Laying performance and digestibility of nutrients by Japanese quails fed diets containing peeled and cooked sweet potato meal

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A six-month feeding trial was carried out to investigate the effect of feeding peeled cooked sundried sweet potato tuber on hen-day egg production and digestibility of nutrients by Japanese quails. Five isonitrogenous (20%CP) diets were compounded. The control diet (A) had zero sweet potato tuber meal. In the other four diets, 25, 50, 75 and 100% of maize (respectively) was replaced by peeled cooked sundried sweet potato tuber meal. 300 point-of-lay female Japanese quails were randomly assigned the diets in a completely randomized design with feed and water provided ad libitum. Each diet was allocated to 60 quail chicks which were further divided into three replicates of 20 birds each. Feed intake, body weight change, age at first eggs, age at 50% egg production, age at 75% egg production, hen-day egg production, hen-housed egg production and feed per dozen eggs were similar ($p > 0.05$) across the diets. Water intake was significantly ($p < 0.05$) or ($p > 0.05$) higher by birds on diet D (51.93ml/bird/day) than by those on diets A (42.60) and C (46.68ml/bird/day). Water intake by birds on diet A was significantly ($p < 0.05$) lower than by birds on the sweet potato diets. Dry matter digestibility was significantly ($p < 0.05$) better on diet C (70.54%) than on diets B (68.44) and D (68.54%). Ether extract digestibility was significantly ($p < 0.05$) better on diet E (67.60%) than on diets A (54.57), B (54.60), C (49.70) and D (51.42%). Crude protein digestibility was not affected by the diets. It can be concluded that peeled cooked sundried sweet potato can completely replace maize in the diet of laying quails without adverse effects on performance or on digestibility of nutrients.

Keywords: Feed intake, water intake, hen-day egg production, hen-housed egg production, digestibility

Introduction

Japanese quail birds are small-sized, early maturing, hardy and prolific (Robbins, 1981). They come to egg production between the 5th and 6th week of life but adult plumage is not attained until the 12th week of age (Martins, 1987). The eggs are small, mottled and weigh between 8 and 10g each (Edache *et al.*, 2003a, Musa *et al.*, 2008). The meat and eggs are low in body fat and cholesterol (Schwartz and Allen, 1981) which is of public health significance. Persons prone to high blood pressure and related diseases could consume these products with less risk. 18 - 20% crude protein diet has been recommended for acceptable performance for laying

Japanese quail, (Edache *et al.*, 2003^b). The cost of conventional feed materials pose a great challenge to effective feeding of laying Japanese quails. Agbede *et al.* (2002) observed that the usual high inclusion of maize translates into high cost of finished feed because of seasonal variations in production and competition for it by man hence the need for alternative energy sources.

Sweet potato belongs to the family convulvulaceae. There are about 50 genera and more than 1000 species of this family. Of this family, only *Ipomoea batatas* is a crop plant whose large starchy, tasty tuberous root is an important root vegetable (Purseglove, 1991). The edible tuberous

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root is long and tapered, with a smooth skin whose colour ranges between red, purple brown and white (Woolfe, 1992). It is widely cultivated in the tropics and the warmer temperate climates. The edible part is an enlarged tuberous root, varying in shape from oblong to pointed oval. Neild, (1992) reported that the solid root consists largely of starch and that the orange-fleshed varieties are high in carotene, vitamin A and B₆ or pyridoxine. Studies by Oboh (1987) and Tewe (1992) have shown that sweet potato can be utilized efficiently by poultry. Maphosa *et al.* (2003) and Afolayan *et al.* (2012) reported that addition of sweet potato to broiler diet negatively affected their performance and that only 50% of maize should be replaced with sweet potato meal in finisher diet to avoid adverse effect on performance. Ladokun *et al.* (2007) reported that not more than 50% of maize should be replaced by sweet potato meal in the diet of laying chickens to maintain profitable performance. Aina and Fanimu (1997) showed that hen-day egg production, egg weight, feed intake and shell thickness did not differ significantly between birds fed maize-based diets and those fed sweet potato diets. Cooking did not significantly affect the utilization of energy (Oyenuga and Fetuga, 1975), but increased the digestibility of the nutrients (Oyenuga and Fetuga, 1975; Canope *et al.*, 1977). The objective of this study is to determine the effect of replacing maize with peeled cooked sundried sweet potato meal on hen-day egg production and digestibility of nutrients by Japanese quails.

Materials and methods

Source and processing method of sweet potato tuber

The white-fleshed sweet potato tuber used in this study was purchased from Jos and

from a border market between Plateau and Kaduna States. The sweet potato tubers were cleaned and processed as follows. Sweet potato tubers were peeled, sliced (3mm), cooked (20 minutes) and sun-dried for seven days during the harmattan. The cooking was done by pouring the sliced sweet potato tubers into boiling water and left to boil for 20 minutes.

The processed sweet potato tubers were milled using a hammer mill fitted with an 8 mm sieve for incorporation into experimental diets. The diets were analyzed for proximate chemical components (Table 2) by procedures outlined by AOAC (2000).

Experimental birds

300 point-of-lay Japanese quail birds obtained from Poultry Division of National Veterinary Research Institute, Vom were used in this study. They were healthy and uniform in body weight and size.

Experimental design and housing

Three hundred point-of-lay Japanese quails were randomly allotted to five dietary treatments in a completely randomized design. Each treatment group had sixty (60) quail birds and was replicated three times. Each replicate had twenty quail birds. The birds were housed in a standard deep litter poultry house spaced 150 sq. cm per bird as recommended (Musa *et al.*, 2008).

Experimental diets

Peeled cooked sundried sweet potato meal was used to replace maize in a isonitrogenous (20% CP) diets. Diet A without peeled cooked sundried sweet potato served as the control. In diets B, C, D and E, 25%, 50%, 75% and 100% of maize in the diets was replaced by peeled cooked sundried sweet potato tuber meal, respectively. The diets were fortified with vitamins and minerals. The ingredient composition of the experimental diets is presented in Table 1.

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Table 1: Percent ingredient composition of experimental diets for laying quails

Ingredients	Diets				
	A	B	C	D	E
Maize	40.23	29.26	18.27	7.25	0
Sweet potato meal	0	10.06	20.11	30.22	40.23
Ground nut cake	25.57	26.48	27.41	28.33	30.31
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	1.00	1.00	1.00	1.00	1.00
Palm kernel cake	14.00	14.00	14.00	14.00	14.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	6.50	6.50	6.50	6.50	6.50
*Vit. Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100	100	100	100	100
Calculated composition:					
C.P. %	20.00	20.00	20.00	20.00	20.00
M.E.(Kcal/kg)	2575.83	2521.79	2467.57	2413.24	2377.48
Ca. (%)	3.17	3.18	3.18	3.18	3.19
P (%)	0.47	0.47	0.47	0.46	0.45
C.F. (%)	4.63	5.05	5.48	6.90	6.17
Cost/kg Diet (₹)	63.72	62.99	62.26	61.53	61.04

* Bio Mix Layer premix supplied the following per 100kg of diet: Vitamin A, 850,000 I.U; Vitamin D₃, 150,000 I.U; Vitamin E, 1,000 I.U; Vitamin K, 1000 mg; Thiamin (B₁), 150 mg; Riboflavin (B₂), 450mg; Pyridoxine (B₆), 300mg; Niacin, 1500mg; Vitamin B₁₂, 1.5mg; Pantothenic acid, 450mg; Folic acid, 60mg; Biotin, 50mg; Choline chloride, 17,500mg; Anti-oxidant, 125mg; Manganese, 4000mg; Zinc, 3000mg; Iron, 2000mg; Copper, 300mg; Iodine, 100mg; Selenium, 20mg; Cobalt, 20mg. Key: C.P, crude protein; M.E, metabolizable energy; Ca, calcium; P, phosphorus; C.F, crude fibre.

Table 2: Nutrient composition (%) of laying quail diets used in the experiment

Parameters (%)	A	B	C	D	E	SEM
Dry matter	94.70	94.50	94.39	94.04	94.22	±0.43NS
Crude Protein	20.10	20.10	20.08	20.11	20.10	±0.06NS
Ash	10.06	8.00	6.40	6.09	7.02	±4.11NS
Ether extract	5.07	4.78	5.54	4.92	4.98	±0.49NS
Crude fibre	8.01	8.06	8.70	9.06	8.53	±0.71NS
Nitrogen Free Extract	51.46	53.06	53.67	53.86	53.59	±2.23NS

Key: A = Control diet (with no cooked sweet potato tuber), B = Diet with 25% of maize replaced by peeled cooked sundried sweet potato meal, C = Diet with 50% of maize replaced by peeled cooked sundried sweet potato meal, D = Diet with 75% of maize replaced by peeled cooked sundried sweet potato meal, E = Diet with 100% of maize replaced by peeled cooked sundried sweet potato meal, SEM - Standard error of mean, N.S – not significant (P ≥ 0.05).

Management of birds and data collection

Each treatment group of birds was fed one of five experimental diets in which 0, 25, 50, 75 and 100% of maize was replaced by peeled cooked sundried sweet potato tuber meal, respectively. The birds were fed the

experimental diets daily and corresponding leftover weighed to determine feed intake over time. Water intake was measured daily using a calibrated cylinder. All birds were given feed and water ad libitum throughout the experimental period of 6 months. All

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recommended routine medications and other routine management practices were strictly adhered to as outlined by NVRI (1996) and Musa *et al.* (2008). Constant administration of vitamins and antibiotics as required keeping birds fit was carried out. All birds in each replicate were weighed at the start of the feeding trial and once a week for the period of the feeding trial. Daily egg collection was carried and sample of eggs from each replicate weighed weekly to record mean egg weight.

Parameters measured

The initial weight of birds at point-of-lay and the final weight of the birds at the end of the experiment were taken. Body weight change was measured by the difference between the final weight and the initial weight of the quail birds multiplied by 100. The birds were offered an amount of feed daily and the corresponding left over was weighed and recorded. The difference between the amount fed and the corresponding leftover divided by the specified period was the daily feed intake. Protein efficiency ratio (PER) was determined as a ratio of weight of egg produced to the protein consumed.

Energy efficiency ratio (EER) was determined as ratio of weight of eggs produced to the energy consumed. Water consumption: Daily water consumption was determined accounting for evaporative loss using the procedure outlined by Shoremi *et al.* (2001). Mortality records was kept throughout the experimental period.

Production parameters

Hen day egg production was measured as the total number of eggs laid divided by the number of hens in the house multiplied by 100. This is given as;

$$\text{HDEP} = \frac{\text{number of eggs produced}}{\text{number of live birds}} \times 100$$

Hen housed egg production was measured as the total number of eggs laid divided by the number of hens originally housed (dead, culled etc inclusive) multiplied by 100.

$$\text{HHEP} = \frac{\text{number of eggs produced}}{\text{number of birds originally housed}} \times 100$$

Feed conversion ratio was measured as the gram feed consumed per gram of dozen eggs produced while **Egg weight** was measured as the average weight of individual egg.

Apparent nutrient digestibility study

At the end of the twenty third week of experiment, four birds (4) per replicate whose live weight were as close as possible to the mean live weight for the treatment group were used for the trial. The four birds from each replicate were placed in a compartment of the digestibility crate and given a quantity of feed that they can consume per day. After they were fasted over- night, they were placed on the experimental diets for seven days. Fecal collection was carried out for the seven days. The collected feces were each weighed and oven-dried for a period of 18 hours at a temperature of about 105°C and weighed daily. At the end of the collection period, the fecal samples collected from each treatment replicate were bulked, milled and thoroughly mixed to obtain a homogenous mixture. Samples were then taken and analyzed for proximate composition according to the methods outlined by AOAC (2000).

Statistical analysis

Data obtained were subjected to One Way Analysis of Variance (ANOVA) and where significant differences were observed, means were separated using Duncan's Multiple Range Test (Duncan, 1955) as described by Steel and Torrie (1980).

Results and discussion

Results of performance characteristics are presented in Table 3. The final body weight seemed to decrease from 197.75g/bird for birds on the control diet to between 187.38 and 194.43g/bird on the sweet potato diets. However, the differences were not significant. Values between 187.38 - 197.75g/bird obtained in this study were higher than the final body weight of 163-184.33g/bird reported by Edache *et al.* (2012), 187.55-192.67g/bird reported by Akinfenwa *et al.* (2011) and (180-186.50g/bird) reported by Akpa *et al.* (2008) and 141.30 - 154.00g/bird reported by Odunsi *et al.* (2007). Body weight change was not significantly affected by the diets. In the report of Ladokun *et al.* (2007) body weight change was significantly higher in birds on the complete replacement with sweet potato than on other diets. The lack of significant effect of the diets on body weight change in the present report is in consonance with the report of Akinfenwa *et al.* (2011) for laying quail.

Feed intake in the present study was not significantly affected by the diets. This seems to be a contradiction to the report of Ladokun *et al.* (2007) who reported that feed intake decreased significantly as the levels of sweet potato increased. The report of Panigrahi *et al.* (1996) and Aina and Fanimu (1997) seems to support the report of this study for they observed no significant differences between the feed intake of chickens on maize diets and those on sweet potato diets. As reported earlier, the energy level of the diets was decreasing as the level of sweet potato increased. Since birds eat to satisfy energy requirement (NRC, 1994), the increased effort at feed intake by birds on the various sweet potato meal diets must have led to the similarity in feed intake between the test diets and the control. According to Vasco de Basilio *et al.*

(1997), feed consumption was not affected as maize was replaced by sweet potato meal for laying Japanese quails up to 100% of the diet confirming the result obtained in this study.

Hen-day egg production decreased from 78.11 (diet A) to 73.09 % (diet E) but did not differ significantly between the diets as the level of sweet potato root meal increased. These figures were higher than those (77.02 - 62.71%) reported for laying Japanese quail fed toasted mucuna seed meal (Tuleun and Dashe, 2010) and also higher than 66.80 - 59.40% reported by Aggoor *et al.* (2006) for laying quail fed rice bran or broken rice at two different energy levels and higher than that (75.78 - 68.60%) reported by Akinfenwa *et al.* (2011) for laying coturnix quail and higher than the 59.00 - 49.80% reported by Odunsi *et al.* (2007) for laying Japanese quail. Aina and Fanimu (1997) had reported that egg production was not significantly different between birds fed maize and sweet potato diets and attributed it to adequacy of dietary protein and metabolizable energy of the diet. This view seems to support the result of this work and has been noted before in the submission of Dominguez (1990) and Akinfenwa *et al.* (2011).

Hen-housed egg production measured in the course of this study varied from 69.02% (diet A) to 73.44% (diet C). Despite these variations, the differences were not significant. This has been attested to by Tuleun and Dashe (2010) and Kaya and Yildirim (2011) who fed laying chickens with sweet potato vines and may be due to the adequacy of dietary protein and metabolizable energy.

Water intake by quail birds on the experimental diets differed significantly from the control as the level of sweet potato increased. Water intake of birds on diets C was significantly lower than on dietD

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(51.93ml/bird). According to Ezieshi *et al.* (2003) water consumption for laying hen increased as laying progressed to peak production (18 weeks of laying). Similar trend was observed for Japanese quails used in this study. Ezieshi *et al.* (2003) reported that average water intake per bird was about 300ml/day and that this was much higher than earlier report (Savory, 1978) for laying birds in temperate countries. Water to feed ratio as reported by (Savory, 1978) for chicken was about 2.5 and that there were no published data from tropical zones for layers to compare their result with (Ezieshi *et al.*, 2003). According to Rajput (2006), daily feed and water consumption for young quail was observed to be 16.25g/bird and 33.07ml/bird respectively. In the present study, water to feed ratio ranged from 1.48 (diet A) to 1.73 (diet D) which is lower and may be due to the differences in environmental temperatures where the studies were carried out. However, the mean daily water intake in the present study is higher than what was reported for Japanese quail (Rajput, 2006) and may be responsible to the differences in climate where the researches were carried out since birds under higher environmental temperatures must consume more water to maintain body temperature. Birds have been reported to consume more water in the tropics in order to control their body temperature (Ezieshi *et al.* 2003).

Feed per dozen eggs varied from control (0.45kg; diet A) to diet D (0.49kg) but differences were not significant. This report is similar to what has been reported elsewhere (Aina and Fanimo, 1997) for laying chickens. They reported that there were no significant differences either in feed per dozen eggs or feed per kilogram egg between maize diets and sweet potato diets. Similar results have been reported (Ladokun *et al.*, 2007) for laying birds and

Vasco de Basilio *et al.* (1997) for laying Japanese quail fed sweet potato root meal diets and by Kaya and Yildirim (2011) for laying chickens fed sweet potato vines. However, lack of significant difference in the present study is contrary to that reported for Japanese quail fed rice bran or broken rice at two energy levels with or without avizyme supplementation (Aggoor *et al.*, 2006) and may be due to differences in diets utilized.

Egg laying reached 5% by the 35th day of age for all the birds irrespective of sweet potato inclusion levels. Ladokun *et al.* (2007) fed sweet potato meal to laying chickens and observed significant difference ($P < 0.05$) for age at first egg. Ladokun *et al.* (2007) reported that birds on the sweet potato meal had delayed onset of egg production. This was not noticed in the present work. While age at 50% egg production was reached between the 38 and 39th day of life in this study, Aggoor *et al.* (2006) reported 43 days of age at 40% egg production in Japanese quails. Age at 75% egg production in this study was between 41 and 43 days of life which fairly corresponds to the age reported for 40% egg production by Aggoor *et al.* (2006).

Feed cost per dozen eggs increased from diet A (28.89) and was highest for diet D (30.15) as the content of sweet potato increased in the diet. Diet E (29.50), however, has lower feed cost per dozen eggs than diet D even though the differences were not significant. The figures for feed cost per dozen eggs obtained in this study is similar to the cost of feed/egg (2.62-2.23) reported by Tuleun and Dashe (2010). The result of feed cost per dozen eggs in this study followed similar pattern with feed conversion ratio. Contrary to the report of Ladokun *et al.* (2007), feed cost per dozen eggs produced was numerically better in the control than the sweet potato diets. The non-

significant situation in feed cost per dozen eggs was similar to the submissions of Akinfenwa *et al.* (2011) for laying quail fed dietary lysine. While the least cost in the report of Ladokun *et al.* (2007) was by birds on the sweet potato diets, in this report, the least cost per dozen eggs was obtained in birds fed the control diet. Ladokun *et al.* (2007) reported that birds on the sweet potato diets consumed more feed than birds on the control. This is in agreement with the feed intake values in the present work.

Energy intake of laying quail decreased from 74.49 (diet A) to 69.20kcal/kg (diet E) but the differences were not significant. This observation was contrary to the report of Aina and Fanimu (1997) who fed laying chickens with sweet potato meal and observed a significant reduction in energy intake between birds fed the maize diet and those fed sweet potato diets. The difference between the energy level of the maize diet (2660kcal/kg) and sweet potato diet (2550kcal/kg) in their study was not far apart. The Japanese quail has been reported to be able to adjust feed intake within a wide dietary energy range of between 1700 and 2400kcal/kg (Weber and Reid, 1967). This is perhaps responsible for the similarity in energy intake in this study.

Daily protein intake of birds in the present study slightly increased from 5.78g/bird (diet A) to 6.00g/bird (diet D). Daily protein intake of birds on the other experimental diets (5.88g/bird; B, 5.85g/bird; C, 5.79g/bird; E) were lower than. However, the differences were not significant. This is in consonance with earlier report (Aina and Fanimu, 1997) for laying chicken.

Protein efficiency ratio (PER) decreased from 2.03 for birds on diet A to 1.86 for those on diets B and D but the differences were not statistically significant. The

energy efficiency ratio (EER) in the current work increased numerically from 0.15 for birds on diet A to 0.16 for those on diet E as the level of sweet potato increased to 100% replacement of maize. In the work of HosseiniVashan *et al.*, (2010), the PER and EER were decreased in broiler chicks fed low crude protein and metabolizable energy content during the growing (8-28 days) period but was not affected during starter period (0-7 days) and finisher period of 29-42days. Whereas in the work of HosseiniVashan *et al.*, (2010) there was a consistent reduction in PER (2.063-1.823) and EER (12.894-11.397) during the grower period during 8-28 days of broilers as the energy content of the diet decreased (3200-2800kcal/kg), in the starter and finisher period, PER and EER were not significantly affected. In the current work, there were no significant differences in PER and EER between the sweet potato diets and the control even though the energy level was decreasing from 2576 to 2377kcal/kg which in part agrees with the report of HosseiniVashan *et al.*, (2010). Magala *et al.* (2012) did not observe significant differences in EER (8.9- 7.9) in the feeding of cockerels between dietary energy range of 2800-3000kcal/kg which is similar to the observations in this work. That the PER was not affected by the diets on the different energy levels is supported by the work of Magala *et al.* (2012) who fed cockerels on dietary energy ranging from 2800-3000kcal/kg.

Egg weight measured varied slightly between 11.15 grams (diet D) and 10.91 grams (diet E). Similar results have been published by Aina and Fanimu (1997) who fed sweet potato meal to laying birds, Vasco de Basilio *et al.* (1997) who placed laying Japanese quail on sweet potato meal diets, Akinfenwa *et al.* (2011) who fed laying Japanese quail dietary lysine and Tuleun

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and Dashe (2010) who fed laying Japanese quail with toasted mucuna seed meal. Mean egg weight compared favourably with the range of 10.31- 10.46 grams reported by Akinfenwa *et al.* (2011) and 10.28-10.50 grams reported by Aggoor *et al.*, (2006) but

was higher than the range of 8.65-9.54 grams reported by Tuleun and Dashe (2010) and the range (9.33-10.10grams) reported by Odunsi *et al.* (2007) but was lower than the 13.71g reported by Kumar *et al.* (2008) and may be due to variations in species, weather and diets employed.

Table 3: Effects of replacement levels of peeled cooked sundried sweet potato tuber meal for maize on performance of laying Japanese quails.

Parameters	Diets					SEM
	A	B	C	D	E	
Initial weight (g)	155.00	155.67	155.33	155.00	155.00	0.58 ^{NS}
Final weight (g/bird)	197.75	187.38	192.85	194.43	187.48	6.32 ^{NS}
Weight change (%)	27.57	20.39	24.15	25.44	20.96	3.94 ^{NS}
Feed intake (g/bird/day)	28.88	29.39	29.22	29.98	29.11	1.23 ^{NS}
Waterintake (ml/bird/day)	42.60 ^a	48.32 ^{bc}	46.68 ^b	51.93 ^c	49.19 ^{bc}	1.81 [*]
Hen-day egg prodn (%)	78.73	76.68	73.83	74.73	73.09	3.75 ^{NS}
Hen-housed egg prodn (%)	69.02	66.73	73.44	73.00	72.12	5.48 ^{NS}
Feed/doz eggs	0.45	0.47	0.48	0.49	0.48	0.03 ^{NS}
Age at 1 st egg (days)	35.00	35.00	35.33	35.33	35.00	0.37 ^{NS}
Age at 50% egg (wks)	5.43	5.48	5.43	5.58	5.52	0.14 ^{NS}
Age at 75% egg (wks)	6.00	5.86	5.95	5.90	6.19	0.25 ^{NS}
Feed cost/doz eggs (₦)	28.89	29.90	30.09	30.15	29.50	1.88 ^{NS}
Energy intake (kcal/g/bird)	74.49	73.97	72.19	72.24	69.20	3.09 ^{NS}
Protein intake (g/bird/day)	5.78	5.88	5.85	6.00	5.79	0.26 ^{NS}
Energy Efficiency Ratio	0.15	0.15	0.16	0.15	0.16	0.007 ^{NS}
Protein Efficiency	2.03	1.86	1.89	1.86	1.87	0.099 ^{NS}
Rratio						
Mortality (%)	2.20	2.49	0.28	0.55	0.54	1.40 ^{NS}

a, b, means with same superscripts letters within rows are not significantly ($p \geq 0.05$) different. SEM, standard error of mean. N.S = not significant, A, control (no sweet potato tuber meal); B, diet with 10.06% peeled cooked sweet potato tuber meal; C, diet with 20.11% peeled cooked sweet potato tuber meal; D, diet with 30.22% peeled cooked sweet potato tuber meal; E, diet with 40.23% peeled cooked sweet potato tuber meal.

'Dry matter digestibility (Table 4) showed that values for birds fed diet C (70.50%) was significantly better than those on diets B (68.44%) and D (68.54%). This is much lower than the apparent dry matter digestibility (95.30%) for pigs on raw sweet potato (Rose and White, 1980), 90.40% (Canopeet *al.*, 1977) on raw sweet potato diets and dry matter digestibility (93.50%) for pigs fed cooked sweet potato diets Canopeet *al.* (1977). The figures for dry matter digestibility reported for laying

quails fed sweet potato root meal diets were also lower than the 91.00% reported by Tomita *et al.* (1985) for pigs on ensiled sweet potato root. The figures reported in this study for laying quails are close to the figures (71.3 – 70.2%) reported by Aina and Fanimu (1997) for laying chickens on sweet potato diets and 72.00 - 64.30% reported for growing birds (Gerpacio *et al.*, 1978). Digestibility of crude protein varied between 45.02% (diet E) and 40.68% (diet B) but was not significant. The range of

protein digestibility in the present work was between 45.02 – 40.68% which is lower than 72.60 – 61.80 % for broilers on sweet potato diets reported by Gerpacio *et al.* (1978) and lower than the protein digestibility for cooked sweet potato meal (52.80) for pigs reported by Canope *et al.* (1977), but close to the protein digestibility (49.80%) of raw sweet potato for pigs reported by Rose and White (1980) and higher than the protein digestibility (32 %) for ensiled sweet potato meal for pigs reported by Tomita *et al.* (1985). Crude protein digestibility in the report of Malik *et al.* (2011) was not significantly affected by the diets and this is in agreement with the present report. In the report of Abonyi *et al.* (2009), crude protein digestibility was significantly higher at the 25 and 50% dietary sweet potato leaf meal for rabbits than for the rest of the diets. This was not observed in the present work.

Ether extract digestibility was significantly

higher on birds fed diet E (67.60%) than for those fed other dietary treatments (A; 54.57%, B; 54.60%, C; 49.70%, D; 51.42%). Differences between the other diets were not significant. This is contrary to the report for rabbits fed sweet potato peel meal (Malik *et al.*, 2011) and Abonyi *et al.* (2009) for rabbits fed sweet potato leaf meal and may be due to differences in diets and species used. The digestibility of ether extract (79.18 – 89.90 %) reported by Malik *et al.* (2011) and that reported (84.51-89.16%) by Abonyi *et al.* (2009) is much higher than the report of the present study and may be responsible for the differences in species since the meat and eggs of Japanese quail are low in fat and cholesterol content (Garwood and Diehl, 1987). This report also seems to confirm earlier report that cooking increased the digestibility of nutrients (Canope *et al.*, 1977).’

Table 4: Digestibility of nutrients in diets containing peeled, cooked, sundried sweet potato tuber meal fed to laying Japanese quails (%)

Parameters	Diets					SEM
	A	B	C	D	E	
Dry matter	69.99 ^{ab}	68.44 ^b	70.50 ^a	68.54 ^b	69.38 ^{ab}	±0.80*
Crude protein	44.16	40.68	42.40	42.19	45.02	±2.90 ^{N.S}
Ether extract	54.57 ^b	54.60 ^b	49.70 ^b	51.42 ^b	67.60 ^a	±5.70*

Key: a, b, means with same superscripts letters within rows are not significantly (P>0.05) different. SEM = standard error of mean. N.S = not significant. A = Control (no sweet potato tuber meal), B = Diet with 10.06% peeled cooked sundried sweet potato tuber meal, C = Diet with 20.11% peeled cooked sundried sweet potato tuber meal, D = Diet with 30.22% peeled cooked sundried sweet potato tuber meal, E = Diet with 40.23% peeled cooked sundried sweet potato tuber meal. N.S = Not significant (P > 0.05)

Conclusion

Sweet potato is well suited to our climate and does well particularly in the savannah regions and has been known to be cheaper to produce than cereals. Parameters measured to determine the effect of feeding peeled cooked sundried sweet potato in laying quail diet showed that only water intake increased significantly as the levels of sweet potato increased in the diet. Dry matter digestibility was significantly affected but followed no particular trend. On the other hand, ether extract digestibility was significantly better on the complete replacement with sweet potato. Other differences were not significant.

Therefore, peeled and cooked sweet potato could completely replace maize in the diet of laying Japanese quails without adverse effect on performance.

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