult area of description and interpretation and to ensure the correct levels of bone mineralisation the correct application of this information is very important.

Further help and discussion are available from Aviagen Turkeys.

REVISED GUIDELINES FOR CALCIUM AND PHOSPHORUS FOR B.U.T. AND NICHOLAS COMMERCIAL TURKEYS

Per Mj/kg

Males Age in Days	Females Age in Days	Gms Av. Phos per Mj/kg	Gms NPP per Mj/kg	Gms Dig. Phos. per Mj/kg	Gms Calcium per Mj/kg
0-21	0-21	0.60	0.576	0.55	1.18
22-42	22-42	0.53	0.525	0.48	1.06
43-63	43-56	0.47	0.475	0.43	0.94
64-84	57-70	0.42	0.426	0.38	0.84
85-105	71-84	0.36	0.363	0.33	0.72
106-126	85-98	0.32	0.317	0.29	0.64
127-147	99-126	0.28	0.278	0.26	0.56

REVISED GUIDELINES FOR CALCIUM AND PHOSPHORUS FOR B.U.T. AND NICHOLAS COMMERCIAL TURKEYS

Per 1500 cals/lb

Males Age in Days	Females Age in Days	% Av. Phos per 1500 cals/lb	% NPP per 1500 cals/lb	% Dig. Phos per 1500 cals/lb	% Calcium per 1500 cals/lb
0-21	0-21	0.830	0.797	0.761	1.633
22-42	22-42	0.733	0.726	0.664	1.467
43-63	43-56	0.650	0.657	0.595	1.301
64-84	57-70	0.581	0.589	0.526	1.162
85-105	71-84	0.498	0.502	0.457	0.996
106-126	85-98	0.443	0.439	0.401	0.886
127-147	99-126	0.387	0.385	0.360	0.775

Appendix 1: % Phosphorus levels in feed ingredients

Ingredient	Total Phosphorus	Available Phosphorus	NPP	Digestible Phosphorus	Phytate Phosphorus	Calcium
Wheat	0.30	0.11	0.11	0.12	0.19	0.04
Maize	0.26	0.08	0.09	0.07	0.17	0.05
Barley	0.36	0.12	0.17	0.13	0.19	0.06
Oats	0.33	0.11	0.10	0.10	0.23	0.08
Sorghum	0.26	0.08	0.09	0.09	0.17	0.03
Soya Hipro	0.65	0.21	0.23	0.27	0.42	0.25
Canola Meal	1.11	0.33	0.30	0.36	0.81	0.65
Sunflower Meal	1.10	0.33	0.17	0.22	0.93	0.30
Wheat Middlings	0.95	0.31	0.30	0.31	0.65	0.12
Wheat Bran	0.92	0.30	0.29	0.30	0.63	0.12
DDGS	0.73	0.24	0.20	0.4	0.53	0.23
Field Beans	0.46	0.15	0.16	0.12	0.34	0.23
Fishmeal	2.50	2.38	2.38	2.00	0	4.00
Meat+Bone	4.70	4.20	4.20	3.60	0	9.20
Poultry Meal	2.00	1.80	1.80	1.60	0	4.50

Data on phosphorus analysis in feed ingredients is limited and so the information shown above is a compliation of information from many sources: CVB, Premier nutrition, Nelson et al 1968, Cossa et al 1997, Van der kliss et al 1996, Coon et al 1998, Amezcua et all 2004

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Every attempt has been made to ensure the accuracy and relevance of the information presented. However, Aviagen Turkeys accepts no liability for the consequences of using the information for the management of turkeys.

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