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EFFECT OF PARTIALLY REPLACING OF YELLOW CORN WITH PRICKLY PEAR PEELS ON THE GROWTH PERFORMANCE OF Hy-Line W-36 MALE CHICKS

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SUMMARY:

The experimental work of the present study was carried out at the Poultry Research Station, Poultry Production Department, Faculty of Agriculture, Fayoum University. This experiment was conducted to study effect of partially replacing of yellow corn (YC) with prickly pear peel (PPP) in Hy-Line W-36 male chick diets with or without enzyme supplementation. The enzyme used in this study was kemzyme dry (KD), used at a rate of 1 kg/tonne (0.1%) of complete feed. At 14 days of age, birds were divided into six treatments (30 birds each), each treatment contained 3 replicates of 10 birds each.

The experimental treatments were as follows:-

1-The control diet (D_1). 2-The control diet (D_1) + 0.1% KD (D_2).
3-15% YC in D_1 was replaced by PPP. 4-15% YC in D_2 was replaced by PPP.
5-30% YC in D_1 was replaced by PPP. 6-30% YC in D_2 was replaced by PPP.

Results obtained could be summarized in the following:

1- Partially replacing YC with PPP in growing Hy-Line W-36 male chick diets with or without enzyme supplementation had an insignificant effect on live body weight (LBW), live body weight gain (LBWG), feed conversion (FC), crude protein conversion (CPC) and caloric conversion ratio (CCR) during all ages studied.
2- Hy-Line W-36 male chicks fed 0.0% PPP diet had lower feed intake (FI) during the final period studied, while those fed diet containing 30% PPP+KD had the highest FI value during the these period.
3- Enzyme supplementation improves LBW ($P \leq 0.05$), LBWG ($P \leq 0.05$), FC ($P > 0.05$), CPC ($P > 0.05$) and CCR ($P > 0.05$) compared with those fed enzyme un-supplemented diet during the period from 14 to 70 days of age.
4- Partially replacing YC with PPP in growing Hy-Line W-36 male chick diets with or without enzyme supplementation were insignificant, regarding slaughter parameters, some blood parameters and chemical composition of meat, except ash%.
5- Hy-Line W-36 male chicks fed diet containing partially replacing YC with 30% PPP+KD gave the best economical and relative efficiency values being 1.842 and 108.77%, respectively when compared with the control. Whereas, chicks fed control diet had the lowest corresponding values, being 1.694 and 100.00%, respectively.

Generally: 1-The best performance was seen when 30% PPP+KD was incorporated in Hy-Line W-36 male chick diets.

2- We can be suggest that Hy-Line W-36 male chicks can be used to partial participate in solve the problem of low animal protein consumption.

Key words: prickly pear peel, kemzyme dry, performance, Hy-Line W-36 male chicks.

INTRODUCTION

Poultry production was one of the fastest growing industries in Egypt. Feeding cost is considered the most expensive item (60 to 70%) in the whole production process. Yellow corn (YC) production in Egypt is not adequate to supply poultry feed, so it depends on the use of imported YC. The key for successful process in poultry projects is through maximizing the profit. On the other hand, minimizing the feed cost could be achieved through the use of untraditional cheaper feed ingredients or improving utilization of common feeds by using some additives.

Attention therefore should be drawn towards the use of some local by-products available in certain areas of Egypt. Prickly pears (*Opuntia* spp., Cactaceae) have a fundamental economic importance in many desert areas, which are produced in abundant quantities **(Ali, 2001 and EL-Nagmy *et al.*, 2001).** In Egypt, Libya, Saudi Arabia, Jordan and other parts of the Middle East, prickly pears (Egypt, it is known as *teen shouky*) of the yellow and orange varieties are grown by the side of farms, beside railway tracks and other otherwise noncultivable land, and is considered a nice refreshing fruit for summer season. Prickly pear fruit is a berry, typically weighs 100 to 200 g, and consists of a thick fleshy skin or peel (30-40% of total fruit weight), typically have high sugar (10% of total rind weight) content **(Benson, 1982; Barbera *et al.*, 1992 and Ali, 2001)**. It is particularly attractive as a feed because of its high efficiency in converting water to dry matter and thus digestible energy **(El-Kholy, 1999).**

For instance, a great quantity of prickly pear peel (PPP) accumulate after eating refreshing fruit or processing of prickly pear that can cause environmental pollution. Prickly pear peels are widely used as animal fodder **(Felker, 1995; Ali, 2001 and El-Nagmy *et al*., 2001). El Kholy (1999)** found that PPP are rich in vitamins A and E and free from alkaloids as anti-nutritional factors and can be replaced up to 75% of YC without any adverse effect on the fish performance. A number of studies have reported the proximate chemical composition of PPP on air dry matter basis shows that crude protein, ether extract, crude fiber and ash concentrations of 7.20 to 10.21, and 2.00 to 3.85%, 10.45 to 14.33 and 8.02 to15.80, respectively, have been reported in the literature **(Ali, 2001; El-Nagmy *et al.*, 2001 and Ragab, 2007).** Also, PPP contains reasonable amount of NFE being 48.89% **Ragab (2007)** and such value was nearly similar to that previously obtained by **El-Kholy (1999)**; **Ali (2001)** and **El-Nagmy *et al.* (2001)**. They also indicated higher content of cellulose and lignin in PPP than those in YC. So, it will cause the hardness, the less digestible and the less utilization of PPP as compared to YC. **Ali (2001); El-**

Nagmy *et al.* (2001) and Ragab (2007) indicated that PPP contained true metabolizable energy (ME) 2800 to 2850 K cal/kg on DM basis.

The addition of enzyme preparations to poultry feed is not a new concept, but it is becoming more fine tuned with the production of special enzyme preparations specific for the substrate. Recent market research indicates that in the U.K. approximately 90-95% of all broiler diets contain feed enzymes. Enzymes are added to animal feeds to supplement low enzyme production or improve utilization of poorer quality feeds. **Farrel (1994) and El-Sebai and Osman (1999)** reported that enzyme addition to diets improved body weight of chicks which depends on type of diets. Also, **Ghazalah *et al*. (1994)** reported that supplementing enzyme mixture to broiler diets containing high level of fiber improved feed utilization. However**, El-Nagmy *et al*. (2001)** found no significant differences among treatment groups of quails in their feed intake due to replacing YC by PPP in their diets either un-supplemented or supplemented with Prozyme.

Total animal protein consumption in Egypt is low, in the year 2007 the animal protein consumption levels in Egypt are almost 60.99 percent (8.24 (g/capita/day) protein supply quantity) of the global consumption (13.51(g/capita/day) protein supply quantity). Poultry meat is the representing over 35.07 percent of total animal protein consumption. The annual per capita poultry meat consumption is approximately 8.27 kg ((22.65 g per day of total poultry meat) this is equivalent to 2.89 grams poultry meat protein), this is below the average world consumption of 12.26 kg per capita reported for that year **(FAO, 2012).** One of the principal constraints for the development of the poultry industry in Egypt relates to feed resources and aspects of feed, which contribute, to poor feed conversion ratio (FCR). According to the previously reported (**El-Anwer *et al.*, 2010; Namra *et al.*, 2010** and **Tollba *et al*., 2010)**, the FCR for the native breeds (average, 4.29 g feed/g gain) is much higher (but they are better for adaptation and disease resistance) than that for the exotic modern broiler strains (1:1.8). Local strains are known to have slow growth rate and insufficient in feed utilization as well as tendency to consume large amounts of feed. The average annual production of layer day old chicks was approximately 21 million in the years 2004 and 2005 **(Hosny, 2006)**. So, there are abundant numbers of the chicken males over the breeding need, therefore these access numbers could be used in meat production **(Urdaneta and Leeson, 2002).**

Therefore, the purpose of the present work was to determine the effect of partially replacing of YC with PPP on the growth performance of Hy-Line W-36 male chick diets with or without enzyme supplementation and use Hy-Line W-36 male chicks to partial participate in solve the problem of low animal protein consumption.

MATERIALS AND METHODS

The experimental work of the present study was carried out at the Poultry Research Station, Poultry Production Department, Faculty of Agriculture, Fayoum University. Chemical analyses were performed in the laboratories of the same department according to the procedures outlined by **A.O.A.C. (1990)**.

The enzyme used in this study was kemzyme dry (KD) which is manufactured by Kemin Company, Egypt, used at a rate of 1 kg/tonne (0.1%) of complete feed. It is a multi-enzyme preparation that includes: alpha-amylase, bacillolysin (protease), beta-glucanase, cellulase complex and lipase. Peels of prickly pears (PPP) were collected from the sellers, and then spread on a clean floor for sun drying. After complete dryness, the material was ground and stored until formulating the experimental diets.

A total number of 180 one-day old Hy-Line W-36 male chicks were used in this experiment and were initially fed a control diet (containing about 23% CP and 2900 Kcal ME/Kg) for 13 days. Chicks were wing-banded and randomly allotted to the dietary treatments. Birds were raised in electrically heated batteries with raised mesh wire floors and had a free access to feed and water. Batteries were placed into a room provided with a continuous light and fans for ventilation. The birds were reared under similar environmental conditions, and were given the experimental diets from 14 days until 70 days of age.

At 14 days of age, birds were divided into six treatments (30 birds each), each treatment contained 3 replicates of 10 birds each.

The experimental treatments were as follows:-

1- The control diet (D_1).

2- The control diet (D_1) + 0.1% KD (D_2).

3- 15% YC in D_1 was replaced by PPP.

4- 15% YC in D_2 was replaced by PPP.

5- 30% YC in D_1 was replaced by PPP.

6- 30% YC in D_2 was replaced by PPP.

The experimental diets were supplemented with minerals and vitamins mixture and DL-methionine to cover the Hy-Line W-36 male chicks recommended requirements (Table1). Birds were individually weighed to the nearest gram at weekly intervals during the experimental period. At the same time, feed consumption was recorded and feed conversion (FC, g feed/g gain) and live body weight gain (LBWG) were calculated. Crude protein conversion (CPC) and caloric conversion ratio (CCR) were also calculated **(Ragab, 2001)**.

Mortality was recorded daily (no mortality of birds were recorded during the study period). At the end of the experiment (70 days), a slaughter test was performed using four chicks around the average LBW of each treatment. Birds were individually weighed to the nearest gram, and slaughtered by severing the carotid artery and jugular veins (islamic method). After four minutes of bleeding, each bird was dipped in a water bath for two minutes and feathers were removed by hand. After the removal of head, carcasses were manually eviscerated to determine some carcass traits, including dressing% (eviscerated carcass without head, neck and legs) and total giblets% (gizzard, liver, heart and spleen). The eviscerated weight included the front part with wing and hind part. The abdominal fat was removed from parts around the viscera and gizzard, and weighed to the nearest gram. The bone of front and rear were separated and weighed to calculate meat percentage. The meat from each part was weighed and blended using a kitchen blender. Chemical analyses of representative samples of the experimental diets and carcass meat (including the skin) were carried out to determine percentages of dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and ash contents according to the methods of **A.O.A.C (1990).** Nitrogen free extract (NFE) was calculated by difference.

Table 1 : Composition and analyses of the experimental diets.

Item, %	0-13 days of age	Level of yellow corn replacing %					
		14 – 42 days of age			43 – 70 days of age		
		0	15	30	0	15	30
Yellow corn, ground	59.25	64.00	54.40	44.80	69.00	58.65	48.30
Prickly pear peels[1]	0.00	0.00	9.60	19.20	0.00	10.35	20.70
Soybean meal (44%CP)	29.90	24.30	23.80	23.30	18.70	18.20	17.70
Broiler concentrate (48%CP[2])	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Sodium chloride	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Vit. and Min. premix [3]	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Dicalcium phosphate	0.40	0.50	0.50	0.50	0.50	0.50	0.50
Vegetable oil [4]	0.00	0.70	1.20	1.70	1.30	1.80	2.30
DL–Methionine	0.10	0.15	0.15	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Determined analysis:							
Moisture	10.30	10.45	10.56	10.60	10.50	10.67	10.59
Crude protein(CP)	22.98	21.03	20.98	21.09	19.06	19.10	18.95
Ether extract (EE)	2.56	2.89	3.03	3.06	2.76	2.83	3.14
Crude fiber (CF)	3.25	3.26	3.39	3.56	3.10	3.18	3.58
Ash	5.21	5.05	6.07	7.18	6.58	8.16	10.04
Nitrogen free extract	55.70	57.32	55.97	54.51	58.01	56.07	53.72
Calculated analysis [5]:							
CP	23.05	21.02	20.96	20.91	18.98	18.94	18.89
EE	2.99	3.83	4.33	4.83	4.57	5.07	5.57
CF	3.50	3.21	3.97	4.72	2.93	3.75	4.56
Calcium	1.21	1.21	1.21	1.21	1.20	1.20	1.20
Available phosphorus	0.64	0.64	0.64	0.64	0.63	0.63	0.63
Methionine	0.46	0.48	0.48	0.48	0.46	0.45	0.45
Methionine+Cystine	0.81	0.81	0.80	0.80	0.75	0.75	0.74
Lysine	1.24	1.10	1.09	1.07	0.96	0.95	0.94
ME, kcal./Kg	2900.3	2999.4	2985.2	2971.1	3096.0	3078.1	3060.2
Cost (£.E./ton) [6]	2175.4	2159.9	2027.7	1895.5	2113.3	1970.2	1827.1
Relative cost [7]	100.0	99.29	93.21	87.13	97.14	90.57	83.99

[1] The proximate chemical composition was calculated according to **Ragab,2007** (10.21, 3.85, 10.45, 15.02% and 2850 for CP, EE, CF, ash and ME Kcal/kg, respectively).

[2] Broiler concentrate manufactured by Hybrid International Company and contains: 48% CP, 2.2% CF, 4.5% EE, 8-10% calcium, 3% available phosphorus, 1.5% methionine, 2% methionine + cystine, 2.7% lysine, 2450 K cal ME/kg. Also, each 1 kg broiler concentrate contains :-120000 IU Vit. A; 25000 IU Vit. D3; 150 mg Vit. E; 15 mg Vit. K3; 10 mg Vit. B1; 50 mg Vit. B2; 20 mg Vit. B6; 150μg Vit. B12; 100 mg pantothenic acid; 300 mg nicotinic acid; 10 mg folic acid; 500μg biotin; 5000 mg choline chloride; 150 mg Cu; 10 mg I; 600 mg Fe; 800 mg Mn; 500 mg Zn; 1.5mg Se; 2 mg Co; 1250 mg anti-oxidant (ethoxyquin).

[3] Each 3.0 Kg of the Vit. and Min. premix manufactured by Agri-Vet Company, Egypt and contains: Vit. A, 12000000 IU ; Vit. D_3 2000000 IU; Vit. E, 10 g; Vit. K_3, 2.0 g; Vit. B1, 1.0 g; Vit. B2, 5 g; Vit. B6, 1.5 g; Vit. B12,10 mg; choline chloride, 250 g; biotin, 50 mg; folic acid, 1 g; nicotinic acid, 30 g; Ca pantothenate, 10 g; Zn, 50 g; Cu,10 g; Fe, 30 g; Co, 100 mg; Se, 100 mg; I, 1 g; Mn, 60 g and anti-oxidant, 10 g, and complete to 3.0 Kg by calcium carbonate.

[4] Mixture from 75% soybean oil and 25% sunflower oil.

[5] According to **NRC, 1994**.

[6] According to the local market price at the experimental time.

[7] Assuming the price of the control group equal 100.

At the end of the growing period, individual blood samples were taken from 4 birds. The blood samples were collected into dry clean centrifuge tubes and centrifuged at 3000 rpm for 20 min. The clear serum samples were carefully drawn and transferred to dry, clean, small glass bottles, and stored at–20Ċ in a deep freezer until the time of chemical determinations. Serum constituents were determined colorimetrically using commercial kits, as previously described by **Ragab (2007).**

To determine the economical efficiency for meat production, the amount of feed consumed during the entire experimental period was obtained and multiplied by the price of one Kg of each experimental diet which was estimated based upon local current prices at the experimental time. Statistical analysis of results was performed using the General Linear Models (GLM) procedure of the SPSS software (SPSS, 1999), according to the follow general model:

$$Y_{ijk} = \mu + L_i + E_j + LE_{ij} + e_{ijk}$$

Where:

Y_{ijk}**:** observed value μ**:** overall mean

L_i**:** level of yellow corn replacing effect (**i**: 0, 15 and 30%)

E_j: enzyme supplementation effect (**j**: 0.0 and 0.1%)

LE_{ij}: interaction of level of yellow corn replacing effect by enzyme supplementation effect

e_{ijk}: random error

Treatment means indicating significant differences ($P \leq 0.01$ and $P \leq 0.05$) were tested using Duncan's multiple range test **(Duncan, 1955)**.

RESULTS AND DISCUSSION

Growth performance: Effect of partially replacing YC with PPP on live body weight (LBW), live body weight gain (LBWG), feed intake (FI) and feed conversion (FC) in growing Hy-Line W-36 male chick diets with or without enzyme supplementation are shown in Table 2. Level of YC replacing effect was significant for LBW at 42 days and LBWG during the periods from 14 to 42 and 14 to 70 days of age (Table 2). However, level of YC replacing had an insignificant effect on LBW at 14 and final body weight of Hy-Line W-36 male chicks at 70 days of age and LBWG during the period from 43 to 70 days.

Table 2: Effect of partially replacing yellow corn (YC) with prickly pear peels (PPP) on live body weight (LBW, g), live body weight gain (LBWG, g), feed intake (FI, g) and feed conversion (FC) of growing Hy-Line W-36 male diets with or without enzyme supplementation.

Items		LBW, g (age / days)			LBWG, g (age period / days)			FI, g (age period / days)			FC (age period / days)		
		14	42	70	14-42	43-70	14-70	14-42	43-70	14-70	14-42	43-70	14-70
Level of YC replacing (L)%:													
0		120.64	520.7[A]	1179.9	400.0[A]	669.4	1061.1[a]	882.6	1853.6[C]	2736.2[C]	2.24[C]	2.78[B]	2.58[C]
15		120.26	491.0[B]	1136.3	370.7[B]	645.3	1016.0[ab]	878.8	1911.1[B]	2789.9[B]	2.41[B]	3.00[A]	2.78[B]
30		123.36	466.1[B]	1119.9	342.7[C]	653.8	996.50[b]	880.3	2004.9[A]	2885.2[A]	2.62[A]	3.10[A]	2.92[A]
±SEM[1]		3.22	9.38	17.18	7.66	10.71	15.72	6.72	9.32	14.05	0.05	0.05	0.05
Enzyme addition (En) %:													
0.00		121.08	492.0	1120.9[b]	371.0	635.7[B]	1001.1[b]	880.2	1896.6[B]	2776.8[B]	2.43	3.02	2.80
0.10		121.76	493.1	1169.8[a]	371.3	676.7[A]	1048.0[a]	881.0	1949.7[A]	2830.7[A]	2.41	2.91	2.72
±SEM		2.63	7.65	14.70	6.26	9.05	12.84	5.49	7.61	11.47	0.04	0.04	0.04
L% x En% (treatments):													
0	0.00	120.33	531.7	1179.8	411.4	668.5	1063.2	912.1[A]	1869.4[C]	2781.6[C]	2.27	2.80	2.62
	0.10	120.95	509.7	1180.0	388.7	670.3	1059.0	853.1[C]	1837.8[C]	2690.9[D]	2.21	2.77	2.55
15	0.00	120.62	490.2	1108.7	369.6	618.4	988.05	857.9[C]	1846.3[C]	2704.2[D]	2.36	3.04	2.77
	0.10	119.91	491.7	1163.9	371.8	672.2	1044.0	899.7[A]	1975.9[B]	2875.6[AB]	2.47	2.97	2.78
30	0.00	122.29	454.1	1074.2	331.9	620.1	951.95	870.5[BC]	1974.2[B]	2844.7[B]	2.67	3.21	3.01
	0.10	124.43	478.0	1165.5	353.5	687.5	1041.0	890.1[AB]	2035.5[A]	2925.7[A]	2.56	2.99	2.83
±SEM		4.55	13.26	24.30	10.84	15.14	22.24	9.51	13.19	19.87	0.08	0.07	0.06

[1] **Pooled SEM**

a, …b, and A,… D, values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to b ; $P \leq 0.01$ for A to D).

Inclusion of PPP in Hy-Line W-36 male chick diets at different levels caused a significant ($P \leq 0.05$) decrease in LBWG during the total period, on the other hand, Hy-Line W-36 male chicks fed diets containing 15 or 0.0% PPP had higher LBWG values during the these period (differences among 0.00 and 15% PPP were not significant).

Interaction due to level of YC replacing x enzyme addition (experimental treatments) had an insignificant effect on LBW and LBWG during all ages studied (Table 2). In conclusion, the experimental results demonstrated that PPP can be used safely in YC based diets up to 30% partial replacing of YC for Hy-Line W-36 male chicks without any adverse effect on chicks LBW and LBWG. These results agree with the findings of **El-Nagmy *et al.* (2001)** who reported that no significant differences in LBW and LBWG due to feeding quail chicks on PPP supplemented with Prozyme and all other treatments.

Concerning the FI values, significant differences were found due to level of YC replacing during the periods from 43 to 70 and 14 to 70 days of age, male chicks fed 0.0% PPP had lower FI during these periods, while, male chicks fed partial replacing of YC by 30% PPP had higher FI value during these periods. On the other hand, partial replacing of YC by PPP increase FI during the periods from 43 to 70 and 14 to 70 days of age when compared with those fed the 0.0% PPP (Table 2). This may be due to the negative factor in this by-product i.e. the high fiber content. The high fiber level may induce a poor digestibility of the diets associated with a higher FI and poorer efficiency of feed utilization. On the other hand, this may give an indication that inclusion of PPP in Hy- Line W- 36 male chick diets did not have a negative effect on diet palatability. Also, it is worthy to note that no mortality was observed during the experimental period, meaning that there is no antinutritional factors in PPP can affect the viability of males.

Concerning the FC values, significant differences were found due to level of YC replacing during all ages studied, male chicks fed 0.0% PPP had the best FC, while, male chicks fed partial replacing of YC by 30% PPP had the worst FC value during these periods.

Enzyme supplementation significantly affected LBW at 70 days, LBWG and FI during the periods from 43 to 70 and 14 to 70 days of age (Table 2). Chicks fed enzyme supplemented diet had heavier LBW at 70 days and LBWG during the periods from 43 to 70 and 14 to 70 days of age. Enzyme supplementation increase FI during the periods from 43 to 70 and 14 to 70 days of age compared with those fed enzyme un-supplement diet (Table 2). On the other hand, enzyme supplementation improves LBW and LBWG compared with those fed enzyme un-supplemented diet (the improvement noted in body weight has been attained due to an significant increase in FI). No significant differences among treatments due to supplementing enzyme to males diet on FC values, numerically, enzyme supplementation improved FC (P>0.05) during all excremental periods (Table 2).

These results are in harmony with those obtained by **Farrel (1994) and El-Sebai and Osman (1999)** who found that enzyme treatment improved LBW of chicks. While, these results disagreed with those of **Emam (2007)** and **Ragab (2007)** who reported that diets supplemented with Kemzyme had insignificantly affected LBW and LBWG of Japanes quail. However, **Zeweil (1996)** reported that LBWG insignificantly increased in the period from 0-3 weeks of age for quails fed diets supplemented with Kemzyme as compared to quails fed diets without enzyme supplementation. These results disagreed with those of **El-Nagmy *et al.* (2001)** who found no significant differences among treatments due to replacing YC by PPP in quail diets either un-supplemented or supplemented with Prozyme. Also, these results agreed with the findings of **Zeweil (1996); El-Gendi *et al.* (2000)**, **Emam (2007) and Ragab (2007)** who reported that birds fed diets supplemented with Kemzyme had significantly the highest FI. Our results are in harmony with those obtained by **Ragab (2007)** who reported that enzyme supplementation insignificantly affected FC values during all periods studied. These results disagreed with those of **Ghazalah *et al.* (1994); El-Sebai and Osman (1999)** and **El-Nagmy *et al.* (2001)** who found that supplementing enzyme mixture to broiler or quail diets containing high level of fiber improved feed utilization.

Significant interactions between level of YC replacing and enzyme supplementation were observed for FI values. It is clear that chicks fed control diet with enzyme supplemented had lower FI value during all experimental periods (Table 2). Interaction due to level of YC replacing x enzyme addition (experimental treatments) had an insignificant effect on FC during all ages studied (Table 2). In conclusion, the experimental results demonstrated that PPP can be used safely in YC based diets up to 30% for Hy-Line W-36 male chicks without any adverse effect on chicks FC (Table 2).

No available publications on the use of PPP in males ration. In this respect, **El-Nagmy *et al*. (2001) and El-Kholy (1999)** reported that FI was not affected due to replacing YC by PPP in quail or fish diet, while, supplemented PPP diets with Prozyme was significantly ($P<0.05$) improved FC compared with the unsupplemented diets, however, the differences were insignificant compared with the control diet.

Effect of partially replacing YC with PPP on crude protein conversion (CPC) and caloric conversion ratio (CCR) male chick diets are shown in Table 3. Level of YC replacing effect was significant for CPC and CCR during the periods from 14 to 42, 43 to 70 and 14 to 70 days of age (Table 3), it is clear that, inclusion of PPP in Hy-Line W-36 male chick diets at different levels caused a significant ($P\leq0.01$) decrease CPC and CCR during these periods. Male chicks fed 0.0% PPP had better CPC and CCR values during the privies periods, while, male chicks fed partial replacing of YC by 30% PPP had worst CPC and CCR values during all periods studied (Table 3).

Enzyme supplementation insignificantly affected CPC and CCR during all experimental periods. Enzyme supplementation improved ($P>0.05$) CPC and CCR during these periods compared with those fed enzyme unsupplemented diet but the differences were not significant (Table 3). Interaction due to level of YC replacing x enzyme supplementation had also insignificant effect on CPC and CCR (statistically, the same trend as that of LBW, LBWG and FC) during the all periods studied (Table 3). In conclusion, the experimental results demonstrated that PPP can be used safely in YC based diets up to 30% for Hy-Line W-36 male chicks without any adverse effect on chicks CPC and CCR (Table 3).

Table 3: Effect of partially replacing yellow corn (YC) with prickly pear peels (PPP) on crude protein conversion (CPC) and caloric conversion ratio (CCR) of growing Hy-Line W-36 males diet with or without enzyme supplementation.

Items		CPC (age period / days)			CCR (age period / days)		
		14-42	43-70	14-70	14-42	43-70	14-70
Level of YC replacing (L)%:							
0		0.462^{B}	0.542^{B}	0.505^{B}	6.67^{C}	8.54^{B}	7.65^{C}
15		0.489^{B}	0.577^{A}	0.533^{A}	7.12^{B}	9.18^{A}	8.15^{B}
30		0.528^{A}	0.588^{A}	0.558^{A}	7.71^{A}	9.43^{A}	8.57^{A}
±SEM[1]		0.011	0.010	0.009	0.16	0.15	0.14
Enzyme addition (En) %:							
0.00		0.495	0.579	0.539	7.20	9.22	8.24
0.10		0.491	0.558	0.525	7.14	8.88	8.01
±SEM		0.009	0.008	0.007	0.13	0.13	0.11
L% x En%(treatments):							
0	0.00	0.468	0.544	0.512	6.75	8.58	7.76
	0.10	0.456	0.539	0.497	6.58	8.49	7.54
15	0.00	0.478	0.584	0.531	6.96	9.29	8.13
	0.10	0.500	0.570	0.535	7.28	9.07	8.18
30	0.00	0.539	0.610	0.574	7.88	9.78	8.83
	0.10	0.517	0.567	0.542	7.55	9.09	8.32
±SEM		0.015	0.014	0.013	0.22	0.22	0.19

[1] **Pooled SEM**

A,… C, values in the same column within the same item followed by different superscripts are significantly different (at P ≤0.01 for A to C).

These results agreed with those of **Ragab (2007)** who found that enzyme supplementation insignificantly affected CPC and CCR in quail diets during all periods studied. However, **El-Nagmy *et al.* (2001)** found that supplementing enzyme mixture to quail diets containing high level of fiber improved CCR.

Blood parameters: Table (4) shows effect of partially replacing YC with PPP on some blood parameters. Calcium, cholesterol, triglycerides, AST, total protein, albumin, globulin and glucose were not affected significantly by level of YC replacing. Level of YC replacing effect was significant only for ALT and albumin/globulin ratio (Table 4). Male chicks fed 0.0% PPP had lower ALT and albumin/globulin ratio, whereas, those fed partial substitution of YC by 15 and 30% PPP had higher ALT and albumin/globulin ratio, respectively at the end of experimental periods. Numerically, partial substitution of YC by PPP decrease cholesterol and globulin, but increase AST and albumin (P>0.05) when compared with those fed 0.0% PPP (Table 4).

Table 4: Effect of partially replacing yellow corn (YC) with prickly pear peels (PPP) on some blood parameters of growing Hy-Line W-36 males diet with or without enzyme supplementation.

Items		Calcium mmol/L	Cholesterol mmol/L	Triglycerides mmol/L	AST U/ml	ALT U/ml	Total protein g/L	Albumin g/L	Globulin g/L	Albumin / Globulin ratio	Glucose mmol/L
Level of YC replacing (L)%:											
0		4.81	3.68	1.001	57.00	16.75[B]	46.65	19.31	27.34	0.718[b]	19.19
15		2.99	3.64	1.068	61.50	30.25[A]	48.46	21.41	27.06	0.795[b]	18.03
30		3.32	3.52	0.947	67.00	25.75[A]	42.03	22.96	19.07	1.367[a]	19.48
±SEM[1]		0.79	0.14	0.06	3.91	1.89	2.87	1.19	2.66	0.13	1.11
Enzyme addition (En) %:											
0.00		3.11	3.57	0.963	61.83	24.83	47.91	21.81	26.11	0.870	20.72[a]
0.10		4.30	3.65	1.047	61.83	23.67	43.52	20.65	22.87	1.050	17.08[b]
±SEM		0.64	0.11	0.05	3.19	1.54	2.34	0.97	2.17	0.11	0.91
L% x En% (treatments):											
0	0.00	4.04	3.64	1.023	57.00	17.50	46.15	20.06	26.09	0.775	20.53
	0.10	5.58	3.72	0.978	57.00	16.00	47.14	18.56	28.58	0.661	17.85
15	0.00	3.60	3.65	0.880	68.50	29.50	49.78	22.14	27.64	0.804	19.73
	0.10	2.38	3.62	1.257	54.50	31.00	47.14	20.67	26.47	0.786	16.32
30	0.00	1.70	3.42	0.987	60.00	27.50	47.80	23.21	24.59	1.031	21.90
	0.10	4.94	3.62	0.907	74.00	24.00	36.26	22.71	13.55	1.703	17.06
±SEM		1.11	0.20	0.08	5.53	2.67	4.06	1.68	3.76	0.18	1.57

[1] Pooled SEM

a, …b, and A,… B, values in the same column within the same item followed by different superscripts are significantly different (at $P \le 0.05$ for a to b ; $P \le 0.01$ for A to B).

Concerning the impact of enzyme supplementation, insignificant (P>0.05) effects were observed in blood parameters except, glucose (Table 4), it was found to be significantly (P≤0.05) higher in chicks fed unsupplemented diets. Interaction due to partially replacing YC with PPP (level x enzyme supplementation) insignificantly affected some blood parameters during all growth periods (Table 4).

In this respect, **Ragab (2007)** indicate that the effects of replacing YC with PPP on serum constituents in growing Japanese quail diets with or without enzyme supplementation were insignificant except for AST, ALT and glucose contents.

Slaughter parameters%: The slaughter parameters of chicks fed different levels of PPP with or without enzyme supplementation are presented in Table 5. It is clear that, partially replacing YC with PPP level, enzyme supplementation and interaction due to partially replacing YC with PPP level x enzyme supplementation insignificantly affected slaughter parameters during all experimental periods (Table 5). Therefore, it may be concluded that PPP used in this study can substitute up to 30% of YC at 14 to 70 days of age without any detrimental effect on slaughter parameters. These results are in harmony with those obtained by **Ragab (2007)** who reported either level of PPP or enzyme supplementation insignificantly affected slaughter parameters of Japanese quails.

Chemical composition of Hy-Line W-36 male chicks meat: Data presented in Table (6) showed that level of YC replacing and enzyme significantly affected protein% of chicks meat. Higher protein (consequently lower fat%, (P>0.05)) values were observed for chicks fed diet containing 30% replacing YC with PPP, while those fed 0.0% PPP had lower protein of meat. However, insignificant differences were observed in moisture, fat, ash and NFE percentages of meat.

Concerning the impact of enzyme supplementation, lower protein% values were observed for chicks fed enzyme supplemented diet compared with those fed the diet without enzyme supplementation. However, insignificant differences were observed in moisture, fat, ash and NFE percentages of meat.

Table 5: Effect of partially replacing yellow corn (YC) with prickly pear peels (PPP) on some slaughter parameters% of growing Hy-Line W-36 males diet with or without enzyme supplementation.

Items		Live body weight (g)	Slaughter parameters%							
			Total giblets	Abdominal fat	Half front	Half rear	Front meat	Rear meat	Carcass weight after evisceration	Dressing
Level of YC replacing (L)%:										
0		1128.4	4.91	0.428	14.28	15.03	72.20	71.97	71.43	64.75
15		1107.3	5.18	0.578	14.33	14.64	68.76	70.02	71.33	63.96
30		1092.9	5.32	0.216	13.43	15.52	71.33	70.27	71.69	64.54
±SEM[1]		18.01	0.13	0.17	0.30	0.22	1.62	1.21	0.45	0.49
Enzyme addition (En) %:										
0.00		1110.8	5.15	0.385	14.10	14.93	69.60	71.05	71.25	64.38
0.10		1108.3	5.12	0.430	13.92	15.20	71.92	70.46	71.71	64.46
±SEM		14.71	0.11	0.14	0.24	0.18	1.32	0.99	0.37	0.40
L% x En% (treatments):										
0	0.00	1161.5	5.00	0.544	14.30	14.87	71.35	72.52	71.42	64.62
	0.10	1095.3	4.82	0.311	14.26	15.19	73.05	71.41	71.45	64.89
15	0.00	1083.7	5.30	0.399	14.13	14.52	68.18	69.90	71.31	64.07
	0.10	1131.0	5.06	0.757	14.53	14.76	69.35	70.14	71.34	63.85
30	0.00	1087.3	5.16	0.212	13.89	15.39	69.28	70.72	71.03	64.44
	0.10	1098.6	5.48	0.221	12.98	15.64	73.37	69.82	72.35	64.64
±SEM		25.47	0.18	0.23	0.42	0.32	2.29	1.72	0.64	0.69

[1] Pooled SEM

Table 6: Effect of partially replacing yellow corn (YC) with prickly pear peels (PPP) on chemical composition of meat% of growing Hy-Line W-36 males diet with or without enzyme supplementation.

Items		Moisture%	Protein%	Fat%	Ash%	NFE%
Level of YC replacing (L)%:						
0		69.95	19.44^{b}	7.79	1.60	1.22
15		69.22	20.66^{ab}	7.42	1.48	1.23
30		69.50	21.07^{a}	6.94	1.40	1.22
±SEM[1]		0.50	0.43	0.52	0.07	0.01
Enzyme addition (En) %:						
0.00		69.09	20.96^{a}	7.29	1.45	1.23
0.10		70.02	19.74^{b}	7.48	1.54	1.22
±SEM		0.41	0.35	0.44	0.06	0.01
Carcass part						
Front		69.45	21.43^{A}	6.11^{B}	1.59^{a}	1.22
Rear		69.65	19.38^{B}	8.54^{A}	1.40^{b}	1.23
±SEM		0.42	0.33	0.35	0.06	0.01
L% x En% (treatments):						
0	0.00	69.27	19.78	8.26	1.47^{ab}	1.22
	0.10	70.62	19.10	7.33	1.73^{a}	1.22
15	0.00	68.67	21.23	7.28	1.59^{ab}	1.23
	0.10	69.77	20.09	7.56	1.36^{b}	1.22
30	0.00	69.32	21.85	6.32	1.29^{b}	1.22
	0.10	69.67	20.03	7.56	1.51^{ab}	1.23
±SEM		0.70	0.60	0.75	0.09	0.01

[1] **Pooled SEM**

a, …b, and A,… B, values in the same column within the same item followed by different superscripts are significantly different (at P ≤ 0.05 for a to b ; P ≤0.01 for A to B).

Carcass part significantly influenced (P≤0.05 and P≤0.01) protein, fat and ash%, front part had higher protein and ash% (consequently lower fat%) than the rear part. However, the rear part had higher fat than front part (Table 6). Interaction due to level of YC replacing and enzyme insignificantly affected chemical composition of meat, except ash% (Table 6). In this respect, **Ragab (2007)** show that level of PPP insignificantly affected chemical composition of quail meat. Also, he demonstrated that carcass part significantly influenced ash%, front part had higher ash%, than rear part, however, insignificant differences were observed in NFE percentages of meat. On the other hand, KD supplementation significantly affected moisture and EE%, higher moisture (lower EE%) values were observed for quails fed diet without enzyme supplementation, while those fed 0.1% KD had lower moisture% and consequently higher EE% (**Ragab, 2007)**.

Economical efficiency (EEf): Results in Table (7) show that EEf values during the period from 14 to 70 days of age was improved of chicks fed diets 6,3,2,5 and 4 as compared with those fed the control diet. Chicks fed diet 6 had the best economical and relative efficiency values being 1.842 and 108.77%, respectively followed by chicks fed diet 3 (1.756 and 103.70%, respectively) then chicks fed diet 2 (1.735 and 102.47%, respectively) when compared with chicks fed control diet. Whereas, chicks fed control diet had the lowest corresponding values, being 1.694 and 100.00%, respectively. The relative efficiency varied between 100.00% (diet 1) to 108.77% (diet 6) which is of minor importance relative to other factors of production. This again favors the use of PPP with enzyme than use of the PPP without enzyme supplementation in feeding Hy-Line W-36 male chicks (Table 7).

On the other hand, results in Table (7) show that EEf values during the period from 14 to 70 days of age was improved of Hy-Line W-36 male chicks fed all experimental diets containing PPP with or without enzyme as compared with those fed the control diet. This is logical since the tested material (PPP) has low or no price compared to the YC, so any substitution level will enhance in lowering feed cost, and thus increasing the economic efficiency.

These results are in harmony with those obtained by **El-Nagmy *et al.* (2001) and Ragab (2007)**, who found that feeding quails PPP with Prozyme or KD, respectively, increased relative economical efficiency as compared with groups fed corn as the only source of energy. Similar results with other agricultural by-products supplemented with enzyme preparation were reported by **Ghazalah *et al*. (1994)** and **El-Sebai and Osman (1999).**

Table 7: Effect of partially replacing yellow corn (YC) with prickly pear peels (PPP) on economical efficiency (EEf) of growing Hy-Line W-36 males diet with or without enzyme supplementation.

Items	Level of YC replacing by PPP %					
	0		15		30	
	0.0En*	0.1 En	0.0 En	0.1 En	0.0 En	0.1 En
	D**1	D2	D3	D4	D5	D6
a_1	0.9121	0.8531	0.8579	0.8997	0.8705	0.8901
b_1	215.99	218.99	202.77	205.77	189.55	192.55
a_1 x b_1=c_1	197.004	186.820	173.956	185.131	165.003	171.389
a_2	1.8694	1.8378	1.8463	1.9759	1.9742	2.0355
b_2	211.33	214.33	197.02	200.02	182.71	185.71
a_2 x b_2=c_2	395.06	393.90	363.76	395.22	360.71	378.01
(c_1+c_2)=c_{total}	592.06	580.72	537.71	580.35	525.71	549.40
d	1.0632	1.059	0.98805	1.044	0.95195	1.041
e	1500.0	1500.0	1500.0	1500.0	1500.0	1500.0
d x e=f	1594.8	1588.5	1482.1	1566.0	1427.9	1561.5
f- c_{total} =g	1002.74	1007.78	944.36	985.65	902.22	1012.10
g/ c_{total}	1.6936	1.7354	1.7562	1.6984	1.7162	1.8422
r	100.00	102.47	103.70	100.28	101.33	108.77

* Enzyme % ** Diet

a_1 and a_2 ……………..average feed intake (Kg/bird) during the periods from 14-42 and 43-70 days of age, respectively.

b_1 and b_2…………..… price / Kg feed (P.T.) during the periods from 14-42 and 43-70 days of age, respectively (based on average local market price of diets during the experimental time).

c_1 and c_2……………. feed cost (P.T.) during the periods from 14-42 and 43-70 days of age, respectively.

Total feed cost (P.T.) = c_{total} = (c_1+c_2)

Average LBWG (Kg/ bird) d

Price / Kg live weight (P.T.) e……..(according to the local market price at the experimental time).

Total revenue (P.T.) = d x e = f

Net revenue (P.T.) = f - c_{total} =g

Economical efficiency = (g / c_{total}) ......(net revenue per unit feed cost).

Relative efficiency r…….(assuming that economical efficiency of the control group (1) equal 100)

Generally, it may be concluded from the economical point of view that:

1- The best performance was seen when 30% PPP+KD was incorporated in Hy-Line W-36 male chick diets. Prickly pear peel may make an attractive option for Hy- Line W- 36 male chicks production when the availability of corn is limited and corn prices are elevated.

2- Enzyme supplementation to diets of Hy- Line W- 36 male chicks are beneficial in productive performance as it decreased the dietary cost.

3- We suggest that Hy-Line W-36 male chicks can be used to partial participate in solve the problem of low animal protein consumption.

4- More research is necessary regarding the use of PPP in feeding different species of poultry with regard to their digestibility, amino acid profile and content of anti-nutritional factors.

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تأثير الاستبدال الجزئي للأذرة الصفراء بقشر التين الشوكي علي الأداء الإنتاجي لذكور Hy-Line W-36 النامية

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أجريت هذه التجربة في المزرعة التجريبية الخاصة بقسم الدواجن - كلية الزراعة – جامعة الفيوم. بغرض تأثير الاستبدال الجزئي للأذرة الصفراء بقشر التين الشوكي علي الأداء الإنتاجي لذكور Hy-Line W-36 النامية. استخدم مخلوط الإنزيمات التجارية كيم زايم دراي **(0.1%)** بمعدل ١ كجم/طن قسمت الطيور علي عمر ١٤ يوم إلي ٦ معاملات (٣٠ طائر / معاملة) واحتوت كل معاملة علي ٣ مكررات (١٠طائر / مكرر) كما يلي:

١- كنترول. ٢- كنترول + ٠,١ % كيم زايم.

٣: استبدال ١٥% من الأذرة الصفراء في عليقة ١ بقشر التين الشوكي.

٤: استبدال ١٥% من الأذرة الصفراء في عليقة ٢ بقشر التين الشوكي.

٥: استبدال ٣٠% من الأذرة الصفراء في عليقة ١ بقشر التين الشوكي.

٦: استبدال ٣٠% من الأذرة الصفراء في عليقة ٢ بقشر التين الشوكي.

وتتلخص النتائج المتحصل عليها فيما يلي:-

١- لم يكن هناك آي تأثير معنوي نتيجة الاستبدال الجزئي للأذرة الصفراء بقشر التين الشوكي في علائق ذكور Hy-Line W-36 النامية مع أو بدون إضافة الإنزيمات علي وزن الجسم الحي، وزن الجسم المكتسب، كفاءة تحويل كلا من الغذاء والطاقة والبروتين طوال فترات الدراسة.

٢-استهلكت المجموعة التي غذيت علي عليقة المقارنة أقل كمية غذاء مستهلك خلال الفترة النهائية. بينما استهلكت الطيور المغذاه علي عليقة تحتوي علي ٣٠% قشر التين الشوكي+ الإنزيم أعلي كمية غذاء مستهلك في الفترة من ١٤-٧٠ يوم من العمر.

٣-أدت إضافة الإنزيمات إلي تحسن معنوي في كلا من وزن الجسم الحي، وزن الجسم المكتسب، كفاءة تحويل كلا من الغذاء والطاقة والبروتين الفترة من ١٤-٧٠ يوم من العمر.

٤- لم يكن هناك اي تأثير معنوي نتيجة الاستبدال الجزئي للأذرة الصفراء بقشر التين الشوكي في علائق ذكور Hy-Line W-36 النامية مع أو بدون إضافة الإنزيمات علي صفات الذبيحة بعض صفات الدم والتحليل الكيمائي للحم فيما عدا نسبة الرماد.

٥- أظهرت ذكور Hy-Line W-36 النامية المغذي علي عليقة تحتوي علي ٣٠% + الأنزيم قشر التين الشوكي أحسن كفاءة اقتصادية واعلي كفاءة اقتصادية ونسبية (١,٨٤٢ و ١٠٨,٧٧%) عند مقارنتها بمجموعة المقارنة.

ومن هذه النتائج يمكن استنتاج أن أحسن أداء إنتاجي لذكور Hy-Line W-36 النامية كان عند التغذية علي عليقة تحتوي علي ٣٠% قشر التين الشوكي مضاف إليها الإنزيمات. يمكن استخدام ذكور Hy-Line W-36 النامية لحل مشكلة نقص البروتين الحيواني جزئياً