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EFFECT OF USING RAW PALM KERNEL MEAL AND TREATED WITH LOCAL ENZYMES (CELLULASE, AMYLASE, AND PROTASE) INSTEAD OF YELLOW CORN IN COMMON CARP FISH (*CYPRINUS CARPIO*) DIETS

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Abstract

The experiment was conducted with the aim of using the raw palm kernel meal(PKM) and Palm kernel meal treated with local enzymes (Cellulase, Amylase, and Protase) (Produced-laboratory)(PKME), And partially and completely replaced by 33%, 66% and 100% from yellow corn in common carp fish diets *Cyprinus carpio L.* for 75 days. Fish (70 fish) were randomly distributed to 7 Experimental treatment by 2 replicate per transaction (5 fish per replicate), the average individual weight of 41.26 gm in 14 aquariums. Fish were fed 3% of body weight with protein-content diets about 31.41% and 31.99% and energy ranged from 2785 Kcal/kg and 3035 Kcal/kg. The control treatment was T1-free with (PKM) and (PKME), The T2, T3, and T4 contained PKM by replacing 33%, 66% and 100% of yellow corn respectively, and the treatments T5, T6 and T7 contained PKME by replacing 33%, 66% and 100% of yellow corn respectively. The following parameters were studied as it is Final Weight (FW), Weight Gain (WG), Specific Growth Rate (SGR), Feed Conversion Rate(FCR), Protein Efficiency Ratio(PER), Protein Production Value(PPV), and Feed Intake(FI). The results showed a High Significant difference ($P < 0.01$) for T2 in the final weight, weight increase, and specific growth rate of 61.50 g / fish, 20 g / fish, and 0.7gm/day, respectively. T1 was the highest in amount of feed intake was 79.46 g, followed by T2 with the amount of 77.74 g. T2 recorded the lowest feed conversion ratio of 3.90 and did not differ significantly with T1, T2, T3, and T5. The differences in protein efficiency ratio (PER) were not significant among the treatments; T1, T2, T3, and T5 were 0.78, 0.82, 0.70 and 0.72, respectively. While T7 was significantly higher ($P < 0.01$) in protein product value of 7.44%. The study concluded that there is an effective role to substitution a raw palm kernel meal (PKC) by 33% of yellow corn 25% in common carp fish diets, as it led to an increase in the growth criteria and the criteria of the assessment of the diets and protein.

***Keywords*:** Palm kernel, enzymes, yellow corn, common carp fish

Introduction

The high total cost of fish production comes from the high cost of feeding. There have been many attempts to reduce the cost of fish feed, either by reducing the proportion of animal protein used in these feeds or replacing one of its components with other non-conventional materials that are cheaper. Including the remnants of the food industries and the remnants of agricultural crops and their inclusion in feed components, they either progress in raw form or after performing some treatments to improve their nutritional value (physico-chemical-microbial). This study was conducted as one of the means For the use of palm residues (palm kernel) in fish feeding, the ratio of palm kernel was estimated to be about 11.4% to 21% of the fruit weight (Azri, 2013), It contains protein, fat, carbohydrates and fiber up to 6.9%, 10.9%, 80% and 16.7%, respectively (Ur Rehman *et al*., 2017). as well as free of aflatoxin (Nuzul, 2013). As well as containing a high proportion of food energy equivalent to almost the energy found in traditional feed sources such as corn, barley, wheat bran, and others.

Yellow corn is widely used as a source of energy for fish feed, And because the cost is high, so it can be replaced with raw palm kernel meal or palm kernel meal treated with enzymes. The palm kernel contains high levels of Non-Starch Polysaccharides (NSP) in the cell wall of (lignin, cellulose and hemicellulose) (N.R.C., 2011), fodder enzymes are used to overcome the negative effects of NSP In feeding the fish with a simple stomach, NSP causes increased viscosity in the intestines that inhibits active contact between digestive enzymes and primary nutrients and leads to significant changes in the composition and function of the intestines(Afaf *et al*., 2001), Enzymes help to release reduced sugars by breaking down and destroying the cell wall in the palm kernel and releasing the nutrients Thus helping to absorb these sugars and nutrients and thus improve the effectiveness and quality of the palm kernel meal (Saenphoon *et al*., 2011). it has been observed that some of the enzymes treated with palm kernel meal such as Cellulase, Amylase, and Protase improve the growth and efficiency of feed utilization (Ng *et al*., 2002). The study aimed at the possibility of using the raw palm kernel meal(PKM) and Palm kernel meal treated with local enzymes (Produced-laboratory) (PKME) And Partially and completely replaced by yellow corn in common carp fish diets *Cyprinus carpio*.

Materials and Methods

Treatment of palm kernel meal with local enzymes

Obtained from their preparation in the laboratories of the Center for Biotechnology-Agricultural Research Department. The weight of 5 ml of the enzyme was added to 1000 g of meal of palm kernel , then transferred to the incubator for 24 hours at 28 °C And then placed in the oven 40 °C for 48 hours for drying.

The Experiment

After the preparation of the Feeding materials, seven diets were formed with a partial and total replacement of 25% yellow corn in both raw PKM and PKME with 33%, 66% and 100% for each treatment (table 1).

70 fish of common carp *Cyprinus carpio L.* were randomly distributed to 7 Experimental Transactions by 2 replicate per transaction (5 fish per replicate), the average individual weight of 41.26 gm in 14 aquariums (dimensions 30*40*40 cm), Fish were fed 7 diets, gradually until reaching 3% of fish weight was reached by three meals (7 am, 11 am, 4 pm). The Regionalization period lasted 10 days and the experiment lasted 75 days starting from 18/8/2018. The fish were weighed every 15 days with a Chinese electronic sensitive balance.

Table 1 : Experimental diet

Ingredients	control	PKM			PKME		
	T1 0%	T2 33%	T3 %66	T4 %100	T5 %33	T6 %66	T7 %100
Fishmeal	20	20	20	20	20	20	20
Soybean Meal	33	33	33	33	33	33	33
yellow corn	25	16.75	8.5	0	16.75	8.5	0
PKM	0	**8.25**	**16.5**	25	**8.25**	**16.5**	25
bran	3	3	3	3	3	3	3
Flour	4	4	4	4	4	4	4
Millet	5	5	5	5	5	5	5
Rice bran	7	7	7	7	7	7	7
Fish oil	1	1	1	1	1	1	1
minerals and Vitamins	1	1	1	1	1	1	1
salt	1	1	1	1	1	1	1
	Chemical Analysis						
Crude Protein%	**31.49**	**31.44**	**31.41**	**31.36**	**31.66**	**31.82**	**31.99**
Crude Lipid%	**5.38**	**5.24**	**5.11**	**4.97**	**5.19**	**5.01**	**4.82**
Crude Fiber%	**4.07**	**6.07**	**8.07**	**10.13**	**5.47**	**6.87**	**9.32**
carbohydrate%	**40.12**	**38.81**	**37.65**	**36.37**	**39.42**	**38.72**	**37.00**
Ash%	**9.09**	**8.08**	**8.07**	**8.06**	**8.19**	**8.29**	**8.39**
Gross Energy kcal/kg	**3035**	**2950**	**2970**	**2785**	**3006**	**2977**	**2947**

Growth parameters

Weight Gain (WG)

Weight Gain (g / fish) = final weight (g) - initial weight (g) (Pitcher and Hart, 1982)

Specific Growth Rate(SGR)

$$SGR = \frac{\text{lin final weight - lin initial weight}}{\text{Trial duration}} \times 100$$

(Jobling and Koskela, 1996)

Feed Conversion Ratio (FCR)

$$FCR = \frac{\text{Weight of feed intake (g)}}{\text{Weight gain (g)}}$$ (Uten, 1978)

Protein Efficiency Ratio (PER)

$$PER = \frac{\text{Weight gain (g)}}{\text{Protein Intake (g)}}$$ (Gerking *et al.* 1971)

Productive Protein Value (PPV)

$$PPV = \frac{\text{Protein retained in tissue}}{\text{Dietary Protein consumed}} \times 100$$ (Donald *et al.*, 1976)

Results and Discussion

Growth parameters : FW, WG, and SGR

The results showed that there were no significant differences between the treatments for the initial weight (table 2), While the final weight rate (FW) recorded High significant differences ($P < 0.01$) between the treatments, As it excelled T2 and T1 at Rate 61.50 g and 61.40 g respectively on all treatments, There were no significant differences between T5 and T3 and T6 respectively.

The results showed a table (2) of the Weight Gain (WG) has High significant differences ($P < 0.01$)between the treatments, T2 exceeded the highest rate of 20 g / fish on the experimental treatments except for the control treatment (T1) and the treatment T5 at 19.60 and 17.20 g / Respectively, The differences were not significant between T5 and T3 and T6 .

The results showed that the Specific Growth Rate (SGR)(Table 2) high significant differences($P < 0.01$)for T2 and T1 (0.70 and 0.69% respectively) on treatments with no significant differences with T5 and T3 on 0.62 and 0.61% respectively.

The results showed that T2 (Raw palm kernel meal (PKM) 33% replace from yellow corn) was the highest for all traits (final weight (FW), Weight gain (WG), relative growth rate (RGR), and specific growth rate (SGR)) Followed by the treatment of T1 (control) and the treatment of palm kernel meal treated with local enzymes (PKME) by replacing 33%(T5) compared to other treatments, parameters gradually decrease with the increase in the percentage of replacement from 33% to 66% to 100%.

May be caused The improvement in the growth rates of T2, T1, and T5 Compared to other treatments to maintain fish these treatments to consume the same amount of feed suitable for growth during the days of the experiment giving them the ability to gain more weight compared to fish other treatments. This may be due to the fact that the palm kernel contain digestible carbohydrates, as the fibers of palm kernel contain monosaccharides such as glucose, fructose, maltose, and mannose (Khalid *et al*., 2016) and polysaccharides such as cellulose, hemicellulose, xylose, and lignin

These monosaccharides and polysaccharides have an interrelated effect in regulating the digestion rate and absorption of nutrients, the basic article l of the intestinal tubule (Microflora) found in the gut, And helps to soften and relax the intestines of the bowel (Schneeman, 2002). Aldhaheri *et al*. (2004) also noted that mannose accounted for 78.3% of totally free sugar after hydrolyzing carbohydrates to monosaccharides, the high ratio of mannose May be caused to improved growth parameters in T2 treatment, which acts as a growth promoter.

The result was better than the result of Ahmed and others (2017) when adding (PKM) by 0%, 2.5% and 5% in

common carp fish diets for 70 days, The treatment recorded (PKM) 5% the highest rates of in weight gain (WG) and Specific growth rate (SGR).

The reason of improvement in the growth of T5 may be to treat Palm kernel meal by local enzymes and the release of nutrients present in the fiber and smashing the cellulose and protein chain and making it more palatability and digestible increasing the digestibility thus improving the efficiency of nutrition, as confirmed by Kroghahl *et al*. (2010), While Ng *et al*. (2002) found that there is a higher significant differences (P<0.05) in the values of FW, WG, and SGR for treatment 40% Palm kernel meal treated with enzymes for (Protase, Amylase, Cellulase, and Lipase) compared to the treatment with a 40% raw palm kernel meal And did not differ with treatments containing 20% palm kernel meal with and without enzymes in tilapia fish diets.

The results showed that the growth parameters were reduced when the replacement rate of yellow corn increased by the raw palm kernel meal (PKM) and palm kernel meal treated with local enzymes (Produced - laboratory) (PKME) increased to 66 and 100%, This may be due to the low feed intake (Table 3). The low of feed intake was due to the high fiber content of the palm kernel (Belal and Al-Awaifer, 2005) which negatively affected fish growth, the reason may also be attributed to the non-palatability of these diets By the fish, This hypothesis was agreed with the findings of Gaber *et al.* (2012) that the diet's palatability decreases with the increase of palm kernel meal, When the yellow corn was replaced by 0, 15, 30 and 45% palm kernel meal.

Table 2 : Growth parameters for common carp fish fed on diets containing (PKM), (PKME) (mean ± standard error)

Specific growth rate %	Weight gain g / fish	Final weight g / fish	Initial weight g / fish	Treatments
0.0±0.69 a	0.0±19.60 ab	0.0±61.40 a	0.0±41.80 a	T1
0.03±0.70 a	1.0±20.00 a	1.1±61.50 a	0.1±41.50 a	T2
0.05±0.61 abc	1.3±16.70 c	1.1±57.90 b	0.2±41.20 a	T3
0.05±0.51 de	1.3±13.30 de	1.1±54.10 de	0.0±40.80 a	T4
0.04±0.62 ab	1.0±17.20 abc	0.5±58.30 b	0.5±41.10 a	T5
0.04±0.58 bcd	1.3±15.90 c	1.3±57.50 b	0.0±41.60 a	T6
0.01±0.42 e	0.3±11.10 e	0.3±52.50 e	0.0±41.40 a	T7
**	**	**	N.S	significant level
N.S : no significant differences / ** : (0.01 <P)				

T1: Treatment of control
T2: Treatment of (PKM) with 33% replacement ratio of the 25% proportion of yellow corn
T3: Treatment of (PKM) with 66% replacement ratio of the 25% proportion of yellow corn
T4: Treatment of (PKM) with 100% replacement ratio of the 25% of yellow corn
T5: Treatment of (PKME)with 33% replacement ratio of 25% of yellow corn
T6: Treatment of (PKME) with 66% replacement ratio of 25% of yellow corn
T7: Treatment of (PKME) with 100% replacement ratio of 25% of yellow corn

Feed intake (FI), Food conversion rate (FCR), Protein efficiency ratio (PER), Protein production value (PPV)

The results for the feed intake (FI) (Table 2) showed High significant differences (P < 0.01) between the treatments, T1 the control treatment have the highest amount wich 79.46 g / fish on the experimental treatments , but which did not differ significantly from T2 amount of 77.74 g / fish which did not significant differences with T6, T5 and T3 respectively, The latter treatments showed no significant differences, and between T4 and T7, which recorded the lowest quantities, It is clear from the foregoing that the amount of feed consumed decreases gradually with the increase of the raw palm kernel meal (PKM) and Palm kernel meal treated with local enzymes (PKME) in the diets, Belal and Al-Owaifer (2005) explained the reason for the decrease in the amount of feed consumed is due to the high percentage of dietary fiber in the palm kernel meal. Low intake of diets may be due to an anti-nutrient factor that will affect the Palatability of diets with content high of the raw palm kernel meal(PKM) and Palm kernel meal treated with local enzymes (PKME), Belal (2008) indicated that palm kernel fiber contains galactomannan, a growth inhibitor that can reduce the palatability and consumption of diets and thus negatively affect fish.

The results of the statistical analysis showed high significant differences (P < 0.01) between the treatments in FCR (Table 3), the treatment T2 recorded the lowest dietary conversion ratio of 3.9, with no significant differences with T1, T5 and T3, This may be due to improved digestion and absorption of nutrients in the fish intestines. Sigleo *et al*. (1984) have shown that some fibrous compounds (methoxylated pectin and cellulose) cause changes in the length and width of the villus and its number. Belal *et al*. (2015) observed in the study conducted on the feeding of tilapia fishes by diets containing 0% and 20% palm kernel meal resulted in an increase in villus Intestinal in terms of number and size compared to other proportions, which led to an improvement in the absorption of nutrients and make up for their lack in palm kernel meal. While Led the increase in the percentage of palm kernel meal to 30% to negative changes in the intestinal villus. Kwasi *et al*. (2015) found that the feed conversion ratio containing 18% and 36% palm kernel meal was high 3.45 and 4.18 respectively, with the superiority of control with the lowest feed conversion ratio of 2.7%.

The results showed that the protein efficiency ratio (PER) (Table 3) was higher significant differences (P < 0.01) for T2 and T1 by 0.82 and 0.78% respectively. The results show that the efficiency benefit of the common carp fish intake from the protein found in the diet for the treatments containing the palm kernel meal(PKM) and Palm kernel meal treated with local enzymes (PKME) parameters 33% replacement ratio and the control treatment, came in the first in comparison to other treatments with 66% and 100%

replacement ratio, This may be due to the high proportion of fiber in those diets, which accelerated the passage of food in the gut and this led to a reduction in the benefit of the protein found in those diets, This is confirmed by Kwasi *et al*. (2015).

The results of the statistical analysis showed a table (3) for protein production value (PPV) The High significant differences (P < 0.01) for the T7 treatment In their impact on all treatments, We note the improvement in the protein production value in the treatments Palm kernel meal treated with local enzymes (PKME) on Palm kernel meal (PKM) and control treatment. This may be due to an increase in essential amino acids especially sulfur (lysine, and methionine) when treated raw palm kernel meal with enzymes, which play an important part in the formation and building of protein in the body of fish (Siew, 1989), as well as the work of the enzyme-treated with the palm kernel meal, which led to improved digestion and absorption of food and thus improves the protein production value in those treatments. This result is consistent with the findings of Siti-Norita *et al*. (2015) with significant improvement (P <0.05) for the treatments added to it 40% of Palm kernel meal treated with local enzymes (Hemi) and enzymes prepared in vitro, For the protein production value of 32.82 and 30.16, respectively, Compared to the treatment added to the palm kernel meal by 40% which amounted to 22.11 in diets red tilapia fish.

Table 3 : The parameters of the assessment of the diets and protein for common carp fish fed on diets (mean ± standard error)

Protein production value %	Protein efficiency ratio	Feed conversion ratio	Feed intake/g	Treatments
0.0±5.94 fe	0.0±0.78 a	0.0±4.05 de	0.0±79.46 a	T1
0.23±4.45 h	0.04±0.82 a	0.17±3.90 e	0.55±77.74 ab	T2
0.0±5.13 g	0.06±0.70 ab	0.38±4.57 de	0.46±75.81 bc	T3
0.01±6.44 c	0.05±0.57 cd	0.5±5.63 bc	0.72±74.21 c	T4
0.02±6.70 b	0.06±0.72 ab	0.33±4.44 de	1.18±76.02 bc	T5
0.0±6.25 cd	0.05±0.66 bc	0.32±4.81 cd	1.18±76.10 bc	T6
0.0±7.44 a	0.01±0.47 d	0.11±6.64 a	0.8±73.63 c	T7
**	**	**	**	significant level
** : (0.01 > P)				

T1: Treatment of control
T2: Treatment of (PKM) with 33% replacement ratio of the 25% proportion of yellow corn
T3: Treatment of (PKM) with 66% replacement ratio of the 25% proportion of yellow corn
T4: Treatment of (PKM) with 100% replacement ratio of the 25% of yellow corn
T5: Treatment of (PKME) with 33% replacement ratio of 25% of yellow corn
T6: Treatment of (PKME) with 66% replacement ratio of 25% of yellow corn
T7: Treatment of (PKME) with 100% replacement ratio of 25% of yellow corn

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