LOCAL PEPPERS AS SOURCES OF VITAMIN A AND COLOUR IN THE EGG YOLK

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ABSTRACT

Two varieties of peppers, Capsicum frutescence and Capsicum annum were included in rations for laying hens at 2%, 4% and 6% levels. Egg production was not affected by these levels of the peppers but larger egg sizes were obtained. The annum produced more carotene in the egg yolk than the frutescence.

Similar results were obtained for the yolk vitamin A. Corresponding levels of the two peppers produced similar colours in the egg yolk and the dark-yolked eggs preferred by many consumers can be obtained with 4% and 6% levels of either peppers.

INTRODUCTION

Egg yolk colour plays a prominent role in egg acceptance by consumers. In Nigeria, intensive poultry production is one of the quickest approaches to alleviating low levels of animal protein consumed by the population. The Joint Planning Committee of the Federal Ministry of Agriculture and Natural Resources (1974) set the target for poultry production in 1976 at over 100 million birds.

If a quarter of this number are laying birds, then a substantial amount of eggs should be available in Nigeria.

Eggs are needed not only for direct consumption but also for the hatchery operation. Many Nigerians prefer dark pigmented egg yolks and as such consumers have preference for guinea fowl eggs which are available in appreciable quantities at limited periods of the year. Egg yolk colour had been adjusted in different parts of the world to suit local demands. A review of products so used as well as study of some Nigerian pasture species that pigment egg yolk had been made by Ogunmodede and Wogar (1971). As forage production throughout the year is still not practised widely in Nigeria, the possibility of inadequate supply and competition between herdsmen and poultry feed manufacturers for these pasture species had been envisaged. Consequently, other pigmenters for yolk are being investigated.

Furthermore, carotenoids and vitamin A are accumulated in the egg yolk in attempts to adjust the yolk colour. This is useful for the growth of chicks subsequently hatched from the eggs. Vitamin A plays a role in the rate of growth of animals and the relationship between liver reserves of retinol in chicks and protein metabolism was shown by Stoewsand and Scott (1964). The storage of vitamin A in the liver of chicks is important in areas where the rate of growth of intensively reared chicks is relatively low. Thus the accumulation of nutrients with vitamin A activities in the egg yolk is the first step in ensuring adequate store of the vitamin in the liver of newly hatched chicks.

MATERIALS AND METHODS

Two varieties of peppers namely "Ata Were" Capsicum frutescens and "Shombo" Capsicum annum were obtained from the Federal Department of Agricultural Research, Moor Plantation, Ibadan. The peppers were dried, milled and incorporated into the rations, shown in Table 1 after the proximate analysis had been done.

Table 1. Percentage Composition of Experimental Rations.

Components	Rations Number						
	1	2	3	4	5	6	7
Maize	61	59	57	55	59	57	55
Groundnut cake	18	18	18	18	18	18	18
Groundnut oil	3	3	3	3	3	3	3
Blood meal	2	2	2	2	2	2	2
Fish meal	3	3	3	3	3	3	3
Dried yeast	2	2	2	2	2	2	2
C.annum	-	2	4	6	-	-	-
C. frutescens	-	-	-	-	2	4	6
Rice bran	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dicalcium phosphate	4	4	4	4	4	4	4
Oyster shell	3	3	3	3	3	3	3
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5
A-D vitamins* (for layers)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D. L. Methionine	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Antibiotics	+	+	+	+	+	+	+

* A synthetic vitamin and mineral mixture that supplied minimum requirement of the laying hen.

Two hundred and ten White Plymouth Rock layers were selected within two weeks of the first eggs being laid, that is when the birds were between 22 and 24 weeks old. The birds were divided into seven groups with thirty birds in each group and they were allocated to the seven experimental rations. The hens were housed individually in battery cages where feed and water were given ad libitum. Eggs were collected daily and weighed while egg samples were taken forthnightly for 16 weeks for the estimation of yolk colour with the Heinmann - Carver rotor chart. The carotene and vitamin A of the egg yolk were determined as outlined by Worker (1957). The experiment was repeated twice for reliability of results.

RESULTS AND DISCUSSION

In formulating the rations, the peppers were used to replace portions of the maize as the gross energy of the maize determined as 350 kcals per 100 gms was not significantly different from the values for the peppers as shown in Table 2. The fibre content of the peppers were about four times as much as that of the maize but none of the rations contained more than 6% of the peppers.

The average values for the weekly feed consumption by the birds were not significantly different as the range was 3.27 to 3.51 kg. The average feed per dozen eggs also varied insignificantly from 2.69 to 2.83 kg of feed per dozen eggs produced. The egg production is shown in Table 3. For all the groups egg production

Table 2. Percentage Proximate Composition of Peppers and Maize.

	C. annum	C. frutescence	Maize
Moisture	13.4	9.8	13.6
Protein	12.8	12.5	9.3
Ether extract	11.9	11.5	3.0
Fibre	22.5	23.3	2.6
Ash	5.7	4.7	1.7
N. F. E.	84.1	38.2	69.8
Gross energy (Kcals/100gms)	336	345	350

Table 3. Mean Percent Hen Day Production.

Weeks	Control	Capsicum annum		Capsicum		Frutescens	
		2%	4%	6%	2%	4%	6%
2	55	50	60	53	55	60	50
4	50	50	65	57	55	60	60
6	67	55	60	55	60	60	55
8	70	55	65	62	65	70	65
10	70	70	75	68	70	70	75
12	73	75	75	70	70	75	75
14	82	80	75	77	70	75	80
16	82	80	85	80	75	80	83

pattern was normal as it ranged between 50 and 60% during the first forthnight and increased gradually to about 80% during the 16th week. However the weights of the

eggs varied as shown in Table 4. An electrical egg grader was used. Eggs weighing $2^{3}/16$ ozs. and above were classified as grade 1. Grade 2 eggs were those weighing between $1^{7}/16$ ozs. while a range of $1\ ^{5}/8$ and $1\frac{1}{2}$ to $1\ ^{5}/8$ ozs. were for eggs in grades 3 and 4 respectively. As the level of pepper was increased in the ration, there was an increase in the grade 1 eggs produced. Such consistent results were not obtained for the other grades of eggs although 6% frutescence in the ration markedly reduced production of grade 4 eggs.

Table 4. Sizes of Total Eggs Produced (Percentages)

Treatments	Grades			
Control	1	2	3	4
	13d	39a	35a	13b
2% annum	15.8d	39.5a	32a	12.7b
4% annum	25.4b	19.7d	29b	25.9a
6% annum	33a	26.2c	31.5b	10.4
2% frutescens	20.5c	36 a,b	30.8b	12.9b
4% frutescens	24.9b	33.5b	33a	8.6c
6% frutescens	30.8a	32b	32.5a,b	4.8d

a, b, c means not underscored by the same letters in the same vertical columns are significantly different from one another.

The level of vitamin A and its precursors in the egg is important as Hill, Scott, Norris and Henser (1961) showed that it is related to the amount of the vitamin deposited in livers of newly hatched chicks. Indeed hatched chicks with

maximum amount of vitamin A in the liver grew at a faster rate. Table 5 showed that the carotene content of egg yolk from ration containing 6% C. annum to be consistently the highest while 6% C. frutescens produced the next accumulation of the provitamin in the egg yolk. In many samplings, dietary 4% C. annum produced as much carotene in the egg yolk as 6% C. frutescence. In all cases carotene deposition from C. annum was higher than from the corresponding dietary level of C. frutescence. Sampling from the sixth week of egg production, carotene deposition in egg remains fairly constant under normal conditions of feeding and managemen

Table 5. Mean Carotene Content of Egg Yolk (Mgms/gm)

No. of Weeks on diet	Control	Capsicum annum 2%	Capsicum annum 4%	Capsicum annum 6%	Capsicum frutescens 2%	Capsicum frutescens 4%	Capsicum frutescence 6%
6	1.37e	5.85b	6.90b	9.00a	3.75d	4.75c	6.50b
8	1.42e	5.10cd	7.80b	9.75a	4.50d	5.50c	7.52
10	1.90e	6.35c	8.52b	10.14a	5.13d	5.80d	8.00b
12	1.96d	5.90c	8.65a	9.37a	5.22c	5.77c	7.98b
14	1.85e	6.48c	8.98a	9.46a	5.16d	5.68d	8.14b
16	1.98e	6.26c	8.97b	10.20a	5.13d	5.79c	8.30b

a, b, c means not underscored by the same letters in the same horizontal columns are significantly different from one another.

Vitamin A of the yolk is also shown in Table 6. As in the case of carotene, 6% C. annum produced consistently highest level of the vitamin in the yolk although in some cases these values were not significantly different from those for 6% dietary frutescens. A level of 4% annum in the feed produced consistently higher vitamin A in the egg yolk; similar results were obtained for 2% of the peppers except during the 10th week when the differences were not significant. Generally, the higher the level of the peppers in the diet, the higher the yolk content of carotene and vitamin A. A comparison of the results in tables 4 and 5 with an earlier study by Ogunmodede and Wogar (1971) showed that dried peppers stimulate higher deposition of carotene and vitamin A in the egg yolk than either Cynodon Plectostachyum or Adansonia digitata.

Table 6. Vitamin A Content of Egg Yolk
(Ugms/gm)

No of Weeks on diet	Control	Capsicum annum 2%	4%	6%	Capsicum frutescens 2%	4%	6%
6	0.70e	1.80c	2.82b	3.35a	1.12d	1.76c	2.60b
8	0.70e	2.00c	2.70b	3.40a	1.44d	2.00c	3.00a
10	0.82d	1.66c	2.74a	3.11a	1.54c	2.00b	2.86a
12	1.00f	2.02c	2.72b	3.24a	1.24e	1.64d	2.94b
14	0.96d	1.79b	2.96a	3.26a	1.35c	1.98b	2.98a
16	1.02e	1.84c	2.88b	3.26a	1.47d	1.99c	2.89b

a, b, c means not underscored by the same letters in the same horizontal columns are significantly different from one another.

Vitamin A and Egg Colour in Relation to Dietary Pepper Levels.

The egg yolk colour in greatest demand is golden yellow and colours of yolk for the different treatments are shown in Table 7. The pattern of egg yolk colouration corresponded with those for carotene and vitamin A deposition as 6% annum produced the highest colouration; nevertheless, the colours produced 6% frutesence were not statistically different from those for 6% annum. In reality, corresponding levels of the two peppers produced similar colours in the egg yolk.

Table 7. Mean Yolk Colour Rating on Heimann-Carver Rotor

Weeks	Control	C. annum			C. Frutescens		
		2%	4%	6%	2%	4%	6%
6	7e	14c	17b	21a	10d	16b	19a,b
8	7e	14c	18b	22a	11d	18b	20a,b
10	8d	14c	18b	22a	12c	17b	20a,b
12	8d	15c	19b	21a	13c	18c	20a,b
14	7d	16b	18b	22a	11c	18b	19b
16	9d	14c	18b	22a	12c	17b	20a,b

This observation can be explained as Goodwin (1954) established that under normal conditions, Xanthophylls contribute about 70% of the total yolk colour while Carlson and his co-workers (1961) found that carotene contributes only 2% of the yolk colour. In this study, emphasis was laid on the carotene and vitamin A as these have nutritive values while the colouration of the egg yolk by Xanthophyll is important in

acceptability of the product by consumers. Carlson and his co-workers (1961) observed that a Heinmann - Carver rotor scale of about 18 is the level accepted by most consumers that prefer dark-yolked eggs. Our results show that 4% or 6% level of either peppers would produce this colour in the yolk. In effect, when egg yolk colour is the only reason for including the peppers in rations for the laying hens, either of the peppers at 4 or 6% would suffice. If the contribution of egg yolk to vitamin A intake by Consumers as well as deposition in the liver of the chicks are considered in addition to the yolk colour, then Capsicum annum should be preferred to Capsicum frutescence.

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