Sugar as an energy source for growing ducklings

M.D. Olver
Animal and Dairy Science Research Institute, Private Bag X2, Irene 1675, Republic of South Africa

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An experiment was conducted to determine whether sugar could successfully be incorporated into feeds for ducklings in the period 0 to 7 weeks of age. Five dietary treatments, with sugar content ranging from 0 to 400 g kg^{-1} were fed to 400 ducklings, sexes separate, of the Cherry Valley strain. There were four replications of each treatment. The results showed no deleterious effects ($P \leq 0,05$) of sugar on live mass gain, feed conversion efficiency or carcass composition over the entire range of levels of inclusion.

'n Proef is uitgevoer om die voedingswaarde van suiker vir eendjies tot op sewe-weke-ouderdom te bepaal. Vyf proefdiëte met 'n suikerinhoud wat wissel van 0 tot 400 g kg^{-1} is aan 400 Cherry Valley-eendjies (200 dagoud-mannetjies en 200 dagoud-wyfies) gevoer. Daar was vier herhalings van elke behandeling. Die resultate het aangetoon dat insluiting van soveel as 400 g kg^{-1} suiker in die dieet geen nadelige effekte ($P \leq 0,05$) op liggaams-massa, voerdoeltreffendheid of karkassamestelling van eendjies tot op 'n ouderdom van sewe weke gehad het nie.

Keywords: Carcass composition, ducklings, feed efficiency, live mass, sugar.

Introduction

South Africa produces about two million tons of sugar annually. The local market absorbs almost 1,2 million tons while the balance is exported at a loss. Unrefined sugar is locally available at R318 per metric ton. Based on least-cost diets, this product has an economic advantage over maize up to a price for sugar of R410 per metric ton. Sugar is, however, essentially an energy feed as it contains no nitrogenous matter or minerals. The energy value of sugar is 15,5 MJ AME kg^{-1} compared with 14,3 MJ AME kg^{-1} for maize (determined at this Institute, using the method of McNab & Fisher, 1984). Since chickens possess an enzyme which digests sugar (invertase) there is no reason why sugar should not be used as a source of energy in broiler diets (Sturkie, 1965). Indeed, several workers have found that sugar can successfully be fed to growing chickens (Palafox & Rosenburg, 1954; Splittgerber & Gysae, 1963; Fromageot, 1965). The amount of sugar used in diets for chickens will depend on its cost relative to maize and other sources of energy, but it is likely that the use of sugar in poultry diets in the developed world will be limited to those periods of time when the world price of sugar falls below that of the available energy sources.

This study was undertaken to investigate the maximum practical level of unrefined sugar that can be fed in starter and finisher duckling diets. Unrefined brown sugar containing at least 97,5% sucrose, sold under the trade name of Golden Brown sugar and produced by Illovo Sugar Company, Umzimkulu, was used in this study.

Materials and Methods

Two isocaloric, isonitrogenous starter and finisher diets were formulated with one containing no sugar and the other 400 g kg^{-1} sugar. The diets were then appropriately blended to produce five experimental diets containing 0, 100, 200, 300 and 400 g kg^{-1} sugar. The compositions of the two basal diets used in the starter (0—3 weeks) and in the finisher (4—7 weeks) periods are shown in Table 1.

Day-old Pekin ducklings, 200 male and 200 female, of the Cherry Valley strain were used in this experiment. Ten ducklings were housed per pen and each dietary treatment was applied to four pens containing male and four pens containing female ducklings. Treatments were randomly allocated to the different pens. The ducklings were reared in electrically heated battery brooders in the first three weeks and in unheated finishing batteries for the next four weeks.

The experiment was terminated when the ducklings were seven weeks of age. Three female ducklings from each treatment were killed and dressing percentage, moisture, fat and protein content for each oven-ready carcass (giblets excluded) determined using standard (AOAC, 1980) methods.

Data in all trials were subjected to regression analysis as outlined by Rayner (1967).

Results and Discussion

The average masses and feed conversion efficiencies of the male and female ducklings on the five experimental diets are shown in Table 2.

At three weeks of age there were no significant differences in live mass or feed conversion efficiency, nor were regression trends evident in male or female ducklings fed any of the starter diets.

The mean masses of seven-week old male and female ducklings and mean feed conversion efficiencies are shown in Table 3.

As with live masses at three weeks and feed conversion efficiencies, no significant differences were observed between treatments at seven weeks of age. Sugar may, therefore, constitute up to 40% of the diet without reducing live mass or efficiency of feed conversion.

The carcass composition data are shown in Table 4.

Female ducklings were used for the carcass analyses since they generally contain more fat than their male counterparts at the same age. There were no treatment

Table 1 Composition (g kg^{-1}) of basal feeds used in this study

Ingredients	Starter diet: No sugar	Starter diet: 400 g sugar kg^{-1}	Finisher diet: No sugar	Finisher diet: 400 g sugar kg^{-1}
Yellow maize meal	647	209	693	242,9
Sugar	–	400	–	400
Fish meal	198	257	79	114
Full fat soybean meal	79	24	–	–
Sunflower oilcake meal	64	68	96	90
Groundnut oilcake meal	10	40	23	124
Carcass meal	–	–	80	27
Wheaten bran	–	–	26	–
Synthetic lysine	–	–	1	–
Synthetic methionine	–	–	–	0,1
Vitamin & mineral pre-mix	2	2	2	2
Calculated analysis				
Protein	240	240	200	200
Fat	61	42	49	31
Fibre	36	28	45	42
Calcium	10	10	9	9
Phosphorus (total)	9	9	8	8
Methionine	5,6	5,7	3,8	3,8
Lysine	14,0	15,3	10,0	10,0
Arginine	14,4	14,4	13,0	15,0
Tryptophan	2,8	2,8	2,0	2,0
Isoleucine	10,8	10,4	8,0	8,0
Leucine	19,0	18,9	16,0	16,0
Valine	12,5	12,5	10,0	11,0
Metabolizable energy (MJ kg^{-1})	13,4	13,4	13,0	13,0

Table 2 Mean three week live mass and feed conversion efficiency (FCE, g gain per g feed) of male and female ducklings (± SD)

Sugar conc. in feed (g kg^{-1})	Males: Mass (g)	Males: FCE	Females: Mass (g)	Females: FCE
0	998 ± 58	0,50 ± 0,01	906 ± 14	0,48 ± 0,01
100	978 ± 38	0,49 ± 0,01	890 ± 43	0,47 ± 0,01
200	1000 ± 50	0,49 ± 0,01	883 ± 33	0,48 ± 0,01
300	979 ± 52	0,49 ± 0,01	904 ± 39	0,47 ± 0,01
400	1008 ± 61	0,50 ± 0,01	880 ± 42	0,47 ± 0,01
Linear effect (± SE)	0,213 ± 0,781	–0,0000 ± 0,0001	–0,362 ± 0,465	–0,0001 ± 0,0002
Quadratic effect (± SE)	0,039 ± 0,067	0,00001 ± 0,00001	0,006 ± 0,048	–0,00001 ± 0,00001

Table 3 Mean seven week live mass and feed conversion efficiency (FCE, g gain per g feed) of male and female ducklings (± SD)

Sugar conc. in feed (g kg^{-1})	Males: Mass (g)	Males: FCE	Females: Mass (g)	Females: FCE
0	2934 ± 124	0,37 ± 0,02	2739 ± 107	0,34 ± 0,02
100	2948 ± 143	0,36 ± 0,02	2764 ± 92	0,33 ± 0,02
200	3009 ± 102	0,36 ± 0,02	2737 ± 107	0,33 ± 0,02
300	2955 ± 114	0,37 ± 0,02	2738 ± 77	0,34 ± 0,02
400	2977 ± 147	0,36 ± 0,01	2762 ± 115	0,33 ± 0,01
Linear effect (± SE)	0,930 ± 1,878	–0,00013 ± 0,00026	0,213 ± 1,466	–0,0001 ± 0,0002
Quadratic effect (± SE)	–0,071 ± 0,162	–0,00001 ± 0,00002	0,018 ± 0,127	0,0000 ± 0,00002

Table 4 Mean dressing percentage, moisture content, fat content and protein content of female ducklings at seven weeks of age (± SD)

Sugar conc. in feed (g kg^{-1})	Dressing percentage	Moisture (g kg^{-1})	Fat (g kg^{-1})	Protein (g kg^{-1})
0	70,0 ± 0,6	598,3 ± 17,0	223,7 ± 17,1	141,3 ± 1,5
100	70,9 ± 1,4	599,7 ± 20,2	225,7 ± 21,2	138,3 ± 8,1
200	70,3 ± 2,1	596,0 ± 26,0	227,0 ± 26,7	140,3 ± 6,5
300	70,5 ± 3,9	603,7 ± 36,6	222,0 ± 29,5	138,7 ± 8,1
400	70,7 ± 1,7	600,7 ± 16,2	221,7 ± 17,8	141,3 ± 4,5
Linear effect (± SE)	0,008 ±0,035	0,0087±0,039	–0,0077±0,037	0,0003±0,010
Quadratic effect (± SE)	–0,0002±0,003	0,0002±0,003	–0,0008±0,003	0,006 ±0,001

differences with regard to dressed yield, moisture, fat or protein content in female ducklings at seven weeks of age. Linear and quadratic trends in responses to increasing concentrations of sugar in the diet were in all cases non-significant. Sugar may, therefore, be used to replace as much maize in a duckling feed as economically viable in a least-cost diet.

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