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INFLUENCE OF DIETARY LACTOSE AND DRIED WHEY ON PERFORMANCE, INTESTINAL MICROBIOLOGY, VILLI HEIGHT AND SOME BLOOD CONSTITUENTS IN BROILER CHICKS

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ABSTRACT

An experiment was conducted to study the effect of lactose and dried whey on performance of broiler chicks, some blood constituents, intestinal microflora and intestinal villi length.

Three hundred day old Ross broiler chicks were allocated into five groups of 60 birds each. For 5 weeks, four groups of birds were fed on a basal diet supplemented with 1 and 2% lactose or 1.5 and 3% dried whey while the fifth group was control.

Body weight gain of chicks at 5 week of age were increased by adding lactose or whey into diets, furthermore the increments were significant at high level of lactose (2%) or whey (3%). Feed conversion ratios (g. feed/g. gain) of chicks fed dietary whey or lactose were better than control at 5 week of age.

Microbiological examination of ileal contents showed that addition of lactose or dried whey cause a huge increase in lactobacilli bacteria was detected. As well, a reduction in total Aerobic, E. coli and Enterococcus bacteria. Dried whey was less effective than pure lactose in stimulating Lactobacilli bacteria.

Ileal villi were higher in birds fed dietary lactose or whey than control. There is no significant effect of lactose or whey on weight of liver or immunity organs. As well as, blood total protein, albumin, or globulin were not affected. The result of immune organs and globulin may indicate to the lack effect of lactose or whey on immune function. Blood cholesterol and total lipids were not influenced by treatments.

It can be suggested that, the improvement effect of lactose and whey on performance of broiler chicks, may be related to their role in stimulating the proliferation of lactobacilli bacteria which excluding intestinal pathogens that may cause malabsorption and health disorders.

As well, feeding lactose and dried whey cause an increase in intestinal villi height which enhances nutrients absorption and utilization. The effectiveness of dried whey in promoting the growth of broiler is similar to lactose, therefore; dried whey may be used as alternative prebiotics for lactose.

Keywords: Lactose-Dried whey-Broiler performance-Ileal microflora-Villi length-Blood constituents.

INTRODUCTION

Recently use of antibiotics as growth promoters have been banned and the researches are intensified to find the alternatives. Use of prebiotics or undigested fermentable sugars instead of antibiotics are going to be popular in poultry in order to increase the useful microbial population of gastrointestinal tract (Van Immerseel, 2002). Lactose sugar is well documented as a prebiotic (Van Immerseel, 2002), since poultry are lacking lactase enzyme (Harms *et al.*, 1977). Therefore, lactose cannot be digested or absorbed efficiently and almost reaches lower intestine intact (Ziggers 2000).

In the lower intestine, lactose can be utilized preferentially by lactobacilli and bifidobacterial species, increasing their proliferation (Naughton *et al.*, 2001). This leads to increase production of lactic acid and short-chain fatty acids, creating unsuitable environment for the activity and proliferation of pathogens like salmonella and E. coli which suffer from the low pH media (Juven *et al.*,., 1991). Based on competitive exclusion concept, pathogens will be expelled out of the gut by useful bacteria which already occupied the gut sites (Nurmi and Rantal, 1973). Excluding of harmful bacterial strains making an appropriate media for digestion and absorption consequently, improve the efficiency of feed utilization (Tellez *et al.*,., 1993; Pelicano *et al.*, 2005) therefore, addition of lactose into diets can increase body weight gain and efficiency of feed utilization (Terada *et al.*, 1994 and Nurettin Gul *et al.*, 2002).

Dried whey is natural and rich source of lactose which represents about two third of whey weight (Zadow and Csiro 1984). A few studies were conducted to validate the effect of whey on broiler performance. Potter and Shelton (1976) stated that, dried whey contains factors which increase body weight gain of young turkeys. Kermanshahi and Rostami (2006) observed an improve in body weight gain and feed to gain ratio due to adding dried whey into broiler diets. Furthermore, Deloach *et al.*, (1990) reported that, whey or non fat dried milk offers alternatives to the use of pure lactose in lowering salmonella typhimurium numbers in young broiler chicks.

However, the researches with whey are still lacking especially under Egyptian conditions. Therefore, this study aimed to investigate the effect of lactose and whey on performance of broiler chicks, some blood constituents and some intestinal microflora, as well as the effect on intestinal villi length will be included.

MATERIALS AND METHODS

This study was carried out in Broiler Nutrition Unit, Fac. of Agric., Ain –Shams Univ.

Three hundred day old Ross broiler chicks were used in this experiment. The birds were allocated randomly into five groups of 60 birds which were divided into three replicates with 20 birds each.

Basal diets were formulated (Table 1) to meet the nutrients requirements of broiler chicks during the starter (0-21 day) and grower (22-35 day) periods according to NRC (1994). Four groups of birds were fed on the basal diet supplemented with two constant levels of lactose sugar (1, 2%) from two sources, pure lactose and dried whey which contain 65% lactose. Therefore the five groups of experimental birds were fed on a basal diet supplemented with 1% and 2% lactose or 1.5% and 3% dried whey, while the fifth group was control. Because of dried whey contains 13% protein (NRC, 1994) the added soy bean meal was slightly modified in whey diets to keep the protein ratio constant as the basal diet (Table 1). Water and mash feed were provided ad lib.

The chicks were placed in flour pens with wood-shaving litter. Electrical heaters were used for warming. Artificial lighting was providing constantly.

Table (1): Composition and calculated analysis of experimental basal diets

Ingredients	Starter (0-3 wks)	Grower (3-5 wks)
Yellow corn	54.50	60.20
Soybean meal (44%)*	31.15	31.50
Corn gluten meal	7.00	2.00
Vegetable oil	3.50	3.00
Bone meal	3.00	2.70
Common salt	0.25	0.25
Vit. & min. premix**	0.30	0.30
DL. Methionine	0.20	0.05
Lysine	0.10	---
Total	100	100
Calculated composition		
Crude protein%	22.54	20.18
M.E. Kcal/kg	30.80	30.45
% Calcium	0.995	0.908
Available phosphorus	0.51	0.48
Methionine + cystein	0.976	0.721
Lysine	1.15	1.02

***soy bean meal ratios were deducted by 0.44% and 0.88% in the diets containing 1.5% and 3% dried whey respectively that to keep dietary protein ratio constant in all rations because of dried whey contains 13% protein (NRC 1994)**

****Composition of vitamin and minerals premix. Each 3 kg of vitamin and minerals mixture contain: 12000000 IU vitamin A; 2000000 IU D3; 10g E ; 1g K ; 1 g B1 ; 5g B2; 1500mg B6 ; 10mg B12 ;10g Pantothenic acid ; 20g Nicotinic acid ; 1g Folic acid 50mg Biotin ; 500 g choline chloride ;4 g copper ; 300 mg iodine ; 30g iron ; 60 g Manganese; 50g Zinc; and 100mg selenium**

Body weights were recorded weekly for each chick and the average was calculated for each replicate and treatment group. Feed consumption values were recorded weekly in gram, and feed conversion ratio was calculated as gram feed /gram gain. The experimental period was divided into two stages as 0-3 week and 0-5 week of age.

Blood analysis and microbiological, histological examination:

At the end of the experiment nine chicks per treatment group were slaughtered, blood samples were collected and centrifuged for (4000 rpm) 15 minutes.

Plasma total protein was determined according to Biuret method (Henery, 1964), albumin according to Doumas *et al.*, (1971). Plasma globulin was calculated by subtracting albumin from total protein, then albumin to globulin ratio was calculated. Plasma total lipid was determined according to Knight *et al.*, (1972) and total cholesterol according to Watson (1960).

For microbial examination, ileal content samples were collected by pressing the outer wall of ileum to push its content into clean sterile glass bottle.

Microbiological examination procedure was done as follows:

One gram of ileal content was adjustely weighed and transferred into test tube containing 9ml of 0.1sterile peptone. The samples were mixed well and serial dilutions were prepared.

Cultivation and enumeration of bacteria:

Total aerobic bacteria was examined with nutrient agar medium composed of (per liter) yeast extract 2.5g; trypton 5g, glucose 1g, agar 15g and distilled water up to one liter.

Lactobacilli bacteria was counted with M.R.S. agar medium which is composed of casein peptone 10g, meat extract 10g, yeast extract 5g, glucose 20g, tween80 1g, K_2mpo_4 2g, sodium acetate 5g, diammonium citrate 2g., $Mnso_4$ 0.2g and distilled water up to 1 liter.
E. coli bacteria was counted by using MacChonkey agar medium that is composed as pancreatic digest as gelatin 17g. pancreatic digest of casein 1.5g., peptic of animal tissue 1.5g., lactose 10g., bile salts 1.5g., sodium chlorides 5g., neutral red 0.03g., crystal violet 0.001g., agar 3.5g., and distilled water up to 1 liter.
Enterococcus bacteria was counted with MacChonkey agar No.2 medium that is composed of (peptone, 20g., lactose 10g., bile salt 5g., sodium chloride 5.0g., neutral red 0.075g and agar, 12g. per liter).
Salmonella bacterial count was detected in S. S. agar.

Histological examination

Histological examination was done by using small pieces (2.5cm) from the same area of ileum for three slaughtered birds per treatment. The ileum samples were placed in 10% buffered neutral formalin for fixation.
A microtome was used to make 5µ sections that were mounted in glass slides and stained with hematoxylin and eosin. Villi height was measured from the apical to the basal region which corresponded to the superior portion of the crypts of lieberkuhn by using light microscope and micrometer slide.

Statistical analysis*:*

Statistical analysis was carried out using statistical program SAS (1988). Duncan's multiple range tests was used to separate means.

RESULTS AND DISSCUSION

Performance characteristics

Average body weight gains (Table 2) for the entire experimental period (0-5 week) were increased either by adding lactose or dried whey into diets. Furthermore these increments were significant at high level of lactose (2%) or whey (3%). However at 3 week of age the growth promoting effect of lactose and whey were not clear.

Similar results were recorded by Kermanshahi and Rostami (2006) who reported that dried whey had no effect on body weight gain of broilers at 0-21 days of age but was significant at 21-42 days of age. Nurettin Gul *et al.*, (2002) stated that body weight gain was greater for broilers supplemented with lactose (2.5%) or dried whey (3.85%) than for those not supplemented.
It is clear that the effectiveness of dried whey in promoting the growth of broiler chicks was approximately equal to these of lactose. This suggestion is in harmony with the finding of Deloach *et al.*, (1990) that, dried whey can offer alternative to the use of lactose in broiler diets.

In this respect, the growth promoting effect of dried whey have been established early and attributed to its content of unidentified growth factor (Al-Ubaidi and Bird 1964; Potter and Shelton 1976). Recently, the research workers attributed the beneficial effect of supplemental whey to its high content of lactose (more than 60%) which inhibit intestinal pathogens and stimulate the proliferation of beneficial bacteria (Naughton *et al.*, 2001) those

have several health-related effects such as immune enhancement. (Roberfroid, 2000)

There were a reduction in feed consumption values (Table 2) of chicks fed dietary lactose or dried whey either at 3 or at 5 week of age with the exception of chicks fed 3% whey that recorded higher feed intake than control at 5 week of age only. These results are in harmony with those obtained by Waldroup *et al.*, (1992) who observed a reduction in feed intake due to adding lactose into diets, while Nurettin Gul *et al.*, (2002) did not find any effect on feed intake of broiler chicks fed diets supplemented with lactose or whey.

Feed conversion ratio (g feed/ g gain) at 3 week of age recorded a non significant improvement due to adding lactose or whey into diets with the exception of 1% supplemental lactose. For the entire experimental period feed conversion ratio of treated groups were better than control group, furthermore addition of lactose by 1, 2% were significantly higher. These results are in harmony with those of Kermanshi and Rostami (2006) who stated that dried whey addition significantly improved the overall feed to gain ratio. As well, Terada *et al.*, (1994) observed an improvement in feed efficiency of broiler chicks fed dietary lactose sucrose.

On the other hand, the current results disagree with those of Nurettin Gul *et al.*, (2002) who did not observe any effect on feed efficiency of broiler chicks fed diets supplemented with whey or lactose. This disagreement may be related to use of higher levels of lactose (2.5%) and whey (3.85%) compared with 2%level of lactose and 3% whey which were employed in the current experiment. Gleaves and Salim (1982) reported that, less than 2% lactose level is needed to demonstrate its beneficial effect.

Table (2) Effect of dietary lactose and dried whey on performance of broiler chicks

Treats	Control	Lactose 1%	Lactose 2%	Whey 1.5%	Whey 3%
Body Wt. (g) (0-3Week)	704.6^{a} ±15.25	632.45^{b} ±20.76	683.55^{ab} ±17.02	711.78^{a} ±19.85	635.57^{b} ±18.67
Body Wt. (g) (0-5Week)	1405.54^{b} ±31.59	1470.43^{ab} ±52.65	1559.52^{a} ±36.39	1472.35^{ab} ±48.90	1560^{a} ±38.25
Feed Consumption (g/chick/period) (0-3Wk)	1169.64^{a} ±12.37	1106.79^{a} ±42.27	1052.67^{ab} ±48.97	1138.85^{a} ±27.85	972.42^{b} ±40.76
Feed Consumption (g/chick/period) (0-5Wk)	2965.69^{b} ±45.59	2823.23^{c} ±45.15	2869.52^{bc} ±18.65	2929.98^{b} ±20.89	3198^{a} ±30.29
Feed conversion (g. feed/g. wt.)(0-3Week)	1.66^{ab} ±0.048	1.74^{a} ±0.047	1.54^{b} ±0.065	1.60^{ab} ±0.066	1.53^{b} ±0.056
Feed conversion (g. feed/g. wt.)(0-5Week)	2.11^{a} ±0.057	1.92^{bc} ±0.019	1.84^{c} ±0.022	1.99^{ab} ±0.044	2.05^{a} ±0.049

a-b within rows, means with no common superscripts differ significantly ($p \geq 0.05$)

The improvement effect of lactose and whey on broiler performance may be related to their roles in excluding intestinal pathogens and stimulating lactobacilli bacteria that increase intestinal villi length (see Table 4) and enhance the absorption of dietary nutrients (Miles *et al.*, 1981). In addition, to the effect of whey and lactose in reducing gut pH which slow passage rate of

chyme allowing more time for absorption and enhance the activity of proteolytic enzymes (Burnell *et al.*, 1988). This leads to increase the digestibility and retention of nutrients by adding lactose or whey into diets (Balloun and Khajarern, 1974).

Ileal bacteria

Total number of Aerobic bacteria (Table 3) was decreased significantly due to enriching lactose and dried whey into broiler diets. This result is well accepted because of the huge increase in number of Lactobacilli bacteria which occupy the most of colonization sites on intestinal epithelium preventing other bacteria from attaching to the epithelium effectively blocking all receptor sites that are necessary for growth and proliferation of bacteria (Edens 2003).

There was a huge increase in Lactobacilli bacteria by supplementing broiler diets with lactose sugar or dried whey. These results are in a good agreement with those of El-Afifi *et al.*, (2007) who observed an increase in ileal Lactobacilli bacteria of layers fed dietary lactose.

Table (3) Effect of dietary lactose and dried whey on ileal bacterial strains of broiler chicks

Treats	Control	Lactose 1%	Lactose 2%	Whey 1.5%	Whey 3%
Lactobacilli (colonies/g.)	5.1×10^3 $\pm9.76^{c}$	24.67×10^3 $\pm64.58^{ab}$	28.18×10^3 $\pm52.92^{a}$	19.73×10^3 $\pm32.75^{ab}$	12.92×10^3 $\pm30.30^{bc}$
Enterococcus (colonies/g.)	4.2×10^3 $\pm15.88^{a}$	0.8×10^3 $\pm2.09^{b}$	1.32×10^3 $\pm3.45^{b}$	1.87×10^3 $\pm4.78^{b}$	0.97×10^3 $\pm1.54^{b}$
Total aerobic bacteria(colonies/g.)	20.9×10^3 $\pm36.32^{a}$	6.43×10^3 $\pm14.10^{b}$	3.75×10^3 $\pm5.04^{b}$	4.5×10^3 $\pm7.53^{b}$	3.38×10^3 $\pm5.92^{b}$
E. coli (colonies/g.)	4.8×10^3 $\pm11.7^{a}$	1.75×10^3 $\pm1.95^{b}$	3.12×10^3 $\pm7.31^{ab}$	2.77×10^3 $\pm3.2^{ab}$	1.78×10^3 $\pm6.69^{b}$
Salmonella	N. d	N. d	N. d	N. d	N. d

a-b within rows, means with no common superscripts differ significantly ($p\geq0.05$)
N. d = non detected

The increment in Lactobacilli bacteria is an expected propositional result, since lactose and whey are the preferential primary substrate (carbon source) of Lactobacilli bacteria which converting lactose to primarily acetic, propionic and lactic acid (Naughton *et al.*, 2001). In addition, the volatile fatty acids produced, creating a slight acidic media which are favorable for growth and proliferation of Lactobacilli bacteria (Waldroup *et al.*, 1995).

Dried whey was less effective than pure lactose in enhancement of Lactobacilli bacteria. Deloach *et al.*, (1990) showed that dried whey is less effective than lactose in modifying intestinal bacteria.

Enterococcus bacteria decreased significantly by adding lactose or whey into broiler diets. This reduction in Enterococcus bacteria may be related to the high number of Lactobacilli bacteria. Neeser *et al.*, (2000) demonstrated that, Lactobacilli bacteria had two major carbohydrate-binding specificities which similar to those known to be expressed on several Enterobacteria thus Lactobacilli inhibit its proliferation.

E. coli bacteria was reduced significantly as a result of feeding lactose or whey. Morishita *et al.*, (1982) stated that, when lactose was

incorporated into conventional diets, it decreases the count of E. coli. In spite of lactose can be utilized and fermented by E. coli bacteria (Kermanshahi and Rostami 2006,) its number decrease by lactose and whey addition. That may be related to the stimulating effect of lactose on Lactobacilli bacteria. E. coli bacteria may suffer from high count of bacilli by two manners; occupy colonization sites and secretion of volatile fatty acids which inhibit the growth of E. coli bacteria (Nemcova, 1997).

Intestinal villi height (µ)

Villi height (µ) of ileal sections are shown in Table (4) and Fig. (1). It is clear that ileal villi were higher in birds fed diets supplemented with lactose or whey than control. Furthermore, the differences were significant with feeding whey. Moreover, there were great variation in the size and number of the crypts of lieberkuhn associated with the supplemental whey and lactose (2% level). The crypts fluids are rapidly absorbed from the villi lumens, making a circulation form crypts to villi, and this supplies a watery vehicle for the absorption, elaboration and production of antibodies and lymphocytes along with an increase in goblet cells which secrets substances responsible for reducing pH of the intestinal lumen (Fig. 1). This result is in a good agreement with those of Nurettin Gul *et al.*, (2002) who reported that, the length of intestinal villi of broiler chicks fed lactose or dried whey were greater than for control group.

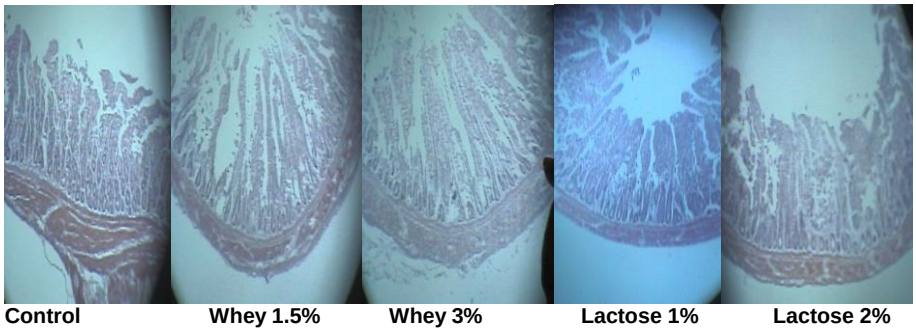
The positive effect of prebiotics on villi height was elucidated by Pelicano *et al.*, (2005) who stated that, when prebiotics are added to the diet, they are fermented and the growth and stability of specific bacterial populations that produce organic acids are stimulated. Therefore, the lumen pH decreases and together with antibacterial substances of the same microbiotic, inhibits pathogenic microorganisms that are sensitive to acid pH, consequently reducing colonization of pathogenic bacteria, and causing an increase in the absorption of available nutrients. This mechanism directly affects the recovery of the intestinal mucosa, increasing villi height.

Table (4) Effect of dietary lactose and dried whey on villi height and some immune organs of broiler chicks

Treats	Control	Lactose 1%	Lactose 2%	Whey 1.5%	Whey 3%
Villi Height (µm)	713.73^{b} ±26.25	875.35^{ab} ±27.20	800.96^{ab}± 49.37	964.64^{a}±8 1.34	954.80^{a} ±86.60
% Liver	3.58 ±0.43	3.54 ±0.40	3.08 ±0.24	3.37 ±0.24	2.88 ±0.10
%Spleen	0.16 ±0.011	0.23 ±0.035	0.123 ±0.02	0.22 ±0.076	0.13 ±0.029
%Thymus	0.80 ±0.17	0.72 ±0.074	0.56 ±0.02	0.82 ±0.186	0.61 ±0.063
%Bursa	0.17 ±0.02	0.24 ±0.052	0.197 ±0.028	0.197 ±0.052	0.21 ±0.038

a-b within rows, means with no common superscripts differ significantly (p≥0.05)

The increment in villi length may introduce another explanation for the improvement in efficiency of feed utilization which was recorded in the current study, because of intestinal villi are responsible for extracting nutrients from feed stuffs during digestion (Miles *et al.*, 1981).



Control **Whey 1.5%** **Whey 3%** **Lactose 1%** **Lactose 2%**

Fig. (1) T. s. in the ileum of control and treated chicks, showing the crypts of lieberkuhn (cr) and ileal villi

Liver and immunity organs.

Liver weight percentages were not affected significantly by treatments. As well, there is no effect of dietary lactose or whey on immune organs spleen, thymus, and bursa. This result is in harmony with Nurettin Gul *et al.*, (2002) who did not show any effect of lactose or whey on lymphoid organs.

Effect on some blood constituents

Addition of lactose or dried whey into broiler diets did not affect total protein values. This result disagree with those obtained by El-Afifi *et al.*, (2007) who observed a reduction in blood total protein of laying hens fed dietary lactose. This disagreement may be related to differences in type and age of birds in the two experiments.

Neither albumin nor globulin was affected significantly by adding lactose or whey into diets. Because of the level of blood globulin may be used as immune indicator, in addition to the lack effect on immune organs (Table5). Therefore it can be suggested that supplementation of lactose or whey into broiler diets have no effect on immune function. El-Afifi *et al.*, (2007) did not find any effect of lactose on blood albumin or globulin or albumin to globulin ratio.

There is no effect on blood total lipids or cholesterol due to adding lactose or whey into broiler diets. El-Afifi *et al.*, (2007) reported that, blood total lipids of layers increased due to feeding dietary lactose which have no effect on blood cholesterol levels.

Table (5) ;Effect of dietary lactose and dried whey on some blood constitutes of broiler chicks

Treats	Control	Lactose 1%	Lactose 2%	Whey 1.5%	Whey 3%
Total protein (g/dl)	3.58±0.427	3.63±0.346	3.78±0.266	3.26±0.283	3.82±0.195
Albumin (g/dl)	1.76±0.206	1.84±0.087	1.91±0.095	1.49±0.178	1.78±0.055
globulin (g/dl)	1.82±0.512	1.79±0.208	1.87±0.093	1.77±0.073	2.04±0.062
Total lipids (g/dl)	4.20±0.115	3.96±0.186	3.75±0.117	3.86±0.161	4.11±0.209
cholesterol(mg/dl)	150±10.24	132±18.54	143±6.30	160±8.44	127±15.41

Non significant differences ($p \leq 0.05$) among means.

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تـأثير اللاكتـوز والشـرش المجفـف بعلائـق كتاكيـت اللحـم علـي الأداء الإنتـاجي وميكروبات الأمعاء وطول الخملات وبعض مكونات الدم

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أجريت هذه الدراسة لمعرفة تأثير إضافة اللاكتوز والشرش المجفف على الأداء الإنتاجي لكتاكيت اللحم وبعض السلالات الميكروبية بالأمعاء وطول الخملات وبعض مكونات الدم.
استخدمت الدراسة عدد ٣٠٠ كتكوت روس عمر يوم والتي قسمت إلى ٥ معاملات من ٦٠ كتكوت لكل معاملة.

تم تغذية الكتاكيت لمدة خمسة أسابيع على علائق تحتوي على مستويين من اللاكتوز ١ و ٢% ومستويين من الشرش المجفف ١,٥ و ٣% وكانت العليقة الخامسة كنترول خالية من أي إضافات. وأشارت النتائج إلى تحسن وزن الجسم للكتاكيت على عمر ٥ أسابيع من العمر نتيجة التغذية على العلائق المحتوية على الشرش واللاكتوز وكانت الفروق في وزن الجسم معنوية للمستويات العالية من اللاكتوز والشرش (٢%) والشرش (٣%). كذلك فإن معدل التحويل الغذائي (جم غذاء/جم وزن جسم مكتسب) كان أفضل عند إضافة الشرش واللاكتوز لعلائق الكتاكيت.
أشارت نتائج الفحص البكتيري لمحتويات الأمعاء إلى زيادة كبيرة في عدد بكتيريا اللاكتوباسلاى ونقص في كل من أعداد بكتيريا E. coli و Enterococcus وكذلك العدد الكلي للبكتيريا الهوائية.

طول الخملات بالأمعاء كان أعلي نتيجة لإضافة اللاكتوز والشرش للعلائق ولم يكن هناك تأثير معنوي على وزن الكبد أو الأعضاء المناعية؛ كذلك لم يتغير مستوى الالبيومين أو الجلوبيولين بالدم، كذلك لم تتأثر الليبيدات الكلية أو الكوليستيرول.

وقد أشارت الدراسة إلى أن إضافة الشرش واللاكتوز للعلائق له تأثير جيد على الأداء الإنتاجي لكتاكيت اللحم نتيجة لتأثيرهما المنشط لبكتيريا اللاكتوباسلاى النافعة والتي تناحي وتثبط البكتيريا الضارة بالأمعاء وتلك التي تسبب بعض التأثيرات الضارة على صحة الطيور وعلى امتصاص العناصر الغذائية بالعليقة. بالإضافة إلى تأثير اللاكتوز والشرش المسبب لاستطالة خملات الأمعاء والذي يسبب زيادة كفاءة امتصاص العناصر الغذائية العليقة.
كذلك أوضحت الدراسة أن الشرش المجفف له نفس كفاءة اللاكتوز في تحسين نمو كتاكيت اللحم ويمكن استخدامه كبديل له في العلائق.