

Effect Of Inclusion Of Dried Tomato Pomace With And Without Roxazyme Supplementation On Performance Of Broiler Chickens

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ABSTRACT

The present study was conducted to study the effects of substituting corn by 5 or 10% dried tomato pomace (DTP) with and without multienzymes supplementation. A total of 75 broiler chicks were allotted into five groups (15 birds/ group) with 3 replicates of 5 birds in each, they were fed on isocaloric and isonitrogenous diets for 6 weeks and the feeding period was divided into 2 stages: Starter stage (0-21day) in which the birds were fed on diet contained CP 23.1% and ME 3024 kcal/kg diet. Grower-finisher stage (22-42) day in which the bird fed diet contained CP 19.2% and ME 3200 kcal/kg diet. Group 1: Fed on basal control diet without any substitution. Group 2,3: fed on a diet contained 5% and 10% dried tomato pomace with multienzymes supplementation . Group 4, 5: fed on a diet contained 5% and 10% dried tomato pomace without multienzymes supplementation. The results revealed that substitution of corn by 5 and 10% DTP had significant increase in average body weight and gain all over the experiment period. However the groups fed diet contained DTP with enzymes showed better live body weight than that fed diet contained DTP without enzymes. There was significant decrease in feed conversion between control group and the birds fed diet contained 5% and 10% DTP with enzymes. Also results showed significant decrease in serum total cholesterol, triglycerides, HDL-C and LDL levels in groups supplemented with DTP. There was no significant difference in dressing%, between control group and other groups while abdominal fat % was significantly decreased in groups supplemented with DTP. Inclusion of dried tomato pomace led to significant increase in total return, net profit, performance index % and economic efficiency in comparison with control group.

INTRODUCTION

The shortage of raw materials such as corn, soybean for poultry feed industry has resulted in a continuous increase in the cost of production, causing a phenomenal rise in the unit cost of product. Wet tomato pulp can be further dried to approximately 900 g/kg DM and, because of its chemical composition, which possesses substantive nutritional value, can provide the poultry industry with an alternative feedstuff (1). Enzyme supplementation of high fibre-containing diets has been reported to bring about reduction in cost as well as improvement in the performance and carcass characteristics of broiler chicks (2,3). Tomatoes are consumed either fresh or canned. The seed and skin are the byproducts of tomatoes. Kaha and Edfina companies produced not less than 1080 tons of tomato waste per year. The possibility of replacing the nonconventional feed (tomato pomace) at levels of 2.5, 5.0, 7.5 and 10% , the 2.5 and 5.0 of tomato pomace resulted

improvement of most the studied traits of broilers i.e. growth performance feed efficiency, performance index, mortality and carcass quality (4).

The multienzyme supplementation to the broiler ration improved feed conversion ratio. Multi enzymes are more effective especially in rations which contain high amounts of barely and sunflower with high cellulose (5).

The improvement in body weight gain obtained upon feeding enzyme mixtures may be attributed to the presence of amylase and NSPs degrading enzymes in enzymes mixture rather than protease that making the nutrients more available to the birds and improve chicks growth performance (6).

MATERIALS AND METHODS

This study was carried out at Poultry Research Unit, Dept. of Nutrition and Clinical Nutrition, Faculty of Veterinary Medicine, Zagazig University. A total number of 75 one-

day old Cobb broiler chicks were randomly assigned in 5 experimental groups (15 bird/group) with 3 replicates of 5 birds in each. Birds were reared in a naturally ventilated open house with saw dust as litter. Continuous lighting was provided and starting temperature was 33°C then decreased gradually 2°C each week. Vaccination program against New Castle and Gumboro diseases was applied.

Broiler chickens fed on diet contained different levels (0, 5, 10%) of dried tomato pomace

(DTP) with and without addition of multienzymes (Roxazyme 0.1% composed of cellulase, glucanase and xylanase combination).

Isocaloric, isonitrogenous starter diets from 0-21 day (3005 kcal/kg ME, CP 23.1%) and grower-finisher diets from 22-42 day (3200 kcal/kg ME, CP 19.1%). Diets were formulated (Tables 1, 2) to meet the nutrient requirements (7).

Table 1. Physical and chemical composition % of the experimental diets used in the starter stage .

Ingredients	Experimental diets				
	Control	DTP 5%		DTP 10%	
		With enzyme	Without enzyme	With enzyme	Without enzyme
Yellow corn	57.84	52.24	52.34	47.24	47.34
DTP	-	5.0	5.0	10.0	10.0
Soybean meal, 44%	26.9	26.0	26.0	24.88	24.88
Corn gluten, 60%	5.0	5.0	5.0	5.0	5.0
Fish meal, 68%	6.0	6.0	6.0	6.0	6.0
Calcium carbonate	1.04	1.04	1.04	1.02	1.02
Calciumdibasic phosphate	0.88	0.88	0.88	0.82	0.82
Soybean oil	1.6	3	3	4.2	4.2
Common salt	0.3	0.3	0.3	0.3	0.3
Premix ¹ (vits &minerals)	0.3	0.3	0.3	0.3	0.3
DL- Methionine, 98%	0.14	0.14	0.14	0.14	0.14
Multienzymes	-	0.1	-	0.1	-
Calculated analysis					
ME, Kcal/Kg	3024	3029	3025	3024	3028
CP, %	23.09	23.16	23.15	23.18	23.19
EE, %	4.40	6.33	6.33	8.08	8.08
CF, %	3.28	4.59	4.59	5.90	5.90
Ca, %	0.95	0.96	0.96	0.95	0.95
Available phosphorus, %	0.55	0.53	0.53	0.50	0.50
Lysine, %	1.29	1.42	1.42	1.54	1.54
Methionine, %	0.62	0.60	0.60	0.58	0.58
Methionine+cystine, %	0.92	0.93	0.93	0.93	0.93

¹Muvco premix: Each 2.5kg contain vit. A (10, 000000 IU),vit. D3 (2, 000000IU), vit. E (10g),vitk3 (1000mg), vit. B1(1000mg), vit. B2(5g),vit. B6(1.5g), pantothenic acid(10g),vit. B12 (10mg), niacin(30g) ,folic acid (1000 mg), biotin(50g), fe (30g), Mn (60g),Cu (4g), I (300 mg), Co(100 mg), Se (100 mg) and Zn(50g)

DTP: Dried tomato pamace

Table 2. Physical and chemical composition % of the experimental diets used in the grower-finisher stage .

Ingredients	Experimental diets				
	Control	DTP 5%		DTP 10%	
		With enzymes	Without enzymes	With enzymes	Without enzymes
Yellow corn	68	62.4	62.5	57.4	57.5
DTP	-	5.0	5.0	10.0	10.0
Soybean meal, 44%	15.5	14.6	14.6	13.4	13.4
Corn gluten, 60%	4.4	4.4	4.4	4.4	4.4
Fish meal, 68%	6.5	6.5	6.5	6.5	6.5
Calcium carbonate	1.45	1.45	1.45	1.45	1.45
Calciumdibasic phosphate	0.65	0.65	0.65	0.65	0.65
Soybean oil	2.8	4.2	4.2	5.4	5.4
Common salt	0.3	0.3	0.3	0.3	0.3
Premix ¹ (vits &minerals)	0.3	0.3	0.3	0.3	0.3
DL- Methionine, 98%	0.1	0.1	0.1	0.1	0.1
Multienzymes	-	0.1	-	0.1	-
Calculated analysis					
ME, Kcal/Kg	3205	3206.6	3210	3204	3204
CP, %	19.2	19.2	19.2	19.2	19.2
EE, %	5.88	7.81	7.81	9.56	9.56
CF, %	2.70	4.01	4.01	5.32	5.32
Ca, %	1.02	1.03	1.03	1.05	1.05
Available phosphorus, %	0.51	0.50	0.50	0.48	0.48
Lysine, %	1.00	1.13	1.13	1.25	1.25
Methionine, %	0.56	0.56	0.56	0.56	0.56
Methionine+cystine, %	0.92	0.93	0.93	0.93	0.93

¹Muvco premix: as starter diet .

Indices for evaluation of growth performance

The birds were individually weighed at first day of age then the body weight was recorded every week to calculate the average body weight in each group. The body weight gain was calculated. Feed intake of each replicate and feed conversion ratio was estimated weekly (8) .

Clinicobiochemical measurements

At end of the experiment birds were fasted over-night and blood samples were taken from wing vein from five birds randomly selected from each treatment group. Blood samples were left to clot at room temperature and then centrifuged at 3000 RPM for 15 minute. The clear supernatant serum was obtained and used for biochemical analysis.

Serum total cholesterol, HDL- cholesterol (9), triacylglycerols (TG) were determined colormetrically (10) .

The LDL-cholesterol level can be calculated from the value of total cholesterol, triacylglycerol and HDL-cholesterol (11) .

Carcass Traits: Five birds from each group were taken randomly at end of experiment for determining carcass characteristics.

Economic efficiency was calculated (12).

Statistical analysis: All the data were analyzed using the general linear model of SAS institue (13) .

RESULTS AND DISCUSSION

The results in Figure 1 revealed significant increase ($P < 0.05$) in average body weight all

over the experiment period. At 6th week the average body weight of control group was 1473.33 g, and the body weight of the groups fed diet contained 5% and 10% DTP with enzymes, and 5% and 10% DTP without enzymes were 1780, 1806.66, 1543.33 and 1880 g respectively. However the groups fed diet contained DTP with enzymes showed better live body weight than that fed diet contained DTP without enzymes.

Supplementation of 2.5 and 5.0 % of tomato pomace resulted improvement of

growth performance, feed efficiency, performance index (4).

Optizyme had no effect on growth performance of chicks fed diets containing sunflower meal (14).

The improvement in body weight gain obtained upon feeding enzyme mixtures may be attributed to the presence of amylase and NSPs degrading enzymes in enzymes mixture rather than protease that making the nutrients more available to the birds and improve chicks growth performance (15,16).

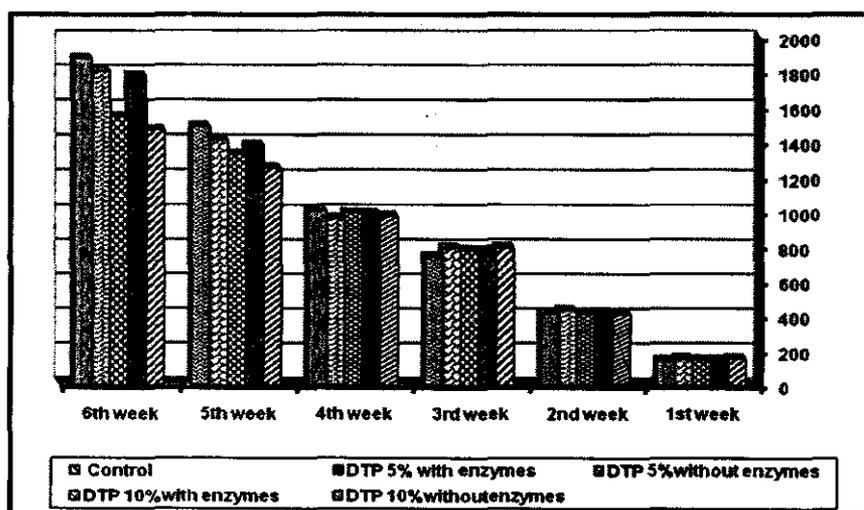


Fig. 1. Effect of inclusion of dried tomato pomace (DTP) in the diet with and without enzyme supplementation on body weight development of broiler chickens

As shown in Table 3 the obtained results revealed significance increase ($P < 0.05$) in average body weight gain all over the experiment period. Groups fed diet contained DTP with enzymes showed better body weight gain than that fed diet contained DTP without enzymes.

The levels of 4, 8 and 12% tomato byproducts were significantly increased weight gains compared with control diet (16). Feeding chicks alkali treated tomato pomace gave the highest live weight gain when compared with other treatments and control group (17).

As shown in Table 4 the obtained results revealed non significant difference ($P > 0.05$) in

feed conversion between control group and other groups in the starter stage (0-3 week). There was significant decrease ($P < 0.05$) in feed conversion between control group (3.14) and the birds fed diet contained 5% and 10% DTP with enzymes 1.83 and 1.80 respectively. Enzyme supplementation improved performance of the broilers (18).

While, addition of enzymes preparation to commercial diets in feeding broilers had no significant effects on feed conversion at marketing age (19).

Results in Table 5 showed no significant difference ($P > 0.05$) in dressing percent, between control group and other groups. However there

was significant decrease ($P < 0.05$) in abdominal fat% between control group and other groups.

Tomato pomace at levels of 2.5 and 5.0% dietary TP exhibited higher values of carcass dressing weight and giblets percentage of chicks (20).

There were significant ($P < 0.05$) decrease in total cholesterol, triglycerides, HDL-C and LDL level Table 6. The serum cholesterol LDL and HDL of broilers fed on diet contained 8, 16% DTP were lower compared with other groups (21).

As shown Table 7 the obtained result revealed significant increase ($P < 0.05$) in total return and net profit between control group and groups fed diet contained 5%, 10% DTP with enzymes and 10% DTP without enzymes. The obtained result revealed significant increase in economic efficiency ($P < 0.05$) between control group and groups fed diet contained 5% and 10% DTP with enzymes and 10% DTP without enzymes.

Enzyme supplementation of high fiber-containing diets has been reported to bring about reduction in cost of broiler chicks (2,3).

The results of the present study revealed no significant difference in dressing%, between control group and other groups while abdominal fat % was significantly decreased in groups supplemented with DTP.

Inclusion of dried tomato pomace led to significant increase in total return, net profit, performance index % and economic efficiency in comparison with control group. While inclusion of dried tomato pomace led to significant decrease in feed cost / kg gain in comparison with control group.

In conclusion, substitution of corn and soybean by 5 and 10% DTP had positive effects on broiler chicken performance. Addition of multienzymes led to improving broiler chicken performance and led to significant improvement in the economic efficiency.

Table 3. Effect of inclusion of dried tomato pomace (DTP) in the diet with and without enzyme supplementation on the average body weight gain (g/week) of broiler chickens (means \pm SE)

Age (week)	Control	Experimental diets			
		DTP 5%		DTP 10%	
		with enzymes	without enzymes	with enzymes	Without enzymes
0-1	113.66 \pm 2.33 ^a	108.66 \pm 4.66 ^a	108.66 \pm 5.92 ^a	114.66 \pm 7.42 ^a	103.33 \pm 4.66
1-2	260.20 \pm 11.09 ^a	272.66 \pm 6.35 ^a	269.33 \pm 5.81 ^a	278.66 \pm 7.42 ^a	268.00 \pm 17.32 ^a
2-3	381.00 \pm 15.82 ^a	357.33 \pm 10.41 ^{ab}	363.33 \pm 5.92 ^{ab}	361.53 \pm 13.63 ^{ab}	332.66 \pm 7.68 ^b
3-4	182.10 \pm 22.59 ^c	212.94 \pm 6.92 ^b	219.77 \pm 12.59 ^{ab}	214.39 \pm 7.89 ^b	264.33 \pm 17.92 ^a
4-5	286.56 \pm 19.03 ^c	391.73 \pm 44.32 ^{abc}	338.89 \pm 22.55 ^{bc}	450.74 \pm 46.44 ^{ab}	481.11 \pm 45.39 ^a
5-6	220.00 \pm 20.00 ^b	396.66 \pm 31.79 ^a	210.00 \pm 30.55 ^b	393.33 \pm 20.27 ^a	390.00 \pm 45.82 ^a
Total gain (0-6)	1443.52 \pm 0.51 ^c	1739.98 \pm 0.83 ^b	1509.98 \pm 0.00 ^c	1766.31 \pm 0.79 ^{ab}	1828.77 \pm 0.83 ^a

Abc Means within the same row with different superscripts are significantly different at ($P \leq 0.05$)

Table 4. Effect of inclusion of dried tomato pomace (DTP) in the diet with and without enzyme supplementation on feed conversion ratio (FCR) of broiler chickens (means±SE)

Age (week)	Experimental diets				
	Control	DTP 5%		DTP 10%	
		with enzymes	without enzymes	with enzymes	without enzymes
1	1.17±0.008 ^{ab}	1.02±0.007 ^b	1.18±0.05 ^a	1.06±0.07 ^{ab}	1.27±0.03 ^a
2	1.54±0.08 ^a	1.56±0.02 ^a	1.46±0.04 ^a	1.55±0.03 ^a	1.62±0.11 ^a
3	1.48±0.03 ^b	1.65±0.11 ^{ab}	1.67±0.03 ^{ab}	1.53±0.12 ^b	1.85±0.02 ^a
4	2.61±0.26 ^a	1.97±0.02 ^b	2.36±0.14 ^{ab}	2.31±0.18 ^{ab}	1.92±0.17 ^b
5	2.09±0.11 ^a	1.74±0.13 ^a	2.21±0.23 ^a	1.58±0.26 ^a	1.62±0.19 ^a
6	3.14±0.19 ^a	1.83±0.16 ^b	3.48±0.12 ^a	1.80±0.14 ^b	2.05±0.05 ^{ab}
0-6	1.95±0.11 ^a	1.80±0.07 ^b	1.50±0.14 ^a	1.48±0.13 ^b	1.83±0.11 ^b

Ab Means within the same row with different superscripts are significantly different at ($P \leq 0.05$)

Table 5. Effect of inclusion of dried tomato pomace (DTP) in the diet on with and without enzyme supplementation carcass traits relative to the live weight of broiler chickens (means±SE)

Age (week)	Experimental diets				
	Control	DTP 5%		DTP 10%	
		with enzymes	without enzymes	with enzymes	without enzymes
Dressing wt %	83.15±1.66 ^a	82.24±0.66 ^a	82.02±0.81 ^a	80.26±1.35 ^a	81.86±1.98 ^a
Liver wt%	2.59±0.35 ^a	2.49±0.37 ^a	3.28±0.29 ^a	3.18±0.02 ^a	3.00±0.28 ^a
Gizzard%	2.16±0.24 ^a	2.02±0.28 ^a	2.24±0.16 ^a	1.82±0.19 ^a	1.98±0.08 ^a
Heart%	0.46±0.01 ^a	0.50±0.06 ^a	0.45±0.02 ^a	0.53±0.01 ^a	0.45±0.01 ^a
Spleen%	0.12±0.01 ^a	0.08±0.01 ^a	0.09±0.04 ^a	0.11±0.02 ^a	0.14±0.03 ^a
Abdominal fat%	3.04±0.12 ^a	2.35±0.07 ^b	2.67±0.12 ^b	2.70±0.08 ^{ab}	2.44±0.11 ^b
Bursa%	0.13±0.01 ^a	0.13±0.02 ^a	0.11±0.01 ^a	0.12±0.08 ^a	0.16±0.01 ^a
GIT%	5.10±0.36 ^a	5.64±0.50 ^a	6.05±0.44 ^a	5.75±0.31 ^a	5.74±0.22 ^a

Ab Means within the same row with different superscripts are significantly different at ($P \leq 0.05$)

Table 6. The effect of dried tomato pomace (DTP) inclusion in the diet with and without enzyme supplementation on serum concentration (mg/dl) of total cholesterol, triglycerides and lipoproteins in broiler chickens (means±SE)

Parameters	Experimental diets				
	Control	DTP 5%		DTP 10%	
		with enzymes	without enzymes	with enzymes	Without enzymes
Total cholesterol	137.77±2.22 ^a	108.88±2.22 ^b	91.11±4.00 ^c	87.77±4.00 ^c	86.66±3.33 ^c
Triglycerides	91.66±4.81 ^a	77.77±5.14 ^{ab}	74.72±4.62 ^b	73.05±4.62 ^b	70.27±2.42 ^b
HDL-cholesterol	90.66±2.13 ^a	75.73±2.82 ^b	60.80±1.84 ^c	61.86±2.13 ^c	51.20±1.84 ^d
LDL-cholesterol	28.77±0.96 ^a	17.60±1.08 ^{bc}	15.36±1.65 ^c	11.30±1.10 ^d	21.41±1.48 ^b

Abc Means within the same row with different superscripts are significantly different at ($P \leq 0.05$)

Table 7. Economic importance of inclusion of dried tomato pomace with and without enzyme supplementation on broiler ration

Parameters	Experimental diets				
	Control	DTP 5%		DTP 10%	
		with enzymes	without enzymes	with enzymes	Without enzymes
Total return (LE)/bird	16.20±0.34 ^b	19.58±0.38 ^a	16.97±0.07 ^b	19.87±0.34 ^a	20.31±0.03 ^a
Net profit	7.98±0.38 ^b	11.11±0.23 ^a	8.19±0.16 ^b	11.47±0.39 ^a	11.33±0.11 ^a
Total costs	8.21±0.04 ^c	8.46±0.20 ^{bc}	8.78±0.17 ^{ab}	8.39±0.10 ^{bc}	8.98±0.09 ^a
Feed costs	6.65±0.03 ^c	6.90±0.19 ^{bc}	7.22±0.18 ^{ab}	6.83±0.11 ^{bc}	7.42±0.08 ^a
Economic efficiency	1.43±0.06 ^b	1.83±0.04 ^a	1.35±0.05 ^b	1.90±0.07 ^a	1.73±0.03 ^a
Feed cost/ kg gain	4.65±0.12 ^a	3.96±0.05 ^b	4.80±0.11 ^a	3.87±0.10 ^b	4.10±0.05 ^b
Performance index %	73.12±3.82 ^b	109.19±2.72 ^a	74.64±1.80 ^b	109.92±2.87 ^a	107.46±3.05 ^a

Abc Means within the same row with different superscripts are significantly different at (P ≤ 0.05)

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الملخص العربي

دراسة تأثير إضافة تفلّة الطماطم المجففة مع الروكسازيم في العلائق علي كفاءة بداري التسمين

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قسم التغذية و التغذية الإكلينيكية - كلية الطب البيطري - جامعة الزقازيق

استخدم في هذه الدراسة عدد ٧٥ كتكوت تسمين قسمت إلي ٥ مجاميع (١٥ طائر/ مجموعة) وكل مجموعة قسمت إلي ٣ تكرارات كل تكرار يحتوي علي ٥ طيور حيث تم تغذيتهم علي ٥ علائق متساوية في الطاقة والبروتين لكل مرحلة عمرية:

المرحلة الأولى: عليقة الباديء (٠ - ٣ أسابيع) تحتوي علي ٢٣,١% بروتين خام و ٣٠,٢٤ كيلو كالوري

طاقة ممثلة /كجم عليقة. المرحلة الثانية: عليقة النامي-الناهي (٣-٦ أسابيع) تحتوي علي

١٩,٢% بروتين خام و ٣٢,٠٠ كيلو كالوري طاقة ممثلة /كجم عليقة مع احلال تفلّة

الطماطم الجافة بنسب (٥ ، ١٠%) محل نفس النسب من كل من الذرة والصويا مع اضافة

او عدم اضافة انزيم الروكسازيم وكانت المجموعات كالاتي:-

المجموعة الأولى: غذيت علي عليقة ضابطة بدون اي استبدال.

المجموعة الثانية: غذيت علي عليقة احتوت علي ٥% تفلّة طماطم مجففة بالاضافة الي الروكسازيم

(١,٠%).

المجموعة الثالثة: غذيت علي عليقة احتوت علي ٥% تفلّة طماطم مجففة بدون اضافة الانزيمات .

المجموعة الرابعة: غذيت علي عليقة احتوت علي ١٠% تفلّة طماطم مجففة بالاضافة الي الروكسازيم (٠,١%) . المجموعة الخامسة: غذيت علي عليقة احتوت علي ١٠% تفلّة طماطم مجففة بدون اضافة الانزيمات .

وتم دراسة تأثير تلك المعاملات علي اداء دواجن التسمين (وزن الطائر الحي , الوزن المكتسب أسبوعيا, معدل استهلاك العلف أسبوعيا, معدل التحويل الغذائي).
تم تسجيل أوزان الطيور فرديا , وزن الجسم المكتسب , معدل الوزن الزائد , كمية العلف المستهلكة ومعامل التحويل الغذائي كل إسبوع .
و في نهاية التجربة تم أخذ عينات دم عن طريق الذبح من كل تكرار خاص بكل معاملة لتحليل نسبة الكوليسترول بالدم , الدهون الثلاثية , مواسفات الذبيحة , الجدوى الاقتصادية .

أتضح من نتائج هذه التجربة ما يلي :

(١) معدلات الأداء :

وزن الجسم :أدي استبدال الذرة والصويا بتفلّة الطماطم الجافة بالنسب المختلفة (٥ و ١٠%) الي زيادة معنوية في وزن الجسم في المجموعات المضاف اليها الانزيمات والغير مضاف اليها الانزيمات عن العليقة الضابطة. وقد اوضحت النتائج ان المجموعات التي اضيفت لها الانزيمات اظهرت زيادة في الوزن افضل من التي لم يضاف لها الانزيمات.

وزن الجسم المكتسب : أدي استبدال بتفلّة الطماطم الجافة بالنسب المختلفة (٥ و ١٠%) الي زيادة معنوية في وزن الجسم المكتسب خلال فترة التجربة في المجموعات المضاف اليها الانزيمات والغير مضاف اليها الانزيمات عن العليقة الضابطة وقد اوضحت النتائج ان المجموعات التي اضيف لها الانزيمات اظهرت زيادة في وزن الجسم المكتسب افضل من التي لم يضاف لها النزيمات.

معدل استهلاك العلف : لا يوجد فروق معنوية بين المجموعة الضابطة والمجموعات التي غذيت علي تفلّة الطماطم الجافة بالنسب المختلفة المضاف اليها الانزيمات بينما معدل استهلاك العلف زاد معنويا في المجموعات التي لم يضاف اليها الانزيمات.

نسبة التحويل الغذائي : يوجد نقص معنوي بين المجموعة الضابطة والمجموعات التي غذيت علي تفلّة الطماطم الجافة بالنسب المختلفة المضاف اليها الانزيمات بينما لا يوجد فروق معنوية بين المجموعة الضابطة والمجموعات التي لم يضاف اليها الانزيمات.

(٢) بعض القياسات الباثولوجية الاكلينيكية والمناعية في الدم:

أدي استخدام تفلّة الطماطم الجافة الطماطم بالنسب المختلفة مع اضافة او عدم اضافة الانزيمات الي حدوث نقص معنوي في مستوي الكوليسترول الكلي وكذلك الجليسيريدات الثلاثية، البروتينات الدهنية عالية الكثافة ومنخفضة الكثافة في السيرم.

(٣) صفات الذبيحة: لم يلاحظ اي تأثير معنوي في النسب المثوية للحويصلة والقونصة والمعدة الغدية و

الأمعاء والكبد والقلب و الطحال والبرسة فابريشيوس في المجموعات التي غذيت علي تفلّة الطماطم الجافة الطماطم بالنسب ٥ و ١٠% باضافة وعدم اضافة الانزيمات مقارنة بالمجموعة الضابطة. بينما سجلت النتائج نقصا معنويا في نسبة الدهون الظاهرة بالبطن في المجموعات التي غذيت علي تفلّة الطماطم الجافة بالنسب ٥ و ١٠% باضافة وعدم اضافة الانزيمات.

(٤) الجدوى الاقتصادية: أدي استخدام تفلّة الطماطم الجافة الطماطم بالنسب المختلفة مع اضافة او عدم اضافة الانزيمات الي حدوث زيادة معنوية في العائد الكلي والربح وفي الكفاءة الاقتصادية مقارنة بالمجموعة الضابطة.

بينما ادي استخدام تفلّة الطماطم الجافة الطماطم بالنسب المختلفة مع اضافة او عدم اضافة الانزيمات الي حدوث نقص معنوي في تكلفة العلف / كجم زيادة في وزن بداري