Evaluation of the use of Ateli plus in broiler production

Aim of the study

The aim of the study to evaluate Ateli plus for broiler production. The product tested represent a supplementary feed of algae and natural herb origin which has been shown to enhance efficiency of feed utilisation, general condition and resistance. The product is registered under Act 36 of 1947 (V22875) and carries a GMP and feed safety assurance certificate from Vossen laboratories, WEERT Nederland.

Materials and methods

The experiment was performed at Stellenbosch University, Mariendahl experimental farm, Stellenbosch. A temperature controlled, positive pressure commercial type broiler house was used. In total 30 pens each with a total floor space of 4.01m^2 equipped with two tube feeders (0.119 m^2) and a bell drinker (0.102 m^2)was used leaving 3.67m^2 available floor space. Chicks were housed at a rate of 80 per pen rendering a density of 21.8 chicks/m^2. Pens were blocked according to position in house and within blocks randomly allocated to treatment.

This design allowed for five treatments with six repetitions and 480 birds per treatment and a total of 2400 birds in the trial. Day old broilers were bought from a commercial hatchery and transported in standard cardboard broiler boxes for a distance of 50km to the experimental farm, travel time was 40 minutes. Upon arrival the birds were counted out into the pens and placed under infrared lamps.

Treatments are shown in Table 1.

Water and feed were supplied *ad libitum*. Starter was supplied at a rate of 900g per bird, grower at a rate of 1200g per bird and finisher at a rate 1200g per bird. Birds were grown to 33 days of age. Lighting was according to the Cobb 500 standard.

Body weight of all birds in a pen were measured at placement (day 0) and weekly thereafter until slaughter at 33 days of age. Individual weights were calculated as an average. Weekly feed intake was determined by weighing the initial amount of feed offered to the birds, feed added during the period and the feed remaining in the feeders at the end of the period. Mortalities and morbidities were recorded twice daily and all dead birds were weighed and necropsies conducted. Feed and water were supplied *ad libitum*. From these data feed conversion efficiency (FCR), average daily gain (ADG), European production efficiency factor (EPEF) and intakes were calculated. All data and calculations were submitted for statistical analysis.

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Table 1 Treatment number and description of treatment feeds

Treatment	Description	Starter and Grower		Finisher	
		Cocsidiostat	Antibiotic growth promotor	Cocsidiostat	Antibiotic growth promotor
Treatment 1:	Positive control with anti-biotic	Salinocox 12%	Stafac 500	Avatec	Stafac 500
Treatment 2:	Negative control without anti-biotic	Salinocox 12%	None	Avatec	None
Treatment 3:	Ateli plus at a rate of 1 kg/ton	Salinocox 12%	None	Avatec	None
Treatment 4:	Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	Salinocox 12%	None	Avatec	None
Treatment 5:	Positive control and Treatment 4	Salinocox 12%	Stafac 500	Avatec	Stafac 500

On day 33 two birds per pen were selected from the middle weight group. These birds were slaughtered according to standard commercial practice including electrical stunning followed by exsanguinations.

At slaughter the following data were collected:

- Live weight at slaughter
- Carcass weight at slaughter
- Dressing percentage
- Cut yield of the carcass i.e. the carcass was halved and the right side of the carcass cut up into breast, thigh, leg, wing and back. Each portion was weighed and expressed as a percentage of the total. Skin and fat was removed from the breast, weights determined and expressed as a total of the total breast weight.
- Meat quality characteristics:
    - pH of the breast and thigh was measured at 15 minutes and 24 hours post slaughter.

    - Colour – Skins and visible fat was removed from the breasts and thighs and these cuts were allowed to bloom for 15 minutes. CieLab colour measurements using Minolta chromameter was taken after blooming.
- At slaughter both tibia were removed from the carcass for the determination of bone ash, bone strength and Ca and P analysis.
- Organ in intestinal data collected include:
    - Liver, spleen, gizzard, heart and bursa weights
    - Gizzards were scored on a scale of 1-5 to establish the presence or severity of gizzard erosion.
    - pH of the stomach, duodenum, jejunum, ileum and caeca were measured.
    - Samples were taken from the duodenum and jejunum, rinsed with saline solution and fixed with 10% buffered formalin. The samples were set in wax, cut and fixed on slides. Villi height and crypt depths of the samples were then compared using video image analysis (VIA).

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Results

Production parameters

Results on production parameters are shown in Table 2 to Table 8. From these tables it can be seen that the inclusion of Ateli plus in comparison with a negative control, positive control and combinations thereof did not significantly (P>0.05) influence any of the production parameters measured.

European production efficiency ratio (EPEF = liveability(%) x live weight (kg) x age (d) / FCR x 100) (Table 2) showed no significant difference.

Average daily gain was estimated by fitting a linear model to individual weight data, the slope of this curve represents ADG. Average daily gain (Table 2) showed no significant differences.

Liveability (Table 2) is expressed as the percentage of birds surviving until slaughter expressed as a percentage of the total number placed. No significant differences were observed for liveability.

Feed conversion ratio was determined as the ratio of the feed consumed per unit of body weight gain. This was done for each week individually (Table 3) as well as cumulatively (Table 4). No significant (P>0.05) differences were observed for either weekly of cumulative feed conversion efficiency.

Average weekly live weights of chicks were determined by weighing all birds in the cage and dividing this weight by the number of chicks in the pen. No significant differences (P>0.05) were observed for weight at any week.

Average cumulative live weight gain was calculated as the difference between the average live weight on the day of weighing and the average live weight at start. No significant differences (P>0.05) were observed at any week.

Average cumulative weekly intake was calculated as the sum of weekly intake per pen divided by the number of birds consuming the feed. No significant differences (P>0.05) were observed at any week.

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Table 2 Means and standard deviations (Std dev) of European production efficiency factor (EPEF), feed conversion ratio (FCR) and average daily gain (ADG) of broilers grown from hatch up to day 33

	EPEF*		Liveability		ADG**	
Treatment	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	358.320	19.321	97.260	3.456	61.12	
Negative control without anti-biotic	353.460	16.411	95.380	2.482	61.16	
Ateli plus at a rate of 1 kg/ton	345.604	5.350	94.377	1.030	61.23	
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	347.436	8.185	95.540	0.961	61.24	
Positive control and Treatment 4	343.947	17.903	94.754	3.261	60.87	
Significance	NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)
*EPEF = ((liveability(%) x live weight (kg)) / (age (d) X FCR)) x 100
**ADG= Average daily gain
**AWG was estimated by fitting a linear model to live weight data y=a+bx where b = Δ = ADG

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Table 3 Weekly feed conversion ratios (FCR) of broilers grown from hatch up to day 33

Treatment	Day 7		Day 14		Day 21		Day 28		Day 33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	1.221	0.022	1.424	0.026	1.674	0.040	1.754	0.040	1.871	0.084
Negative control without anti-biotic	1.170	0.096	1.424	0.033	1.639	0.027	1.764	0.036	1.887	0.051
Ateli plus at a rate of 1 kg/ton	1.194	0.017	1.417	0.022	1.664	0.044	1.779	0.111	1.925	0.145
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	1.208	0.036	1.441	0.025	1.643	0.023	1.776	0.015	1.936	0.115
Positive control and Treatment 4	1.195	0.026	1.440	0.029	1.634	0.029	1.768	0.022	1.911	0.056
Significance	NS		NS		NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Table 4 Mean cumulative feed conversion ratios (FCR) with standard deviations (Std dev) and rate of change with standard errors (Std err) of broilers grown from hatch up to day 33

Treatment	Day 7		Day 14		Day 21		Day 28		Day 33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	1.221	0.022	1.360	0.021	1.523	0.031	1.615	0.027	1.681	0.030
Negative control without anti-biotic	1.170	0.096	1.342	0.033	1.500	0.017	1.604	0.014	1.677	0.015
Ateli plus at a rate of 1 kg/ton	1.194	0.017	1.345	0.012	1.513	0.027	1.618	0.051	1.694	0.025
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	1.208	0.036	1.365	0.015	1.513	0.014	1.617	0.012	1.697	0.032
Positive control and Treatment 4	1.195	0.026	1.360	0.027	1.505	0.025	1.609	0.023	1.686	0.028
Significance	NS		NS		NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Table 5 Average weekly live weight (g) of broilers grown from hatch up to day 33

Treatment	Day 0		Day 7		Day 14		Day 21		Day 28		Day 33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	45.333	0.753	180.758	2.326	471.512	10.061	932.407	11.803	1518.633	18.134	2042.225	37.209
Negative control without anti-biotic	44.542	0.534	180.593	4.090	465.443	4.625	941.902	16.574	1532.936	35.565	2049.828	54.960
Ateli plus at a rate of 1 kg/ton	44.417	0.816	181.598	3.164	468.338	8.294	938.095	11.698	1538.630	31.256	2047.208	37.333
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	44.333	0.983	181.974	2.268	464.479	2.599	945.481	12.487	1535.077	20.416	2035.850	40.665
Positive control and Treatment 4	45.167	0.890	181.553	3.900	461.692	14.279	930.263	25.335	1514.488	26.337	2018.556	33.818
Significance	NS		NS		NS		NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
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Table 6 Average weekly live weight gains (g) of broilers grown from hatch up to day 33

Treatment	Day 0-7		Day 7-14		Day 14-21		Day 21-28		Day 28-33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	135.425	2.136	290.754	8.255	460.894	6.325	586.226	16.675	523.592	39.649
Negative control without anti-biotic	136.052	4.104	284.849	3.990	476.460	15.006	591.034	28.385	516.892	25.396
Ateli plus at a rate of 1 kg/ton	137.181	3.571	286.741	7.496	469.757	7.741	600.536	37.418	508.577	36.680
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	137.640	3.019	282.506	2.186	481.001	10.588	589.596	16.101	500.773	32.061
Positive control and Treatment 4	136.386	4.298	280.139	10.688	468.571	11.517	584.225	15.773	504.068	15.376
Significance	NS		NS		NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Table 7 Average cumulative live weight gains (g) of broilers grown from hatch up to day 33

Treatment	Day 0-7		Day 0-14		Day 0-21		Day 0-28		Day 0-33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	135.425	2.136	426.179	9.984	887.074	11.708	1473.299	18.133	1996.891	37.631
Negative control without anti-biotic	136.052	4.104	420.901	4.405	897.361	16.649	1488.395	35.504	2005.286	54.946
Ateli plus at a rate of 1 kg/ton	137.181	3.571	423.922	8.242	893.678	11.962	1494.214	30.787	2002.791	37.525
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	137.640	3.019	420.146	2.752	901.148	12.177	1490.744	20.662	1991.517	41.014
Positive control and Treatment 4	136.386	4.298	416.525	14.554	885.096	25.566	1469.322	26.553	1973.390	34.177
Significance	NS		NS		NS		NS		NS	

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Table 8 Average cumulative intake (g) with standard deviations (Std dev) of broilers grown from hatch up to day 33 receiving different phytase treatment

Treatment	Day 0-7		Day 0-14		Day 0-21		Day 0-28		Day 0-33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	165.288	3.088	579.321	10.313	1350.573	19.025	2379.197	59.678	3356.548	84.311
Negative control without anti-biotic	159.059	11.289	564.718	10.785	1345.666	26.657	2387.618	58.544	3362.263	92.324
Ateli plus at a rate of 1 kg/ton	163.717	2.672	570.028	8.356	1351.518	16.311	2417.837	73.691	3393.550	107.804
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	166.219	5.343	573.387	5.466	1363.863	22.025	2411.206	44.605	3379.046	92.394
Positive control and Treatment 4	162.886	3.084	566.200	12.467	1331.727	24.795	2364.327	36.249	3327.279	63.893
Significance	NS		NS		NS		NS		NS	

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Table 9 Average weekly intake (g) with standard deviations (Std dev) of broilers grown from hatch up to day 33 receiving different phytase treatment

Treatment	Day 0-7		Day 7-14		Day 14-21		Day 21-28		Day 28-33	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	165.288	3.088	414.033	8.303	771.252	17.000	1028.624	49.815	977.350	36.740
Negative control without anti-biotic	159.059	11.289	405.659	5.958	780.948	22.697	1041.953	36.108	974.645	38.038
Ateli plus at a rate of 1 kg/ton	163.717	2.672	406.311	6.886	781.490	17.423	1066.319	62.172	975.713	43.384
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	166.219	5.343	407.168	5.079	790.476	21.840	1047.343	30.991	967.840	54.072
Positive control and Treatment 4	162.886	3.084	403.314	9.940	765.527	17.952	1032.600	24.951	962.951	33.123
Significance	NS		NS		NS		NS		NS	
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Carcass characteristics

Carcass characteristics are described as a function of dressing percentage (Table 11); cut yield of the carcass (Table 10); muscle, skin and fat, and bone yield of the breast (Table 11); pH_i and pH_u of the breast and thigh muscle (Table 12) and colour characteristics (CieLab) of the breast and thigh muscles.

Initial muscle pH was determined 15 minutes *post mortem* (pH_i) using a calibrated (standard buffers pH 4.0 and 7.0 at 25°C) portable Crison 506 pH-meter by inserting the pH electrode into the breast muscle after making an incision into the centre of the muscle, one third from the top and in the thigh in the centre of the muscle. Ultimate muscle pH was determined 24 hours (pH_u) *post mortem* in the same manner and position as described for pH_i, but on the other half of the carcass. Following the initial pH measurement, the carcasses were hung in cold storage at 4°C for 12 hours where after the remaining measurements were taken. Dressing percentage was calculated as the percentage difference between the live weight of the chicken and the weight of the chilled carcass. Percentage cut yield was determined 24 hours post slaughter. The carcasses were halved using a portion cutter and portioned into breast, thigh, leg, wing and back (remainder of the carcass consisting mainly of the backbone). After weighing of the cuts the breast was dissected into muscle, skin and fat and bone. The skin of the thigh was removed and the dissected breast muscle and exposed thigh muscle allowed to bloom for one hour. Meat colour (L*, a*, b* measurements) were measured with a Minolta® chroma meter (Model CR200, Japan) where L* represents brightness, a* represents the red-green range and b* represents the blue-yellow range, several reading were done over the total area of the muscle and the average calculated.

Neither carcass weight nor absolute weights of different cuts showed significant differences except for thigh weights where the negative control had the smallest thigh and the positive control the largest thigh. Carcass composition in terms of absolute weights of skin & fat, bone and muscle of the breast did not differ between treatments.

Significant differences ($P<0.05$) were observed for meat quality characteristics as expressed as muscle pH at slaughter, muscle pH 24 hours post mortem and muscle colour. pH of breast and thigh muscles were observed to be higher at slaughter as well as 24 hours post mortem (Table 13), resulting in less muscle hydrolysis and subsequently better meat quality as observed in the colour measurements reported in Table 14 of all treatments receiving Ateli plus.

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Table 10 Absolute weights (g) of breast, thigh, leg, back and wing of carcasses obtained from broilers slaughtered at 33 days of age

Treatment	Breast (g)		Thigh (g)		Leg (g)		Back (g)		Wing (g)	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	276.38	37.46	214.10[a]	18.10	94.76	15.22	66.99	12.65	95.31	9.62
Negative control without anti-biotic	267.08	25.30	193.59[b]	16.19	98.37	12.29	65.57	11.81	93.22	9.35
Ateli plus at a rate of 1 kg/ton	247.92	35.08	198.54[ab]	10.50	95.97	10.63	63.54	9.41	101.44	8.90
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	257.88	32.50	201.14[ab]	17.79	94.68	10.45	60.53	11.16	101.15	16.61
Positive control and Treatment 4	272.39	31.88	202.87[ab]	13.44	104.28	13.78	64.55	9.00	96.33	12.55
Significance	NS		0.0304		NS		NS		NS	

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NS – Not significantly different (P>0.05)

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Table 11 Absolute weights (g) of skin, fat and bone of the breast obtained from broilers slaughtered at 33 days of age

Treatment	Muscle (g)		Skin and fat (g)		Bone (g)	
	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	177.57	24.24	23.26	6.70	71.75	25.92
Negative control without anti-biotic	183.14	18.07	20.56	6.98	57.16	9.59
Ateli plus at a rate of 1 kg/ton	175.26	23.33	18.43	2.57	52.03	17.13
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	178.79	23.09	19.57	4.02	53.22	14.29
Positive control and Treatment 4	199.87	14.23	20.45	4.25	49.98	22.31
Significance	NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Table 12 Carcass weight (g) obtained from broilers slaughtered at 33 days of age

Treatment	Carcass weight$_i$	
	Mean	Std dev
Positive control with anti-biotic	1455.72	59.45
Negative control without anti-biotic	1418.64	58.15
Ateli plus at a rate of 1 kg/ton	1404.63	51.09
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	1398.98	66.57
Positive control and Treatment 4	1471.13	70.55
Significance	NS	
Means within columns with different superscripts differ significantly (P<0.05) NS – Not significantly different (P>0.05)		

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Table 13 pH_i and pH_u of breast and thich muscle obtained from broilers slaughtered at 33 days of age

Treatment	pH_i Breast muscle		pH_i Thigh muscle		pH_u Breast muscle		pH_u Thigh muscle	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	5.88[a]	0.13	5.68	0.23	5.55[ab]	0.13	5.60[ab]	0.18
Negative control without anti-biotic	5.84[ab]	0.21	5.64	0.18	5.50[a]	0.13	5.56[a]	0.18
Ateli plus at a rate of 1 kg/ton	5.71[b]	0.12	5.8	0.76	5.56[ab]	0.10	5.68[ab]	0.05
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	5.74[ab]	0.13	5.54	0.19	5.61[ab]	0.06	5.69[ab]	0.13
Positive control and Treatment 4	5.74[ab]	0.11	5.65	0.12	5.66[b]	0.12	5.74[b]	0.11
Significance	0.027		NS		0.013		0.021	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Table 14 Cie Lab colour measurements of breast and thigh meat of broilers slaughtered at 32 days of age.

Treatment	Breast L		Breast a		Breast b		Thigh L		Thigh a		Thigh b	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	60.54[a]	2.44	4.22	1.87	12.22[ab]	1.39	57.06[a]	2.47	5.31[b]	1.60	9.73	1.61
Negative control without anti-biotic	59.06[a]	2.85	5.41	2.14	10.47[b]	1.29	57.31[a]	2.29	5.13[b]	1.30	11.08	2.21
Ateli plus at a rate of 1 kg/ton	57.75[ab]	2.60	5.71	1.69	12.05[ab]	1.97	55.37[ab]	1.95	5.06[b]	0.96	12.20	1.86
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	58.73[a]	2.00	4.35	0.83	12.46[a]	1.13	54.99[ab]	1.88	8.09[a]	2.62	12.85	3.36
Positive control and Treatment 4	54.78[b]	2.70	5.26	1.99	12.29[ab]	2.22	53.74[b]	1.89	7.25[ab]	2.39	12.29	3.55
Significance	0.001		NS		0.0305		<0.0001		<0.0001		0.0500	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Organ and gut parameters

Organs (heart, liver, spleen and bursa of fabricius) were removed fully from the fresh carcass and weighed using a laboratory scale (1kg accurate to 0.001g) (Table 16). Further the gizzard was removed and cut open longitudinally and rinsed under running water. Once rinsed it was immediately scored on an ordinal scale as described in Table 15 below.

Table 15 Gizzard Erosion scoring description

Score	Description
1	No erosion
2	Light erosion (roughness of epithelia)
3	Modest erosion (roughness and gaps)
4	Severe erosion (roughness, gaps and ulcers on stomach wall showing slight haemorrhaging)
5	Extreme erosion (roughness, gaps and haemorrhagic ulcers on stomach wall and separation of epithelia from stomach wall)

After the removal of the organs gut samples were taken of the duodenum (on the gizzard side of the duodenum at the start of the pancreas), jejunum (approximately centre) and the ileum (5mm from the illeao cecal junction). These samples were rinsed with a 9% saline solution and placed in a buffered 10% w/v formalin solution. These samples were maintained in the formalin at room temperature for a period of 30 days and submitted for fixing to the Stellenbosch University School of medicine Histology lab (Tygerberg campus). After sampling the pH were taken at these sites (Table 17) and also in the pro-ventriculus and caecum. pH was taken using a calibrated (standard buffers pH 4.0 and 7.0 at 25°C) portable Crison 506 pH-meter by inserting the pH electrode into the centre of the area of the digestive tract to be measured. The probe was thoroughly rinsed with distilled water between readings and maintained in a crysolite solution.

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Table 16 Mean weights and standard deviations of organs obtained and gizzard erosion score (GE score) from broilers slaughtered at 33 days of age

Treatment	Gizzard weight (g)		Heart weight (g)		Liver weight (g)		Spleen weight (g)		Bursa weight (g)	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	24.01	4.38	11.57	1.53	66.45	14.21	2.88	1.46	4.10	0.94
Negative control without anti-biotic	19.42	3.74	10.69	1.68	60.11	9.88	2.89	0.47	4.62	1.02
Ateli plus at a rate of 1 kg/ton	24.17	2.36	10.66	0.73	55.82	7.11	2.28	0.25	3.68	1.09
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	26.54	4.15	10.86	1.83	52.34	11.68	2.05	0.42	3.86	1.61
Positive control and Treatment 4	22.64	2.72	10.95	1.49	58.03	9.25	2.34	0.45	4.16	2.20
Significance	0.029		NS		NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Table 17 Mean pH and standard deviations of various areas of the digestive tract obtained from broilers slaughtered at 33 days of age

Treatment	Pro-ventriculus		Duodenum		Jejenum		Ileum		Caecum	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Positive control with anti-biotic	3.98	0.46	5.53	0.38	5.73	0.46	6.07	0.80	6.24	0.19
Negative control without anti-biotic	4.48	0.52	5.33	0.34	5.67	0.72	5.97	0.69	5.92	0.48
Ateli plus at a rate of 1 kg/ton	3.78	0.90	5.13	0.57	5.83	0.21	5.55	0.39	5.94	0.20
Ateli plus at a rate of 2 kg/ton week 1 and then 1kg/ton for the remainder of the period	3.91	0.54	5.15	0.58	5.56	0.35	6.57	0.56	5.93	0.42
Positive control and Treatment 4	3.82	0.57	5.39	0.33	5.73	0.23	6.11	1.03	6.04	0.45
Significance	NS		NS		NS		NS		NS	

Means within columns with different superscripts differ significantly (P<0.05)
NS – Not significantly different (P>0.05)

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Conclusion

Ateli plus as tested in the trial was shown to, at all inclusion levels and alternatives mixes to lead to identical broiler performance when compared with both a negative and positive control. This is subject to the maintenance of good farming practice. There appears to be an additional benefit to the use of Ateli plus in terms of meat quality. Since the aim of this study was not to compare these parameters the indications are that the pH measurements and colour measurement show that the use of Ateli plus might lead to a decrease in drip loss from carcasses and cuts. The colour could also be more acceptable to the consumer which could influence the decision to buy at the supermarket fridge. It must be kept in mind that the aim of the trial was to see whether or not Ateli plus could replace the use of antibiotic growth promotors and this was proved in this trial. Ateli was not intended to perform better than the other treatments it was just expected to do the same. It must be kept in mind that the use of antibiotics, Ateli plus or any other additive can never replace good farming practice and stockmanship and that the addition of these substances may not lead to the desired effect if good farming practice is not in place.

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