

Feed Table 2002

**CHEMICAL COMPOSITION OF
POULTRY FEED STUFFS
IN TANZANIA**



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Sokoine University of Agriculture and
ASARECA / FOODNET PROJECT

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PREFACE

Balancing feeds for monogastric animals requires reliable information with regard to the nutritional values of the available feed resources. Such information is limited for Tanzanian feedstuffs. In most cases feed formulations are based on the data obtained from other parts of the world. It is well known that chemical composition and hence feed values are influenced to a large extent by the processing techniques and ecological characteristics of the area and these make the acquired information not precisely representing the nutritional values of those feeds, leading into imbalanced compounded diets. Realising this problem, researchers at Sokoine University of Agriculture (SUA) saw the need to develop this catalogue of feed tables of poultry feedstuffs with the major purpose of improving the quality of poultry feeds produced in Tanzania.

The data given in the tables have been compiled from a number of literature sources of Tanzanian feedstuffs and these are indicated by numbers corresponding to each feedstuffs and listed under reference list. Samples of feed ingredients were reanalysed using SUA laboratories and such values are presented under source number 1. Absence of figures in some cases in the tables does not imply a zero, but merely that the information was not given in the sources or not analysed or not available. It is worth to note here that the tables are deficient in the fact that important information on the amino acids profiles, vitamins and some mineral contents of the feedstuffs is missing and this is due to the limitations existing in our laboratories in analysing those components.

Understanding that compositions of feeds are variable, figures given in these tables should be regarded as representatives and not constant values. One important aspect to be noted here is that feed tables require frequent revisions, since chemical composition of feedstuffs are not constant values, they change depending on several factors, such as fertilization, processing techniques and stage of maturity. Nevertheless, the tables presented in this booklet are useful to the livestock feed processors and for training students at various stages on feed formulation under Tropical conditions.

G.H. Laswai

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ABBREVIATIONS USED IN THE TEXT

EE	Ether extract
CP	Crude Protein
D	Decorticated
DCP	Di-calcium Phosphate
Dar	Dar es Salaam
GE	Gross energy
ME	Metabolisable energy
NFE	Nitrogen free extract
NA	No available data
N	Nitrogen
P	partially decorticated
STA	Starch
SUG	Sugar
U	Undecorticated

PROCEDURES FOR ANALYSIS

Dry matter and ash determination

Dry matter is composed of the organic and inorganic fractions of the feeds. The procedure used was of drying the feedstuffs at 100°C to constant weight. Dry matter percentage was calculated as $\frac{\text{Weight of dry sample}}{\text{Initial weight of sample}} \times 100$.

Ash was determined by ignition at 500°C of the feedstuff and in this process the organic matter was burnt out and the residue was taken as ash or inorganic matter.

Ash was calculated as percentage of dry matter, that is $\frac{\text{Weight of ash} \times 100}{\text{Weight of dried sample}}$

Crude protein

Crude protein content of the feedstuffs was estimated by the nitrogen determination using Kjeldahl method. The proteins and nitrogenous compounds were converted into ammonium sulphate by boiling with conc. sulphuric acid in the presence of catalysts. Liberated ammonia was collected in a weak acid and the actual amount determined by titration with another weak acid.

$$\%N = 14.01 \times \frac{(\text{titre value} - \text{blank value}) \times \text{conc. (acid used)}}{\text{Sample weight} \times 10}$$

$$\text{Crude protein (\%)} = \%N \times 6.25$$

Ether extract- crude fat or lipids

The feedstuff was subjected to a continuous extraction with petroleum ether for 15 minutes in boiling position and 30-45 minutes in rinsing position. The solvent was evaporated and the extract was dried at 100°C for 30 minutes, cooled and weighed.

$$\% \text{ Ether extract} = \frac{\text{Weight of sample} - \text{Weight of extracted sample}}{\text{Weight of sample}} \times 100$$

Crude fibre

Crude fibre was determined by using the ANKOM technology-9/99. The reagents used included sulphuric acid solution, sodium hydroxide and acetone. The analysis involved digestion of the sample in acid followed by alkali and acetone. The residue was then filtered and dried at 105°C for 2-3 hours. It was then ashed in pre-weighed crucible for 2 hours at 550°C.

$$\text{Crude fibre (\%)} = \frac{\text{Weight of residue dry matter} - \text{Ash}}{\text{Sample weight}} \times 100$$

Nitrogen free extract

Nitrogen free extract is another portion of the carbohydrates. When the sum of the amounts of moisture, ash, crude protein, ether extract and crude fibre (expressed in percentage) is subtracted from 100, the difference is designated as nitrogen free extractives. A variable proportion of the cellulose, lignin and hemicellulose are present in the NFE depending upon the species and stage of growth of the plant material.

Starch and Sugar

The starch (STA) and total sugars (SUG) were determined according to the Luff-Schoorl method. 2 g of sample was extracted using 90 ml hot water and clarified using 5ml carrez I solution followed by 5 ml carrez II solution. The volume was made to 100 ml using distilled water and the contents were filtered. 10 ml of the filtrate was extracted and the solution was measured into a 250ml flask and 20 ml of 1 N hydrochloric acid was added and refluxed on a hot plate for 2 hours. The contents were cooled and 20 ml of sodium hydroxide was added. Thereafter, copper reagent was added and the contents were titrated with 0.1 N thiosulphate.

Amount of reducing sugars in the sample was computed using tabulated values as:

$$\frac{\text{Reducing sugar (mg) (Tabulated)}}{\text{Wt of sample (g)}} \times \frac{\text{Total volume of extract (ml)}}{\text{volume of extract analysed (ml)}}$$

Starch content was calculated by subtracting the reducing sugar and non-reducing sugar contents from the total sugar content

Metabolizable Energy

The Metabolizable Energy was predicted according to Carpenter and Clegg (1956) equation, that is, ME Kcal=53+38(%CP+2.25%EE+1.1STA+SUG)±190

OIL CAKES AND OIL SEED MEAL	Cotton			Cotton			Cotton			Cotton		
	seed	meal		seed	meal		seed	meal		seed	meal	
	(Kilosa)			(Shinyanga)			(Shinyanga)			(Shinyanga)		
Source number	24		2			3			1			1
Dry matter, %	93.02		92.6			90.8			92.74			92.64
% in dry matter												
Ash	5.69		6.4			5.6			6.02			13.16
Crude protein	34.48		38.6			33.8			38.47			38.08
Crude fibre	14.41		19.9			15.2			21.23			20.26
Sugar, g/kg									2.4			4.8
Starch, g/kg									0			0.45
Ether extract	7.13		9.07			7			11.27			7.35
NFE	38.29		26			38.5			23.01			21.15
Minerals, per kg dry matter												
Calcium, g	2.4		3.1			3			2.9			3.7
Phosphorus, g	12								12.3			9.8
Sodium, g												
Zinc, mg												
Magnesium, g									48.72			45.36
Manganese, mg									4.5			4.62
Iron, mg									13.5			12.94
ME, MJ/kg									110			150
									9.69			8.51

D- decorticated P- partially decorticated

OIL CAKES AND OIL SEED MEAL	Sunflower seed meal	Sunflower seed meal	Sunflower seed meal D (Singida)	Sunflower seed meal D (Babati)	Sunflower seed meal U (Babati)	Sunflower seed meal U (Singida)
	Source number	4	5	1	1	1
Dry matter, % % in dry matter	91.9	89.8	94.49	94.39	94.33	91.54
Ash	5.4	6	5.92	5.46	4.94	4.56
Crude protein	24.4	23	32.17	32.85	25.82	20.52
Crude fibre	NA	30	30.18	32.73	43.15	45.98
Sugar, g/kg			4.8	4.8	4.8	4.8
Starch, g/kg			2	1.75	1.75	0.56
Ether extract	11.5	14.9	19.16	17.72	12.3	12.51
NFE	NA	26.1	12.57	11.27	18.61	16.43
Minerals, per kg dry matter						
Calcium, g	2.35	3	2.6	3.1		2.4
Phosphorus, g		9.1	10	8.1		8.8
Sodium, g						
Zinc, mg			58.66	61.72	48.72	39.8
Magnesium, g			3.69	3.51	3.65	2.12
Manganese, mg			25.66	27.04	22.2	20.68
Iron, mg			170	110	144	148
ME, MJ/kg			10.24	11.76		9.34

D- Decorticated U- undecorticated

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OIL CAKES	Copra cake Seed meal	Copra cake (Bagamoyo)	Copra cake	Cashewnut cake meal	Dolicus Lablab (Raw)	Dolicus Lablab (Roasted)	Dolicus Lablab (Boiled)
Source number	8	1	11	7	15	15	15
Dry matter, % % in dry matter	88.7	86.89	89.01	92.78	94	94.4	94.1
Ash	5.4	6.57	6.1	5.99	5.2	5.2	4.8
Crude protein	19.5	23.37	22.3	31	30.5	28.6	28.7
Crude fibre	8.5	13.37	12	20.08	12.6	12.4	12.3
Sugar, g/kg		4.8	1.8				
Starch, g/kg		0	3.9				
Ether extract	18.4	15.21	8.4	7.43	3.2	1.3	1.4
NFE	48.2	41.48	51.1	35.4	48.5	52.5	52.8
Minerals, per kg dry matter							
Calcium, g		1.25		4.8	1.2	0.7	1.4
Phosphorus, g		5.4		8.2	3	3	4
Sodium, g							
Zinc, mg		30.48					
Magnesium, g		1.5					
Manganese, mg		70					
Iron, mg		140					
ME, MJ/kg		7.42					

OIL SEED MEAL	Soyabean meal (Extruded full fat)	Soyabean meal (Heat treated)	Soyabean meal (Boiled)	Soyabean (toasted)	Soyabean (toasted)	Soyabean flakes (India)
Source number	23	7	15	11	11	1
Dry matter, %	98.36	92.7	95.5	88.9	87.5	90.9
% in dry matter						
Ash	6.1	5.97	6.2	7	6.6	8.04
Crude protein	42.57	41.92	41.5	48.7	49.9	50.84
Crude fibre	5.95	5.68	5.9	7.2	5.6	6.47
Sugar, g/kg				13.6	15.2	2.4
Starch, g/kg				2.44	2.4	0
Ether extract	14.26	9.46	9.9	3.1	3.1	1.85
NFE	29.48	34.96	36.5	33.9	34.8	30.8
Minerals, per kg dry matter						
Calcium, g	2.9	1.7				3.5
Phosphorus, g	5.8	6				6.8
Sodium, g						
Zinc, mg						47
Magnesium, g						3.16
Manganese, mg						62.02
Iron, mg						122
ME, MJ/kg						7.82

FISH PRODUCTS	Fish meal	Fish meal	Fish meal	Sardines (Mwanza)	Sardines (Musoma)	Sangara meal (Mwanza)	Fish waste	Fish waste
Source number	10	12	13	1	1	1	14	4
Dry matter, %	94.95	93.17	97.26	92.39	93.46	93.42	87.93	90.6
% in dry matter								
Ash	21.46	23.54	27.86	22.09	26.6	36.69	32.7	33.6
Crude protein	58.99	53.57	56.68	60.62	55.48	41.54	44	42.5
Crude fibre	1.46	1.8	1.07	2.47	2.57	10.51	NA	NA
Sugar, g/kg				2.4	2.4	2.4		
Starch, g/kg				0	0	0		
Ether extract	12.45	12.46	8.88	4.15	9.23	7.7	9.27	8.6
NFE	5.64	8.63	5.51	10.67	6.12	3.56	NA	NA
Minerals, per kg dry matter								
Calcium, g	42.5	39.2	36.8	44	45	88	25.11	13.04
Phosphorus, g	20.4	29.9	17.8	19.1	18.6	49	13.8	
Sodium, g								
Zinc, mg				133	138	36.14		
Magnesium, g				1.51	1.46	1.77		
Manganese, mg				23.98	29.76	25.44		
Iron, mg				520	550	540		
ME, MJ/kg				10.98	11.93	12.31		

ANIMAL PRODUCTS & MINERALS	Blood meal	Bone meal (Kilimanjaro)	Bone meal (Dar)	Shell meal (Dar)	DCP	Limestone
Source number	4	1	1	1	1	1
Dry matter, %	97.3	91.3	91.96	99.86	91.81	98.89
% in dry matter						
Ash	9.1	69.13	69.1	98.46	80.42	97.62
Crude protein	85.1	26.89	27.65	0.84		
Crude fibre	NA	2.17	3.09	6.29		
Sugar, g/kg						
Starch, g/kg						
Ether extract	0.9					
NFE	NA					
Minerals, per kg dry matter						
Calcium, g	1.47	264.5	272.2	229.2	228.8	320
Phosphorus, g	1.31	93	115.7	50	140.6	130
Sodium, g						
Zinc, mg		82.64	76.6	47.6	18.7	32.78
Magnesium, g		0.9	3.54	2.27	1.14	2.03
Manganese, mg		22.98	11.7	14.38	18.14	15.24
Iron, mg		300	350	290	74	320
ME, MJ/kg						

GRAINS AND MILLING PRODUCTS	Maize meal	Maize meal	Maize meal	Maize meal (Dodoma)	Maize meal (Arusha)
Source number	10	7	16	1	1
Dry matter, %	89.68	89.96	91.4	89.78	90.02
% in dry matter					
Ash	1.65	1.97	1.86	1.55	1.84
Crude protein	10.2	8.64	9.51	10.25	11.36
Crude fibre	2.97	2.36	2.08	2.47	2.57
Sugar, g/Kg				4.8	4.8
Starch, g/Kg				71.8	68.4
Ether extract	5.09	5.06	3.39	3.5	4.8
NFE	80.17	81.95	83.01	82.23	79.43
Minerals, per kg dry matter					
Calcium, g	0.34	0.16		0.8	0.2
Phosphorus, g	4.84	3.1		5.2	4.1
Sodium, g					
Zinc, mg				22.04	18.7
Magnesium, g				0.91	1.14
Manganese, mg				8.96	5.56
Iron, mg				70	47
ME, MJ/kg				15.46	15.49

GRAINS AND BY-PRODUCTS	Maize bran	Maize bran	Maize bran	Maize bran	Hominy meal	Hominy meal	Hominy meal
Source number	11	17	9	1	11	19	15
Dry matter, %	89.5	95.6	90.76	89.46	90.51	92.85	93.3
% in dry matter							
Ash	2.8	6.17	4.16	6.18	5.15	4.16	7
Crude protein	10.5	11.92	10.81	10.64	13.6	10.06	13.6
Crude fibre	7.1	12.42	7.48	7.57	7.62	7.96	8.4
Sugar, g/kg				12.2			
Starch, g/kg				68.5			
Ether extract	10.6	14.54	7	6.12	12.66	8.1	9
NFE	69	54.91	70.53	69.49	60.67	69.71	62
Minerals, per kg dry matter							
Calcium, g		0.6	0.6	0.59	NA	1.7	
Phosphorus, g		8	6.11	5.5	7.1	NA	
Sodium, g							
Zinc, mg				41.84			
Magnesium, g				3.69			
Manganese, mg				25.66			
Iron, mg				37			
ME, MJ/kg				17.05			

MILLING PRODUCTS

MILLING PRODUCTS	Wheat bran	Wheat bran	Wheat bran	Wheat bran (Arusha)	Wheat pollard (Arusha)
Source number	12	8	20	1	1
Dry matter, %	92.21	87.7	90.61	89.91	89.42
% in dry matter					
Ash	5.55	6.4	6.51	5.43	3.26
Crude protein	17.98	16.9	16.55	18.59	17.96
Crude fibre	13.12	11.3	8.77	10.51	5.7
Sugar, g/kg				19.8	4.8
Starch, g/kg				12	40
Ether extract	3.53	3.8	5.25	2.5	4.1
NFE	59.8	61.5	62.91	62.97	68.98
Minerals, per kg dry matter					
Calcium, g			1.55	1.9	1
Phosphorus, g	15			12.8	5.6
Sodium, g			0.2		
Zinc, mg				83.9	32.78
Magnesium, g				3.77	2
Manganese, mg				89.7	47.62
Iron, mg				130	70
ME, MJ/kg				9.02	11.2

GRAINS AND BY-PRODUCTS	Rice polishing	Rice polishing	Rice bran	Sorghum	Sorghum	Sorghum Var.Lulu	White Sorghum
Source number	18	1	1	13	11	22	1
Dry matter, %	87.65	91.78	91.05	96.6	87.5	87.3	88.49
% in dry matter							
Ash	12.32	13.68	14.83	2.22	2.9	1.83	2.54
Crude protein	13.3	11	9.29	10.93	11.2	13.86	11.41
Crude fibre	13.72	11.26	27.95	3.09	2.5	6.18	2.47
Sugar, g/kg		17.2	9.7				2.4
Starch, g/kg		8.6	10				65
Ether extract	9.61	5.23	4.25	2.97	3.9	3.44	6.12
NFE	51.05	58.83	43.68	80.79	79.5	74.79	77.46
Minerals, per kg dry matter							
Calcium, g		1.0	1.0	0.4		0.3	0.3
Phosphorus, g		3.7	3.6	3.2		2	3.7
Sodium, g							
Zinc, mg		22.62	29.14				20.22
Magnesium, g		5.11	4.22				1.62
Manganese, mg		74.24	71.82				12.74
Iron, mg		18	29				150
ME, MJ/kg		7.13	5.58				14.97

LITING PRODUCTS

LEAF MEALS	Leucaena leaf meal	Leucaena leaf meal	Leucaena regrowths	L.cornuta (Mchungu)	Cassava leaf meal	Morus Alba Leaf meal
Source number	23	1	21	12	20	5
Dry matter, %	93.9	92.6	82.14	90.56	83	89
% in dry matter						
Ash	10.6	9.4	9.3	10.49	17	14.51
Crude protein	19.9	24.6	26.97	17.72	21.7	19.56
Crude fibre	17.4	17.1	14.9	27.82	11.96	12.97
Ether extract	7.4	3.4	4.25	5.74	4.7	2.2
NFE	44.7	45.8	26.68	38.32	44.65	39.76
Minerals, per kg dry matter						
Calcium, g	2.5	1.88		3.2	1.52	1.15
Phosphorus, g	2.2	2.5		5.1	1.57	3.2
Sodium, g	0.1			0.9		
Zinc, mg						
Magnesium, g						
Manganese, mg						
Iron, mg						

TUBERS	Cassava tubers	Cassava tubers	Cassava tubers
Source number	20	11	11
Dry matter, %	85	88	87.4
% in dry matter			
Ash	8.68	5	5.7
Crude protein	2.9	4.3	2.8
Crude fibre	3.54	4.2	3.6
Sugar, g/kg			2.5
Ether extract	1.91	1.4	1.3
NFE	82.97	84.3	86.6
Minerals, per kg dry matter			
Calcium, g	3.4		
Phosphorus, g	8.3		
Sodium, g	0.6		
Zinc, mg			
Magnesium, g			
Manganese, mg			
Iron, mg			

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