EFFECT OF SUPPLEMENTING DIFFERENT LEVELS OF OPTEIGEN AS A REPLACER TO SOYBEAN ON THE STEERS'PERFORMANCE

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ABSTRACT

This study was conducted to evaluate the effect of using Opitgen feed additives as a replacer to soybean meal in the diet of fattening Holistien calves. Fifteen Holistien calves with an average initial weight 260.26±13.25kg and aged seven month were divided into three groups (five in each) based on initial body weight and age. Calves were housed under open sheds. Calves in the first group were fed the control ration (without additives) while the steers in the second and third groups were fed the control ration with addition 75 or 100 gm. of Optigen II (Alltech, Lexington, KY)as a replacer to 0.421 kg of soybean meal which is represented of 1.35 % on dry matter basis (Opt. 75)or100 gm Optigen II(Alltech, Lexington, KY)as a replacer to 0.558 kg of soybean meal which is represented of 1.84 % on dry matter basis (Opt. 100) for 105 days. Dry matter intake, nutrients apparent digestibility, rumen activity, growth performance and economic efficiency were determined.

The results showed that dry matter intake, organic matter, crude protein, ether extract and crude fiber as well as total digestible nutrients and digestible crude protein were not affected by the different experimental diets.The animals in G2 (Opt.75) had the highest digestibility coefficients of all nutrients followed by animals in G3 (opt. 100), while the control group had the lowest values. The nutritive values expressed as TDN or DCP for animals in G2 (Opt. 75) and G3 (Opt. 100) were slightly higher ($P > 0.05$) compared with the control group. There were no significant differences ($p > 0.05$) in pH value among the different experimental group during the trial, the pHvalues are within the normal range. But there were significantly ($p < 0.05$) differences among the different groups concerning ruminal ammonia-N concentration (NH_3-N whereas the G3 (100 g Opt.) recorded the highest NH_3-N concentration which were 7.13, 8.03 and 9.56 mg/100 ml rumen liquor for G1, G2 and G3, respectively. The concentration of TVF`s in the rumen liquor of animals in group II supplemented with optigen (75 g Opt.) was higher significantly ($p < 0.05$) compared with the other groups. The average daily gain for G1, G2 and G3 were 1.35, 1.39 and 1.25 kg/day, respectively. Calves in G2 recorded the highest value of average daily gain compared to the other groups. Also, the animal in G2 (75 g Opt.) recorded the better value of feed conversion compared to the other groups, it improved by 5.21 and 14.04% compared with the control and G3, respectively)**.** The best economic efficiency was recorded by the G2 while the lowest economic efficiency was recorded by the G3 while, the control group had the intermediate value.

Finally it can be recommended that the supplementation of optigen at level 75 gm/ day (1.35% on DM basis) in the diets of Holistien calves.

Keywords:* *soybean meal, optigen, digestibility, rumen fermentation, slow release urea

INTRODUCTION

In Egypt, shortage of feed supply may be considered the major constraint to further increase in animal production. The high cost of feed grains and many high-protein grains may make the use of urea as a protein source very cost-effective in animal feeding. Urea contains about 45% nitrogen (protein contains 16% nitrogen). Therefore, when urea is converted to protein, the crude protein equivalent value of urea is about 281%. It must be recalled that urea contains no other useful feed components such as energy, minerals, or vitamins. When too much ammonia escapes the rumen because the microbes are not able to utilize enough of it for protein, the capacity of the liver for excretion urea is decreased then over toxicity can be occurring.It is vitally important that the right level of urea is fed and that there will be sufficient bacterial action to produce protein.

A potential way to minimize excess ammonia accumulating in rumen reaching the liver is to increase microbial utilization of ammonia by modulating its appearance in therumen. To achieve this goal, some researchers have used microbial urease inhibitors, withmixed results **(Whitelaw *et al*., 1991; Ludden *et al*., 2000).** As recent research suggests, inability of the rumen microorganisms to synthesize sufficient quantities of all amino acids needed to prevent deficiencies or imbalances may be a major factor responsible for the lowered animal performance obtained with urea diets (**William Chalupa, 1968).** Soybean meal (SBM) has long been used as a prominent source of crudeprotein for ruminants,however, with its increasingprice, the use results in ultimately higher costof production**(Chalupa, 2007)**. Therefore, the use of urea as a non-protein nitrogen (NPN) replacement is attractive inruminant diets because of its low cost compared with other protein feeds such as SBM with high rumendegradability**(Wanapat *et al.,* 2009 and Xin *et al*., 2010)**.

Numerous attempts have been made over the years to control the ruminal release of urea by combining urea with starch **(Deyoe *et al.,* 1968),** molasses **(Males *et al.,* 1979),** cellulose **(Conrad and Hibbs, 1968),** or oils **(Owens *et al.,* 1980).** The development of products that slow the ruminal release of ammonia without limiting the extent of urea degradation in the rumen has been challenging **(Males *et al.,* 1979).**

In 2005 Alltech INC. (Lexington, KY) developed and commercialized a controlled- release urea product (Optigen) that involves coating urea. Optigen II(Alltech, Lexington, KY) is a blended urea product with an intermediate N release rate that is less than urea and greater than some of the slow release urea (SRU) products described above. Optigen II provides high N concentration at 256% CP compared with true protein sources such as soybean meal at 53% CP on DM basis **(Tikofsky and Harrison 2007).**

The chemical analysis of optigen with (Alltech Laboratory Lexington, US) was 0.2 % humidity, 256 % crude protein, total nitrogen 41 % and ether extract 12%.Optigenwasblended non-protein nitrogen (NPN) source for ruminants andrumen degradable nutrient-dense nitrogenenhances the growth of fiber-utilizing bacteria andopens up space in the diet for digestible fiber and energy andimproves the efficiency of microbial protein synthesis. The factors to use optigen were 41% N, 256% CP and50% release in the first 12 hours and 95% release in 24-36 hours. The aims of the present study was to investigate the effect of OptigenII(Alltech, Lexington, KY) as a slow release of source of amonia to replacement of soya bean meal in the rations of Holstein calves on the digestibility, rumen fermentation, animals performance and economic efficiency.

MATERIAL AND METHODS

The present work was carried out a commercial animal production farm (el hamamy station) in Abo-Homous, EL-Behira Governorate, Egypt, in co-operation with Department of Animal Production, Faculty of Agriculture, *K*afrelsheikh University.

The experiment was conducted from November 2014 through February of 2015.the trial period was 105 days. Fifteen Holistien calves with average initial weight 260 ± 13.25 kg and average age seven month weredivided into three groups(five in each) based on initial body weight and age. Calves were housed under open sheds.

1- Experimental rations

Calves in the first group were fed the control ration that contained on DM basis 55.5% concentrate mixture (CM) and 45.5 % corn silage (CS)(without additives) while, the calves in the 2^{nd} and 3^{rd} groups were fed the control ration with addition 75gm of Optigen II (Alltech, Lexington, KY)as feed additives to replace 0.421 kg of soybean meal which is represented of 1.35 % on dry matter basis (Opt. 75)or100 gm Optigen II(Alltech, Lexington, KY)as a replacer to 0.558 kg of soybean meal dailywhich is represented of 1.84 % on dry matter basis (Opt. 100),respectively. All tested rations were isocaloric and isonitrogenous.The composition of experimental ingredients are shown in Table (1).

Table (1): Ingredient composition of concentrate % (on DM basis)

Item	experimental rations % DM		
	G1 (Control)	G2 (Opt. 75)	G3 (Opt. 100)
Beat pulp	8.4	9.00	9.20
Soybean meal	37.60	32.08	30.10
Yellow corn	38.80	41.40	42.30
Wheat bran	11.80	12.60	12.90
Calcium carbonate	0.84	0.90	0.92
Minerals & Vitamins	1.01	1.08	1.10
Salt	0.68	0.70	0.72
Sodium bicarbonate	0.68	0.70	0.72
Yeast	0.02	0.02	0.02
Anti-toxic	0.17	0.17	0.18
Optigen	0.00	1.35	1.84
Total	100	100	100

2- Feeding system

Animals were fed to cover their recommend requirement according to NRC(1996).Animals were weighed before morning feeding bi-weekly and the feeding allowances for animals were adjusted based on body weight change. The control and experimental rations were offered once daily at 8 a.m. with TMR (total mixed ration) feeding system. Fresh water was available continuously. Three digestibility trails were conducted during the feeding period (at the middle) using 3 calves from each group to determine the digestibility and nutritive values of the experimental ration by using acid insoluble ash (AIA) as a natural marker (Van keulen and Young, 1997). Chemical analysis of different ingredients, experimental rations and feces were carried out according to the methods of **A.O.A.C. (2012).**

Rumen liquor samples were taken from three calves from each group after 3 hr. from the morning feeding using stomach tube. Every sample was strained through four layers of cheese cloth. Rumen pH was determined immediately after straining the samples using Orion **SA 210** digital pH meters. The total volatile and individual fatty acids were determined in rumen liquor by the steam distillation methods described by (**Warner, 1964).** Ammonia nitrogen was determined using saturated solution of magnesium oxide distillation according to the methods of **A.O.A.C. (2012).**

Animals were weighed before morning feeding on two consecutive days at beginning and at the end of the trial, average daily gain, feed conversion ratio and economic efficiency were calculated.

The data were statistically analyzed using general linear model procedure adapted by SPSS for Windows (2008) for one-way ANOVA. Duncan test within program of SPSS was done to determine the degree of significant among the means.

RESULTS AND DISCUSSION

1- Chemical composition

Chemical composition of different ingredients and experimental rations (on DM basis) is shown in Table (2). The data showed that the chemical composition of experimental ingredients are within the normal range of chemical analysis of feedstuffs used in Egypt as mentioned by APRI(1997) and CLFF(2001).

Data also in Table 2. showed that the chemical composition of experimental concentrate was isocaloric and isonitrogenous (approximately similar in their content of all nutrients, DM, CP, CF, EE, ADF, NDF, NFE and ash).

Table (2): Chemical composition of different ingredients and concentrate mixture used in feeding Holstein calves (on DM basis)

Item	corn silage	soybean	beat pulp	Wheat bran	yellow corn	Optigen
DM	25.8	91.7	93.3	90.69	90.74	--
OM	91.53	92.62	95.98	95.42	98.66	--
CP	7.44	50.1	9.41	16.31	7.97	256
EE	1.92	1.05	0.81	3.01	4.68	--
CF	26.87	2.36	19.76	5.11	1.41	--
NFE	55.30	39.11	66.00	70.99	84.60	--
NDF	61.43	10.1	53.8	35.69	10.98	--
ADF	34.83	3.38	28.7	10.39	4.35	--
Cellulose	30.85	2.87	24.2	7.75	2.88	--
Hemicellulose	26.6	6.75	25.1	25.29	6.63	--
Lignin	3.98	0.51	4.44	2.64	1.47	--
NDFIP	1.43	1.76	6.33	3.59	0.77	--
ADFIP	1.23	0.67	2.32	0.8	0.76	--
NFC	20.75	31.3	32	40.41	75.02	--
Ash	8.47	7.38	4.02	4.58	1.34	--

	Concentrate mixture for experimental rations % DM basis		
	G1(Control)	G2(Opt. 75)	G3(Opt. 100)
DM	91.10	92.00	93.60
OM	96.10	96.30	96.60
CP	23.30	24.00	24.00
CF	4.62	3.86	4.13
NDF	21.51	23.32	23.10
ADF	11.83	11.37	10.47
EE	2.63	3.10	3.29
NFE %	65.55	65.34	65.18
Ash	3.90	3.70	3.40

Calculated experimental rations on DM basis			
OM	94.06	94.02	94.08
CP	16.25	15.92	15.59
CF	14.58	15.05	15.48
EE	2.29	2.30	2.47
NFE	60.94	60.75	60.54
Ash	5.94	6.02	6.13

2- Nutrients digestibility and digestibility coefficient:

The data in Table (3) showed that no significant differences in digestibilities for all nutrientsbut the ether extract digestibility coefficient was significantly higher for G2 and G3 compared with the control ration. The animals in G2 (opt. 75) had the highest digestibility coefficients of all nutrients followed by animals in G3 (opt. 100), while the control group had the lowest values. The improvement in digestibility coefficients could be illustrated on the basis that optigen can play indirect role to stimulate anaerobic fermentation of dry mater that improve the utilization efficiency of nutrients and direct role to improve digestion in abomasum. These results are in a good agreement with this obtained by **Taylor-Edwards *et al.* (2009)**who stated that although apparent total tract digestibilities of DM, OM, NDF and ADF were not affected by treated with slow release urea. But, fecal N excretion increased and apparent total tract N digestibility reduced. Intake of DM, OM, NDF, and ADF did not differ among treatments and there were no detrimental effects on DM and fiber digestibility associated with feeding a slow release urea. Moreover, **Bruno *et al*, (2015)**found that the replacing of soybean meal by slow release urea did not show differences for DM, CP and NDF digestibility.

Table 3: Feed intake, digestibility coefficient and nutritive value for different experimental ration fed to steers (mean ± SE)

Item	Experimental rations % DM			
	G1 (Control)	G2 (Opt. 75)	G3 (Opt. 100)	Overall mean±SE
DM	72.90	77.60	76.90	75.80 ±1.11
CP	83.50	87.80	86.70	86.00 ±1.17
NDF	73.20	70.60	73.50	72.43 ±1.3
ADF	54.60	60.70	58.20	57.83 ±1.13
EE	58.30^{a}	62.10^{b}	61.50^{b}	60.63 ±1.16
NFE	72.30	73.60	69.60	71.83 ±1.8
Nutritive value				
TDN	58.89	62.19	61.69	60.92 ±.51
DCP	13.57	13.98	13.52	14.33 ±.20

Means with different superscripts within the same row are significantly different (P<0.05)

The nutritive values expressed as TDN or DCP for animals in groups II (Opt. 75) and III (Opt. 100) were slightly higher ($P > 0.05$) compared with the control group. This may be due to the slow-release urea diets prolong microbial utilization of additional N sources during ruminal fermentation. **Sinclair *et al.*, (2012)**concluded that the partial replacement of soybean meal and rapeseed meal with feed grade urea or a slow-release urea can be achieved without affecting milk performance or diet digestibility, with the efficiency of conversion of dietary N into milk being improved when the slow-release urea was fed.

3- Rumen liquor parameters:

The effect of optigen supplementation on rumen liquor parameters for calves fed the different experimental rations are shown in Table (4). There were no significant differences ($p>0.05$) in pH value among the different experimental group during the trial period. These values are within the normal range (6.5- 6.8) obtained by**Van Soest (1982)** and **Taylor-Edwards *et al.*, (2009**).The NH_3-N concentration were significantly ($p<0.05$) differences among the different groups The highest concentration of rumen NH_3-N was recorded with feeding 100 gm optigen G3 (9.56 mg/100 ml) ,followed by G2 (8.03 mg/100 ml) .These findings suggest that N from the Optigen diet could be degraded faster than N from control diet with soybean meal, but probably slower than common urea. This idea was in part confirmed by **Harrison *et al.*, (2007)** who found that NH_3-N concentrations withcoated urea (CU) were lower than those from common urea.

The concentration of TVF's in rumen liquor of calves as affected by optigen supplementation are showed in Table (6). The concentration of TVF`s in the rumen liquor of animals in G2 supplemented with optigen(75g Opt.) was higher significantly ($p<0.05$) compared with the other groups. The highest value ($p<0.05$) was recorded by G2 (97.5 mml/100 ml) followed by G1 (96.2 mml/100 ml), while the lowest value of G3 (94.8 mml/100 ml). The were no significant differentces for individual fatty acids (acetate, propionate and valrate percent of TVF`s) amoung the all treatments. While, there were significant differentces for butyrate percent of TVF`sbeing 13.46, 13.80 and 12.8 for G1,G2 and G3, respectively.These results suggest that the anaerobic fermentation for release nitrogen as a slow degradation was more efficient and faster yielding more TVF's than that in the control group.

Table (4): Ruminal parameters for Holistiencalvesfed the experimental rations (Mean ± SE)

Item	Experimental rations			
	G1(control)	G2 (Opt. 75)	G (Opt. 100)	SEM
PH	6.66	6.70	6.70	± 0.48
NH3-N (mg/100ml)	7.13[c]	8.03[b]	9.56[a]	± 0.36
TVF`s mml/100ml	96.2[b]	97.5[a]	94.8[c]	± 0.41
Individual volatile fatty acids %				
Acetate	52.80	52.60	52.60	± 0.098
Propionate	34.10	34.06	35.13	± 0.217
Butyrate	13.46[a]	13.80[a]	12.53[b]	± 0.206
Valrate	0.46	0.46	0.46	± 0.002

Means with different superscripts within the same row are significantly different (P<0.05)

4-Feed intake :

Data of voluntary feed intake (Table 5) indicated that there were insignificant differences among experimental groups in DM,TDN and DCP intake as affected by optigen supplementation.This may be attributed that all tested rations had nearly similar chemical composition (Table2) ,along with nutritive value obtained for all tested rations showed insignificant differences (Table3).

5-Animal performance :

The effect of optigen supplementation on animal's performance is showed in Table (5). There were no significant differences (p>.05) in the average daily gain among the different experimental group during the trial period. Calves in G2 recorded the highest value of average daily gain compared to the other groups (1.39 vs. 1.35 and 1.25 kg/day), while the G3 (100g Opt.) had the lowest value. These result confirmed with the result of **Pinos-Rodríguez *et al.,* (2010)** who reported that usage of optigen at 1% dry matter can replace soybean meal in diets for beef steers without any negative effect on growth performance. The same trend was also reported by **Silveria *et al.*, (2012); Bruno *et al*, (2015); Fernado *et al,*.(2014)** and **Tedeschi *et al.*, (2002).**

These results are agree also with those reported by **Walker *et al.*, (2000)** who foundthat the replacement SBM with slow release urea (RumaPro.) at different levels, 0, 33, 66 and 100% of the supplemental CP by Ruma Pro. ADG were not significant (P < 0.1). Steers fed Ruma Pro at 33% consumed less feed than control steers. For the overall feeding period, feed:gain was improved (P < 0.01) for steers fed Ruma Pro vs. control. However,**Fernado*etal.* (2014) and Gonçalves*et al.,* (2014)** indicated that **t**he replacement of soybean meal by slow-release urea (SRU) does not affect the variables of intake and digestibility of dry matter or milk production of crossbred cows. The same results reported by ***Pinos-Rodríguez et al., (2010)*** with beef steers.

Results of feed conversion (kg feed / kg gain) expressed as DM,TDN and DCP were nearing similar for all experimental groups without significant differences (Table 5) this may be due to that experimental calves were received their recommended nutrients allowances (NRC 1996) and covered their recommended requirements **Sinclair*et al.,* (2012)**and **Bruno *et al*, (2015)** reported that the partial replacement of soybean meal and rapeseed meal with feed grade urea or a slow-release urea can be achieved without affecting milk performance or diet digestibility, with the efficiency of conversion of dietary N into milk being improved when the slow-release urea was fed.

There were no significant differences (p>0.05) in average daily feed cost for steers during the experiment period (20.98, 21.19 and 21.24 L.E for G1, G2 and G3, respectively). While feed cost/ kg gain increased significantly for animals in group 3 compared with other groups being 17.0 vs. 15.2 and 15.02 L. E for the control group and G 2, respectively.

The supplementation of 75 gm optigen improved the income of daily gain (net revenue) by 5.23 and 27.38% compared with the control and G3 (100g Opt.), respectively. The same trend was also reported for feed conversion (6.69 vs. 7.11 and 7.44 feed intake/ kg gain for G2, control and G3, respectively). these result are according with these obtained by **Pinos-Rodríguez *et al.,*(2010) and Inostroza *et al.,* (2010)** who found that animals fed rations supplemented with optigen were more economically efficient than those fed non supplemented rations.

The best economic efficiency and relative economic efficiency were recorded by the G2 (supplemented by 75 gm optigen) while the lowest economic efficiency was recorded by the G3 (supplemented by 100 gm optigen),While the control group had the intermediate value.

Table (5): Effect of optigen supplementation on average daily feed intake, animals' performance and economic efficiency of steers fed the different experimental rations

Item	Experimental rations			
	G1 (Cont.)	G2 (Opt. 75)	G3 (Opt. 100)	Overall mean ± SE
Average daily feed intake as DM (kg per calves /day)				
Feed intake kg DM/ day	9.6	9.3	9.3	9.4 ± 0.05
TDN intake	5.65	5.78	5.74	
DCP intake	1.30	1.30	1.26	
Initial body weight/kg	255.4	269.8	255.6	260.26 ± 13.25
Final body weight/ kg	380.8	399.07	371.6	383.80 ± 13.46
Total gain	125.4	129.27	116.0	123.5 ± 2.69
Daily gain kg/day	1.35	1.39	1.25	1.32 ± 0.029
Feed conversion				
kg DM/kg gain	7.11	6.69	7.44	7.08 ± 0.25
kg TDN/kg gain	4.18	4.15	4.58	4.3±0.068
kg DCP/kg gain	0.95	.98	1.08	1.01±0.019
Economic efficiency				
Feed cost/ head/ daily/ L. E	20.98	21.19	21.24	21.13 ± 0.30
Feed cost/ kg gain/ L.E.	15.54^{b}	15.24^{b}	17.00^{a}	16.01 ± 0.35
Total revenue (L. E.)	39.15	40.31	36.25	38.52 ± 0.84
Net revenue (L. E.)	18.17	19.12	15.01	17.38 ± 3.84
Economic efficiency (%).	86.61	90.23	70.67	
Relative economic efficiency to control	100	1.05	82.61	

The calculations based on local price of year 2014: Corn silage:300 L.E. / ton. Soybean meal:3802 L.E. / ton. Yellow corn ground: 1678 L.E. / ton. Wheat bran:2020 L.E. / ton. Beet pulp: 1860L.E. / ton.Optigen: 25000 L.E. / ton.,Body live weight =29 L.E. / kg

The result of the present study indicated that the replacing soybean meal is as potential plant protein source with optigen as a slow release urea at different levels didn't effect on feed intake, but the supplementation of optigen at level 75 gm/ day (1.35% on DM basis) improved the digestibility coefficients for all the nutrients. The animals in G2 (Opt. 75) gained 11.2% more than those in G3 (Opt. 100) as well as improved the income of daily gain (net revenue) by 5.23 and 27.38% compared with the control and G3 (Opt.100), respectively. Finally it can be recommended that the supplementation of optigen at level 75 gm/ day (1.35% on DM basis) was more economically efficiency.

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الملخص العربى

تاثير إضافة مستويات من الأوبتجن على أداء الحيوان لعجول التسمين الهولشتين

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اجريت هذة التجربة باحدى المزارع الخاصة (الحمادى- ابو حمص –البحيرة2014) حيث استخدم 15 من عجول الهوليشتين متوسط وزنها 260 ±13.25 كجم وزعت عشوائيا الى ثلاث مجموعات طبقا للوزن والعمر.غذيت العجول فى المجموعة الاولى على عليقة الكنترول التى تكونت من العلف المركز وسيلاج الذرة بدون إضافات فى حين غذيت العجول فى المجموعتين الثانية والثالثة نفس عليقة الكنترول مع اضافة 75 جم أو 100 جم أوبتجن كإضافات غذائية بنسبة 1.35 , 1.84 % على أساس المادة الجافة وتم تقدير

معاملات الهضم والقيمة الغذائية لهذة العلائق بالإضافة الى بعض صفات الكرش والأداء الانتاجى والقيمة الاقتصادية .تم حساب الاحتياجات الغذائية لهذة الحيوانات طبقا ل NRC عام (1996) . وأوضحت النتائج : عدم وجود أختلافات معنوية بين المجموعات الثلاث بالنسبة للمادة الجافة المأكولة كانت تتراوح 9.3 الى 9.6 كجم يوميا . سجلت المجموعة الثانية (75 جم اوبتجن) أعلى قيم لمعاملات الهضم تليها المجموعة الثالثة ثم المجموعة الكنترول حيث سجلت أقل قيم لمعاملات الهضم. ايضا القيمة الغذائية معبرا عنها كمجموع المواد الغذائية المهضومة والبروتين الكلى المهضوم لم تتأثر معنويا بإضافة الاوبتجن ولكن سجلت المجموعة الثانية والثالثة أعلى القيم بالمقارنة بالمجموعة الكنترول. لم يتأثر درجة حموضة الكرش معنويا بإضافة الاوبتجن الى العلائق .بينما ازدادت معنويا تركيز نتروجين الامونيا فى سائل الكرش بإضافة الاوبتجن الى العلائق الاولى والثانية مقارنتا بمجموعة الكنترول. لم تتأثر نسب كل من الاسيتات والبروبيونات والفايرات معنويا بينما إنخفضت نسبة البيوترات معنويا فى تركيز سائل الكرش للمجموعة الثالثة حيث كانت 12.53 بالمقارنة بمجموعة الكنترول والمجموعة الثانية 13.46 ثم 13.80 ملى مول / 100 مللى سائل كرش .

لم يتأثر معدل النمو اليومى معنويا بين المجموعات الثلاث خلال فترة التجربة فى حين سجلت المجموعة الثانية اعلى معدل نمو يومى يليها مجموعة الكنترول ثم المجموعة الثالثة حيث كانت كالتالى 1.39 ثم 1.35 ثم 1.25 كجم / اليوم . ايضا سجلت المجموعة الثانية أفضل كفاءة تحويلية غذائية بنسبة 14.04 % ، 5.21 % للمجموعة الثالثة والمجموعة المقارنة . لا توجد أختلافات معنوية فى متوسط التكلفة الغذائية اليومية حيث كانت 20.98 ، 21.19 ،21.24 جنية مصرى يوميا تقريبا ولكن زادت معنويا تكلفة الحصول على كجم وزن للحيوان يوميا حيث كان 17.7 و15.2 ثم 15.02 للمجموعة الثالثة ثم الكنترول ثم المجموعة الثانية. سجلت المجموعة الثانية افضل قيم الكفاءة الاقتصادية ثم سجلت المجموعة الثالثة اقل قيم للكفاءة الاقتصادية فى حين كانت مجموعة الكنترول لقيم وسط بينهم .

مما سبق يتضح انة يمكن استبدال كسب فول الصويا بالاوبتجن حتى مستوى 1.35 % على أساس المادة الجافة وذلك للتغلب على ارتفاع اسعار كسب فول الصويا خلال أشهر السنة المختلفة مع الوصول الى نفس النتائج بأستخدام كسب فول الصويا وذلك فى تغذيت عجول تسمين الهولشتين.