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Service of Cooperation and Cultural Action  
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# Chemical Composition of the main raw materials used in animal feeds in Kenya

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## ***Foreword***

This study is based on the chemical analysis of about 400 samples collected in Kenya between November 2005 and March 2006.

The aims of the project were:

- to provide reference values for the main raw materials present on the market, to the benefit of all stakeholders : feedmillers, producers, breeders, administrations, etc. and to make these values publicly available.
- to compare these resources to international values, in order to identify the specificities of the Kenyan raw materials
- to describe the existing variability and to initiate discussions on the way to reduce it or deal with it for the production of better / more stable feeds.
- To build a reference database for the future development of NIRS (near infrared spectroscopy) calibration allowing to analyse rapidly and cheaply the raw materials

Even a careful sample collection can never be representative of all the existing variability, especially through time (year effects). However the sampling has been designed to cover a wide range of situations. In order to be as representative as possible of the raw materials really used in practice, most of samples were collected:

- directly at the feedmills,
- directly at the source of production
- on the markets

Raw materials were, for most of them, quite variable. It is very important in feed formulation to use the “right” value for a raw material, or at least to use a value well adapted to the batch being used. An over-estimation of the value of raw material leads to a decreased nutritional value of the feed produced. On the opposite, a, under-estimation of a raw material is a waste of money. Therefore, it is important to work on:

- a good description of the raw materials. There is not one “fishmeal”, but a range of different products, with values differing by a factor 3 !
- some analyses when possible, according to the cost, availability and speed of the analyses
- the use of rapid evaluation methods as can be the Near Infrared spectroscopy (NIRS). This tool, once calibrated, allows a fast prediction of the chemical composition of feeds, and at least their classification into quality categories, which is the essential work of the feed manufacturer. In the same way, NIRS can be a tool to check the quality/conformity of the en-product. Some progress has been made in the framework of the present study and equations could be transferred to Kenya in the future.

This document will be updated in the future

- with new data expected on similar raw materials from Uganda
- with the feedback of users, who are very welcome to provide their comments, questions and recommendations
- with more interpretations

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The present document is available on request (paper or electronic form), at the address below.

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# Chemical Composition of raw materials

## ***List of raw materials:***

### **Cereals and by-products:**

- Maize
- Maize Germ
- Maize Germ Meal
- Maize Bran
- Maize Gluten Feed
- Maize Gluten Meal
  
- Wheat
- Wheat Bran
- Wheat Pollards
  
- Rice Bran
- Rice Polishings
  
- Barley

### **Oilseeds and meals**

- Cottonseed Cake
  
- Soybean Seed, full fat
- Soybean Cake, expeller
- Soybean Cake, solvent extracted
  
- Sunflower cake, expeller
- Sunflower cake, solvent extracted
  
- Copra Cake

### **Fishmeal**

- Fishmeal High Quality, Omena
- Fishmeal Intermediate, High Bone Fishmeal
- Fishmeal, poor

### **Various**

- Brewers Yeast
- Pyrethrum marc, Pymarc
- Moringa leaves
- Moringa stenope

# Data on "as fed" basis

## Maize

<b>Number samples Kenya</b>		<b>32</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>2700</i>
<b>D.M.</b>	<i>g/kg</i>	<b>880</b>
<b>C. Fibre</b>	<i>g/kg</i>	<b>19</b>
<b>NDF</b>	<i>g/kg</i>	<b>89</b>
<b>ADF</b>	<i>g/kg</i>	<b>22</b>
<b>C. Protein</b>	<i>g/kg</i>	<b>82</b>
<b>LYS</b>	<i>g/kg</i>	<b>2.4</b>
<b>MET</b>	<i>g/kg</i>	<b>1.6</b>
<b>MET+CYS</b>	<i>g/kg</i>	<b>3.4</b>
<b>THR</b>	<i>g/kg</i>	<b>3.1</b>
<b>TRY</b>	<i>g/kg</i>	<b>0.6</b>
<b>C. Fat</b>	<i>g/kg</i>	<b>39</b>
<b>Starch</b>	<i>g/kg</i>	<b>650</b>
<b>Sugars</b>	<i>g/kg</i>	<b>16</b>
<b>NFE</b>	<i>g/kg</i>	<b>730</b>
<b>Minerals (Ash)</b>	<i>g/kg</i>	<b>12</b>
<b>Ca</b>	<i>g/kg</i>	<b>0.3</b>
<b>P Total</b>	<i>g/kg</i>	<b>2.6</b>
<b>P Available</b>	<i>g/kg</i>	<b>0.5</b>
<b>aME poultry</b>	<i>kcal/kg</i>	<b>3340</b>
<b>Dig. CP poultry</b>	<i>%</i>	<b>86</b>

### Comments :

Corresponds to standard maize  
Some variation on C. Protein

## Data on "as fed" basis

		<b>Maize</b> Germ	<b>Maize</b> Germ meal	<b>Maize</b> Bran
<b>Number samples Kenya</b>		<b>12</b>	<b>16</b>	<b>58</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>100</i>	<i>450</i>	<i>350</i>
<b>D.M.</b>	<i>g/kg</i>	900	910	900
<b>C. Fibre</b>	<i>g/kg</i>	66	83	72
<b>NDF</b>	<i>g/kg</i>	230	370	290
<b>ADF</b>	<i>g/kg</i>	76	99	82
<b>C. Protein</b>	<i>g/kg</i>	123	148	96
<b>LYS</b>	<i>g/kg</i>	4.9	5.8	3.0
<b>MET</b>	<i>g/kg</i>	2.2	2.7	1.6
<b>MET+CYS</b>	<i>g/kg</i>	4.4	5.3	3.6
<b>THR</b>	<i>g/kg</i>	4.5	5.4	3.3
<b>TRY</b>	<i>g/kg</i>	1.1	1.3	0.6
<b>C. Fat</b>	<i>g/kg</i>	188	45	99
<b>Starch</b>	<i>g/kg</i>	220	260	330
<b>Sugars</b>	<i>g/kg</i>	75	65	38
<b>NFE</b>	<i>g/kg</i>	480	580	600
<b>Minerals (Ash)</b>	<i>g/kg</i>	46	57	37
<b>Ca</b>	<i>g/kg</i>	0.6	0.7	1.7
<b>P Total</b>	<i>g/kg</i>	16.5	6.2	3.2
<b>P Available</b>	<i>g/kg</i>	4.1	1.8	0.9
<b>aME poultry</b>	<i>kcal/kg</i>	3440	2010	2500
<b>Dig. CP poultry</b>	<i>%</i>	90	93	74

### Comments :

#### Maize Germ

Similar to standards, with a higher C. Fibre and lower C. Prot. content

Variable (Fat = 17-25%DM)

note : 2 samples with extreme fat content (40%)

#### Maize germ cake / meal

Higher than standard in C. fat and starch

High variation between samples

#### Maize bran

Very different from international standards (different process)

Very high variation for all parameters and nutritional value.

**Note : several misclassifications between these 3 categories**



# Data on "as fed" basis

		<b>Maize</b>	<b>Maize</b>
		Gluten feed	Gluten meal 60-70% CP
<b>Number samples Kenya</b>		<b>17</b>	<b>5</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>2600</i>	<i>750</i>
<b>D.M.</b>	<i>g/kg</i>	925	925
<b>C. Fibre</b>	<i>g/kg</i>	74	8
<b>NDF</b>	<i>g/kg</i>	330	17
<b>ADF</b>	<i>g/kg</i>	86	8
<b>C. Protein</b>	<i>g/kg</i>	258	674
<b>LYS</b>	<i>g/kg</i>	8.0	11.7
<b>MET</b>	<i>g/kg</i>	4.3	16.2
<b>MET+CYS</b>	<i>g/kg</i>	9.5	28.1
<b>THR</b>	<i>g/kg</i>	8.9	22.9
<b>TRY</b>	<i>g/kg</i>	1.7	3.2
<b>C. Fat</b>	<i>g/kg</i>	42	94
<b>Starch</b>	<i>g/kg</i>	150	80
<b>Sugars</b>	<i>g/kg</i>	12	5
<b>NFE</b>	<i>g/kg</i>	490	130
<b>Minerals (Ash)</b>	<i>g/kg</i>	64	14
<b>Ca</b>	<i>g/kg</i>	2.9	0.9
<b>P Total</b>	<i>g/kg</i>	7.9	4.4
<b>P Available</b>	<i>g/kg</i>	2.6	0.9
<b>aME poultry</b>	<i>kcal/kg</i>	1930	4030
<b>Dig. CP poultry</b>	<i>%</i>	88	90

## Comments :

### Gluten feed

Higher in C. Protein than standard

Quite variable product, especially for starch content (12-30% DM)

### Gluten meal

Higher in C. Protein than standard

Quite variable product, especially for starch content (3.5-15.5% DM)

**Note : several samples labelled as gluten meal or gluten feed had a composition very different from these categories (some with 50% starch, some with low C. Fibre and high sugars, etc.)**

# Data on "as fed" basis

		Wheat	Wheat Bran	Wheat pollards
<b>Number samples Kenya</b>		<b>8</b>	<b>30</b>	<b>33</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>7100</i>	<i>5550</i>	<i>1350</i>
<b>D.M.</b>	<i>g/kg</i>	880	900	900
<b>C. Fibre</b>	<i>g/kg</i>	22	100	76
<b>NDF</b>	<i>g/kg</i>	120	430	340
<b>ADF</b>	<i>g/kg</i>	31	130	100
<b>C. Protein</b>	<i>g/kg</i>	117	149	154
<b>LYS</b>	<i>g/kg</i>	3.3	5.9	6.1
<b>MET</b>	<i>g/kg</i>	1.9	2.2	2.3
<b>MET+CYS</b>	<i>g/kg</i>	4.7	5.3	5.4
<b>THR</b>	<i>g/kg</i>	3.5	4.9	5.1
<b>TRY</b>	<i>g/kg</i>	1.4	2.0	2.1
<b>C. Fat</b>	<i>g/kg</i>	21	56	69
<b>Starch</b>	<i>g/kg</i>	590	170	250
<b>Sugars</b>	<i>g/kg</i>	29	56	61
<b>NFE</b>	<i>g/kg</i>	700	540	560
<b>Minerals (Ash)</b>	<i>g/kg</i>	16	58	44
<b>Ca</b>	<i>g/kg</i>	0.7	1.5	1.3
<b>P Total</b>	<i>g/kg</i>	3.4	11.4	9.2
<b>P Available</b>	<i>g/kg</i>	1.7	3.8	3.0
<b>aME poultry</b>	<i>kcal/kg</i>	3110	1710	2180
<b>Dig. CP poultry</b>	<i>%</i>	81	73	78

## Comments :

### Wheat

Very close to international standards, with a good C. Protein value  
Very stable

### Wheat Bran

Close to standards  
C. Fat and C. fibre are above standards

### Wheat pollards

Corresponds to international "wheat middlings"

**There is a continuity between bran and pollards, with some misclassifications**

# Data on "as fed" basis

		<b>Rice Bran</b>	<b>Rice polishings</b>
<b>Number samples Kenya</b>		<b>12</b>	<b>2</b>
<i>Number samples AFZ / INRA / CIRAD</i>			<i>250</i>
<b>D.M.</b>	<i>g/kg</i>	910	910
<b>C. Fibre</b>	<i>g/kg</i>	310	85
<b>NDF</b>	<i>g/kg</i>	500	320
<b>ADF</b>	<i>g/kg</i>	365	120
<b>C. Protein</b>	<i>g/kg</i>	57	127
<b>LYS</b>	<i>g/kg</i>	2.6	5.8
<b>MET</b>	<i>g/kg</i>	1.2	2.6
<b>MET+CYS</b>	<i>g/kg</i>	2.3	5.1
<b>THR</b>	<i>g/kg</i>	2.2	4.9
<b>TRY</b>	<i>g/kg</i>	0.6	1.4
<b>C. Fat</b>	<i>g/kg</i>	44	160
<b>Starch</b>	<i>g/kg</i>	115	190
<b>Sugars</b>	<i>g/kg</i>	17	49
<b>NFE</b>	<i>g/kg</i>	310	440
<b>Minerals (Ash)</b>	<i>g/kg</i>	190	94
<b>Ca</b>	<i>g/kg</i>	0.6	0.8
<b>P Total</b>	<i>g/kg</i>	8.6	16.3
<b>P Available</b>	<i>g/kg</i>	1.3	2.4
<b>aME poultry</b>	<i>kcal/kg</i>	620	2930
<b>Dig. CP poultry</b>	<i>%</i>	60	70

## Comments :

### **Rice Bran**

Very high in C. Fibre and low in C. Protein. Low nutritional value  
Quite variable

### **Rice Polishings**

Corresponds to standard "rice bran"

# Data on "as fed" basis

## Barley

<b>Number samples Kenya</b>		<b>4</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>2750</i>
<b>D.M.</b>	<i>g/kg</i>	<b>880</b>
<b>C. Fibre</b>	<i>g/kg</i>	<b>40</b>
<b>NDF</b>	<i>g/kg</i>	<b>160</b>
<b>ADF</b>	<i>g/kg</i>	<b>48</b>
<b>C. Protein</b>	<i>g/kg</i>	<b>100</b>
<b>LYS</b>	<i>g/kg</i>	<b>3.8</b>
<b>MET</b>	<i>g/kg</i>	<b>1.7</b>
<b>MET+CYS</b>	<i>g/kg</i>	<b>4.0</b>
<b>THR</b>	<i>g/kg</i>	<b>3.4</b>
<b>TRY</b>	<i>g/kg</i>	<b>1.2</b>
<b>C. Fat</b>	<i>g/kg</i>	<b>17</b>
<b>Starch</b>	<i>g/kg</i>	<b>520</b>
<b>Sugars</b>	<i>g/kg</i>	<b>27</b>
<b>NFE</b>	<i>g/kg</i>	<b>700</b>
<b>Minerals (Ash)</b>	<i>g/kg</i>	<b>22</b>
<b>Ca</b>	<i>g/kg</i>	<b>0.6</b>
<b>P Total</b>	<i>g/kg</i>	<b>3.0</b>
<b>P Available</b>	<i>g/kg</i>	<b>1.8</b>
<b>aME poultry</b>	<i>kcal/kg</i>	<b>2740</b>
<b>Dig. CP poultry</b>	<i>%</i>	<b>70</b>

### Comments :

Very close to international standards

Not very variable

**Cottonseed**  
Cake

<b>Number samples Kenya</b>		<b>37</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>300</i>
<b>D.M.</b>	<i>g/kg</i>	930
<b>C. Fibre</b>	<i>g/kg</i>	190
<b>NDF</b>	<i>g/kg</i>	370
<b>ADF</b>	<i>g/kg</i>	260
<b>C. Protein</b>	<i>g/kg</i>	328
<b>LYS</b>	<i>g/kg</i>	13.3
<b>MET</b>	<i>g/kg</i>	4.9
<b>MET+CYS</b>	<i>g/kg</i>	10.4
<b>THR</b>	<i>g/kg</i>	10.9
<b>TRY</b>	<i>g/kg</i>	4.3
<b>C. Fat</b>	<i>g/kg</i>	82
<b>Starch</b>	<i>g/kg</i>	0
<b>Sugars</b>	<i>g/kg</i>	47
<b>NFE</b>	<i>g/kg</i>	270
<b>Minerals (Ash)</b>	<i>g/kg</i>	56
<b>Ca</b>	<i>g/kg</i>	2.2
<b>P Total</b>	<i>g/kg</i>	10.1
<b>P Available</b>	<i>g/kg</i>	7.0
<b>aME poultry</b>	<i>kcal/kg</i>	1760
<b>Dig. CP poultry</b>	<i>%</i>	68

**Comments :**

Corresponds to a non decorticated expeller cake  
with high fat content

Very high variation for C. Protein (30 to 40%DM)  
and for C. Fibre (15 to 30% DM)

# Data on "as fed" basis

		<b>Soybean</b>	<b>Soybean</b>	<b>Soybean</b>
		Seed fullfat	Cake Expeller	Cake Solvent
<b>Number samples Kenya</b>		<b>6</b>	<b>6</b>	<b>6</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>1100</i>	<i>10400</i>	
<b>D.M.</b>	<i>g/kg</i>	920	920	900
<b>C. Fibre</b>	<i>g/kg</i>	58	61	53
<b>NDF</b>	<i>g/kg</i>	120	120	110
<b>ADF</b>	<i>g/kg</i>	71	74	65
<b>C. Protein</b>	<i>g/kg</i>	377	400	456
<b>LYS</b>	<i>g/kg</i>	23.4	24.8	28.3
<b>MET</b>	<i>g/kg</i>	5.4	5.7	6.5
<b>MET+CYS</b>	<i>g/kg</i>	11.2	11.9	13.6
<b>THR</b>	<i>g/kg</i>	15.1	16.0	18.2
<b>TRY</b>	<i>g/kg</i>	4.9	5.2	6.0
<b>C. Fat</b>	<i>g/kg</i>	170	96	22
<b>Starch</b>	<i>g/kg</i>	0	0	0
<b>Sugars</b>	<i>g/kg</i>	77	86	96
<b>NFE</b>	<i>g/kg</i>	250	310	290
<b>Minerals (Ash)</b>	<i>g/kg</i>	63	58	75
<b>Ca</b>	<i>g/kg</i>	2.6	3.2	3.3
<b>P Total</b>	<i>g/kg</i>	5.5	6.6	6.8
<b>P Available</b>	<i>g/kg</i>	1.6	1.7	1.8
<b>aME poultry</b>	<i>kcal/kg</i>	3190	2630	2300
<b>Dig. CP poultry</b>	<i>%</i>	87	87	87

## Comments :

### **Soybean seed**

Corresponds to a fullfat soybean with good protein content and medium fat content

### **Soybean cake, expeller**

Moderate fat extraction, leading to a good energy value  
Quite variable

### **Soybean cake, solvent**

Relatively typical and stable

Note : several products classified as "soyabeen meals" were in fact not in this category : high starch contents, low C. Protein, etc. It could be due to mixing with maize products

Data on "as fed" basis

		<b>Sunflower</b>	<b>Sunflower</b>
		Cake Expeller	Cake Solvent
<b>Number samples Kenya</b>		<b>20</b>	<b>8</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>2750</i>	
<b>D.M.</b>	<i>g/kg</i>	940	930
<b>C. Fibre</b>	<i>g/kg</i>	290	320
<b>NDF</b>	<i>g/kg</i>	450	490
<b>ADF</b>	<i>g/kg</i>	330	360
<b>C. Protein</b>	<i>g/kg</i>	251	263
<b>LYS</b>	<i>g/kg</i>	9.2	9.6
<b>MET</b>	<i>g/kg</i>	5.8	6.1
<b>MET+CYS</b>	<i>g/kg</i>	10.3	10.8
<b>THR</b>	<i>g/kg</i>	8.9	9.4
<b>TRY</b>	<i>g/kg</i>	3.3	3.4
<b>C. Fat</b>	<i>g/kg</i>	115	10
<b>Starch</b>	<i>g/kg</i>	0	0
<b>Sugars</b>	<i>g/kg</i>	45	47
<b>NFE</b>	<i>g/kg</i>	260	290
<b>Minerals (Ash)</b>	<i>g/kg</i>	20	47
<b>Ca</b>	<i>g/kg</i>	2.4	3.6
<b>P Total</b>	<i>g/kg</i>	6.2	9.7
<b>P Available</b>	<i>g/kg</i>	1.1	1.6
<b>aME poultry</b>	<i>kcal/kg</i>	1910	1290
<b>Dig. CP poultry</b>	<i>%</i>	87	87

**Comments :**

The 2 categories differ only by fat content.  
They correspond to non decorticated sunflower cake  
C. Fibre content is very high

# Data on "as fed" basis

		<b>Copra</b>
		Cake expeller
<b>Number samples Kenya</b>		<b>2</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>125</i>
<b>D.M.</b>	<i>g/kg</i>	910
<b>C. Fibre</b>	<i>g/kg</i>	93
<b>NDF</b>	<i>g/kg</i>	360
<b>ADF</b>	<i>g/kg</i>	190
<b>C. Protein</b>	<i>g/kg</i>	224
<b>LYS</b>	<i>g/kg</i>	5.7
<b>MET</b>	<i>g/kg</i>	3.4
<b>MET+CYS</b>	<i>g/kg</i>	6.6
<b>THR</b>	<i>g/kg</i>	6.8
<b>TRY</b>	<i>g/kg</i>	1.9
<b>C. Fat</b>	<i>g/kg</i>	110
<b>Starch</b>	<i>g/kg</i>	0
<b>Sugars</b>	<i>g/kg</i>	100
<b>NFE</b>	<i>g/kg</i>	430
<b>Minerals (Ash)</b>	<i>g/kg</i>	55
<b>Ca</b>	<i>g/kg</i>	1.2
<b>P Total</b>	<i>g/kg</i>	5.7
<b>P Available</b>	<i>g/kg</i>	1.9
<b>aME poultry</b>	<i>kcal/kg</i>	2320
<b>Dig. CP poultry</b>	<i>%</i>	71

## **Comments :**

Better than standard copra cake :  
lower C. Fibre, higher C. Protein and Fat



# Data on "as fed" basis

		<b>Fishmeal</b> High quality Omena	<b>Fishmeal</b> Intermediate	<b>Fishmeal</b> Poor
<b>Number samples Kenya</b>		<b>31</b>	<b>20</b>	<b>8</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>1200</i>	<i>20</i>	
<b>D.M.</b>	<i>g/kg</i>	920	930	960
<b>C. Fibre</b>	<i>g/kg</i>	0	0	0
<b>NDF</b>	<i>g/kg</i>	0	0	0
<b>ADF</b>	<i>g/kg</i>	0	0	0
<b>C. Protein</b>	<i>g/kg</i>	551	384	186
<b>LYS</b>	<i>g/kg</i>	40.8	28.4	7.6
<b>MET</b>	<i>g/kg</i>	15.3	10.6	3.7
<b>MET+CYS</b>	<i>g/kg</i>	20.5	14.3	4.2
<b>THR</b>	<i>g/kg</i>	23.2	16.2	5.8
<b>TRY</b>	<i>g/kg</i>	5.5	3.8	1.8
<b>C. Fat</b>	<i>g/kg</i>	105	130	76
<b>Starch</b>	<i>g/kg</i>	0	0	0
<b>Sugars</b>	<i>g/kg</i>	0	0	0
<b>NFE</b>	<i>g/kg</i>	0	0	0
<b>Minerals (Ash)</b>	<i>g/kg</i>	250	380	685
<b>Ca</b>	<i>g/kg</i>	45.1	84.6	60.5
<b>P Total</b>	<i>g/kg</i>	27.0	50.0	35.5
<b>P Available</b>	<i>g/kg</i>	23.0	43.0	30.5
<b>aME poultry</b>	<i>kcal/kg</i>	2870	2470	1330
<b>Dig. CP poultry</b>	<i>%</i>	90	88	85

## Comments :

***Some samples have a considerable mineral content, with sometimes high amounts of insoluble ash (sand, etc.)***

***Fishmeals are extremely variable, and therefore 3 categories were considered : poor, intermediate, higher, corresponding to CP and fat content***

### **High quality**

Mainly Omena fishmeal. Sometimes sandy

Still variable category : C. Prot. from 40 to 65%DM

### **Intermediate quality**

Samples with very high mineral content, but reasonable insoluble ash  
It can more or less be compared to High bone fish meal.

### **Poor quality**

Extreme mineral contents (up to 80% with 60% insoluble ash)

Very low C. Protein content

# Data on "as fed" basis

## **Yeast** Brewers

<b>Number samples Kenya</b>		<b>2</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>60</i>
<b>D.M.</b>	<i>g/kg</i>	<b>940</b>
<b>C. Fibre</b>	<i>g/kg</i>	<b>0</b>
<b>NDF</b>	<i>g/kg</i>	<b>0</b>
<b>ADF</b>	<i>g/kg</i>	<b>0</b>
<b>C. Protein</b>	<i>g/kg</i>	<b>363</b>
<b>LYS</b>	<i>g/kg</i>	<b>22.1</b>
<b>MET</b>	<i>g/kg</i>	<b>5.4</b>
<b>MET+CYS</b>	<i>g/kg</i>	<b>7.6</b>
<b>THR</b>	<i>g/kg</i>	<b>15.6</b>
<b>TRY</b>	<i>g/kg</i>	<b>3.6</b>
<b>C. Fat</b>	<i>g/kg</i>	<b>24</b>
<b>Starch</b>	<i>g/kg</i>	<b>9</b>
<b>Sugars</b>	<i>g/kg</i>	<b>24</b>
<b>NFE</b>	<i>g/kg</i>	<b>500</b>
<b>Minerals (Ash)</b>	<i>g/kg</i>	<b>55</b>
<b>Ca</b>	<i>g/kg</i>	<b>3.0</b>
<b>P Total</b>	<i>g/kg</i>	<b>10.9</b>
<b>P Available</b>	<i>g/kg</i>	<b>9.4</b>
<b>aME poultry</b>	<i>kcal/kg</i>	<b>3070</b>
<b>Dig. CP poultry</b>	<i>%</i>	<b>76</b>

### **Comments :**

Low C. Protein value compared to standards

**Pymarc**

<b>Number samples Kenya</b>		<b>2</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>0</i>
<b>D.M.</b>	<i>g/kg</i>	910
<b>C. Fibre</b>	<i>g/kg</i>	220
<b>NDF</b>	<i>g/kg</i>	410
<b>ADF</b>	<i>g/kg</i>	310
<b>C. Protein</b>	<i>g/kg</i>	122
<b>LYS</b>	<i>g/kg</i>	5.1
<b>MET</b>	<i>g/kg</i>	
<b>MET+CYS</b>	<i>g/kg</i>	
<b>THR</b>	<i>g/kg</i>	5.0
<b>TRY</b>	<i>g/kg</i>	
<b>C. Fat</b>	<i>g/kg</i>	7
<b>Starch</b>	<i>g/kg</i>	0
<b>Sugars</b>	<i>g/kg</i>	
<b>NFE</b>	<i>g/kg</i>	490
<b>Minerals (Ash)</b>	<i>g/kg</i>	69
<b>Ca</b>	<i>g/kg</i>	3.6
<b>P Total</b>	<i>g/kg</i>	2.7
<b>P Available</b>	<i>g/kg</i>	
<b>aME poultry</b>	<i>kcal/kg</i>	
<b>Dig. CP poultry</b>	<i>%</i>	

Comments :

Data on "as fed" basis

		<b>Moringa</b> leaves	<b>Moringa</b> Stenope
<b>Number samples Kenya</b>		<b>2</b>	<b>1</b>
<i>Number samples AFZ / INRA / CIRAD</i>		<i>0</i>	<i>0</i>
<b>D.M.</b>	<i>g/kg</i>	910	940
<b>C. Fibre</b>	<i>g/kg</i>	82	92
<b>NDF</b>	<i>g/kg</i>	170	220
<b>ADF</b>	<i>g/kg</i>	88	110
<b>C. Protein</b>	<i>g/kg</i>	303	240
<b>LYS</b>	<i>g/kg</i>	15.8	12.5
<b>MET</b>	<i>g/kg</i>	5.2	4.1
<b>MET+CYS</b>	<i>g/kg</i>	9.6	7.6
<b>THR</b>	<i>g/kg</i>	15.8	12.5
<b>TRY</b>	<i>g/kg</i>	5.8	4.6
<b>C. Fat</b>	<i>g/kg</i>	60	62
<b>Starch</b>	<i>g/kg</i>	0	0
<b>Sugars</b>	<i>g/kg</i>		
<b>NFE</b>	<i>g/kg</i>	370	440
<b>Minerals (Ash)</b>	<i>g/kg</i>	93	105
<b>Ca</b>	<i>g/kg</i>	4.0	4.1
<b>P Total</b>	<i>g/kg</i>	0.6	0.7
<b>P Available</b>	<i>g/kg</i>		
<b>aME poultry</b>	<i>kcal/kg</i>		
<b>Dig. CP poultry</b>	<i>%</i>		

Comments :



***List of variables used in this document:***

<b>Parameter</b>	<b>Meaning</b>	<b>Origin of data presented</b>
<b>DM</b>	Dry matter (103°C oven)	Measured
<b>C. Fibre</b>	Crude Fibre (Weende method)	Measured
<b>NDF, ADF</b>	Neutral / acid detergent Fibre (Van Soest fibre fractions)	Calculated from C. Fibre according to equations built by INRA/AFZ (io7 database)
<b>C. Prot.</b>	Crude Protein (N*6.25)	Measured
<b>Amino acids</b>	LYS (Lysine), MET(methionine) , CYS (Cysteine), THR (Threonine), TRY (Tryptophane)	Calculated from C. Protein according to equations built on io7 database and literature survey (20 sources)
<b>C. Fat</b>	Crude Fat or Ether extract	Measured
<b>Starch</b>	Polarimetric method	Measured
<b>Sugars</b>	Total sugars	Measured
<b>NFE</b>	“Nitrogen Free Extract” = DM – Ash - C.Fibre – C.Fat - C.Prot.	Calculated
<b>Minerals</b>	Total ash (550°C furnace)	Measured
<b>Ca, P, PA</b>	Calcium, total Phosphorus, available phosphorus	Data from io7 database and literature survey (20 sources), adapted to Kenya raw materials
<b>aME</b>	Apparent Metabolizable energy in Poultry	Calculated from measured chemical composition, according to equations from Janssen (1988)
<b>Dig CP</b>	Digestibility of crude Protein	Data from io7 database and literature survey (20 sources)

