EFFECTS OF DIETS CONTAINING POULTRY BY-
PRODUCT MEAL (PBPM) ON BROILERS
PERFORMANCE

BY:

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the degree of M.Sc. in Tropical Animal Production

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Dedication

This thesis is dedicated to my Mother,
Father, brothers, Sisters and Miss
F.H. Mohammed
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An experiment was conducted to investigate the nutritive value as well as to determine the extent to which the PBM can be used as a protein source for the broiler chicks diets. Three approximately iso-caloric, iso-nitrogenous diets containing 0.02, 5% and 7.5% PBM were used. The experiment was carried out for 9 weeks, employing two hundred day old, unsexed broiler chick (lohman). The mean highest and the mean lowest daily temperature were 39.25 °C & 22.63 °C respectively and the relative humidity was 30 and 15.25 Feed and water were offered ad libitum during the experimental period. There were no significant (P<0.05) differences between the three dietary treatments as for gain in body weight, feed intake, final body weight, feed conversion ratio, total protein intake and total energy intake. Hot and cold carcass dressing percentages, abdominal fat content and edible and non edible by-product yields were not significantly affected by the dietary treatments. No significant differences due to the dietary treatments were observed for the carcass contents of protein, fat, ash and moisture.
ABSTRACT

An experiment was conducted to investigate the nutritive value as well as to determine the extent to which the P3PM can be used as protein source for the broiler chicks diets. Three approximately iso-caloric, iso-nitrogenous diets containing 0.0%, 5% and 7.5% P3PM were used. The experiment was carried out for 9 weeks, employing two hundred day old, unsexed broiler chick (Lohman). The mean highest and the mean lowest daily temperature were 39.25 °C & 22.63 °C respectively and the relative humidity was 30 and 15.25 Feed and water were offered ad libitum during the experimental period. There were no significant (P<0.05) differences between the three dietary treatments as for gain in body weight, feed intake, final body weight, feed conversion ratio, total protein intake and total energy intake. Hot and cold carcass dressing percentages, abdominal fat content and edible and non edible by-product yields were not significantly affected by the dietary treatments. No significant differences due to the dietary treatments were observed for the carcass contents of protein, fat, ash and moisture.
Chapter (1)

1.0. INTRODUCTION

Recently there has been a rapid growth of the poultry industry in the Sudan, using modern husbandry techniques and high performance strains. The backbone of this progress is the availability of poultry feed stuffs locally, headed by sorghum, which is the main source of energy for both man and animals. In addition to sorghum, oil seed cakes, wheat bran, fish, meat and blood meals.

The commercial broiler production industry started after the establishment of Sudanese Kuwaiti poultry project during 1978, before this broilers production was practiced in the governmental units. In 1984 the Arab-Sudanese Poultry Company started production as sizable and integrated project. In Sudan the upgrading of the commercial broiler industry is depending on the importation of the European day old chicks, fertilized eggs and the broiler parent stocks, in this respect the environment constitutes a major hazard to these stocks, particularly when these stocks can not be offered conditions simulating its temperate environment.

The economic use of animal protein supplements other than fish, meat, bone and blood meals in feed formulation is of interest in animal production especially the poultry production. Protein supplements in poultry diets represents
one of the major items of the production cost, although alternative sources of these supplements might have a beneficial effect of the production cost, providing that they are available at a competitive prices and should be acceptable to poultry.

Poultry By-Product Meal (PBM) has been acceptable as a valuable ingredient for broiler diets, since the early 1950s and could be fed to broiler chicks with good results. PBM is the product resulting from rendering of all the by-products of poultry eviscerating plants. 25% of the live weight of the bird can be utilized for rendering industry in Sudan.

Accordingly the objectives of this study are to investigate the supplemental value of PBM as protein source when incorporated into broiler diets on an iso-caloric and iso-nitrogenous basis, in hope of decreasing the cost of broiler production and limiting the dependence on the importation of the super-concentrated feeds, as well as promoting the utilization of poultry products of the processing plants.
2.0. LITERATURE REVIEW

2.1. Definition of Poultry By-Product Meal (PBPM):

The terminology of poultry by-product other than Hydrolyzed Feather Meal "HFM" has been confusing in the literature. Most research workers have used the word (PBPM) to designate the product composed of viscera, heads and feet of slaughtered poultry (Daghir, 1975). Keppens and Reyntens (1969), however, used the term Poultry Offal Meal (POM) for the product which includes blood, guts, gizzards, heads, feet and hydrolyzed feather meal. Scott et. al. (1969) define PBPM as the product consist of ground wet or dry rendered clean parts of the carcass of slaughtered poultry such as heads, feet, undeveloped eggs, intestines and feathers. Nusheim et. al. (1979) stated that PBPM is the ground dry rendered clean whole some part of the carcass of slaughtered poultry, such as heads, feet, undeveloped eggs, intestines and feathers except in such trace amount as might occur unavoidably in good factory practice. It should contain not more than 16% ash, not more than 4% acid insoluble ash, also it contains about 55% protein and is a good source of calcium, phosphate, lysine and tryptophan.
Pesti (1987) defined PBPM, as the ground, dry-rendered or wet-rendered clean parts of the carcass of slaughtered poultry and hatchery wastes or dissolided Air Floatation (DAF) sludge-high fat content.

2.2 Hydrolyzed Feather Meal "HFM":

Chicken feather meal represents a large potential source of protein for feed production, especially in poultry rations. Most of the work on the use of HFM in poultry rations has been done with growing chickens rather than with laying hens. Moran et al. (1956) stated that feather meal protein is classified as insoluble keratin with cystine content. The molecule of cystine is stabilized by disulfide bonds. The Feather Meal "FM" have to be processed by pressure and temperature to destroy this bond, thus enabling the proteolytic enzymes to attack the protein molecule. Approximately 85-90% of the protein from FM comes from keratin (Harrap and Wood, 1964). Keratinous protein such as feathers, horn, hoof and hair are of little feeding value in their natural state. With proper processing, however, the keratin-type protein can be made digestible and acceptable in poultry feeds. The keratins are classified in the sclero-protein group due to their insolubility in aqueous solvents (Pruton and Simmonds, 1960). The treatment of FM by sodium sulfide as reducing agent improved its utilization by chicks (Draper, 1944). Fuller (1956) postulated that FM was found to exhibit unidentified growth
factors, when adequate methionine level was maintained. Gregory et al (1956) reported that FM protein is deficient in the essential amino acids, histidine, lysine, methionine and tryptophan. On the other hand appreciable quantities of riboflavin, niacin, pantothenic acid and vitamin B12 activities are found. Edwards et al. (1973) reported that the quantity of feathers on the carcass increased with age, the protein content of the feathers also increased with age from low (37.2%) at 2 weeks old to high (68.6%) at 8 weeks old females.

Neshlein et al. (1979) defined HFM as a product of treating under steam pressure, clean undecomposed feathers from slaughtered poultry. Not less than 80% of its crude protein content must be consist of "digestible protein". Feather meal does not have a balanced amino acid pattern for feeding poultry, since it is deficient in lysine, methionine and tryptophan.
2:3 Nutritional value and level of inclusion of Hydrolyzed Feather Meal (HFM) in broiler diets:

Feather meal when used as the sole source of protein in a ration would not support weight gain in growing chickens. Supplementation of FM - protein with essential amino acids, in which it is reported to be deficient, improved rate of weight gain, but did not improve net protein utilization (Summers et al., 1955). Wilder et al. (1955) concluded that when feather meal was fed at levels ranging from 2.7 to 7.7% of the ration to supply 2.4 to 6.2% protein to the diets, an excellent chick growth and feed efficiency were obtained when FM were used to supply 2.4% protein. Gerry (1953) observed good results when FM replaced part of fish and/or soybean oil meal in an all-mash broiler ration. Naber et al. (1961) concluded that properly processed FM can supply up to 25% of the crude protein in the chick starting diets containing 20% protein. They also reported that when feather meal was used to supply one third or more of total dietary protein of the ration, growth depression was marked and could be restored only with amino acid supplementation. Sibbald et al. (1962) showed that 3% and 6% FM could replace an equal amount of soybean meal in diets containing 19.5% and 21.5% protein, respectively. Replacing 3% of soybean meal by an equal amount of FM in a diet containing 15% protein resulted in markedly reduced
weight gain. Up to 4% of FM could be used in a 20% protein ration and 8% feather meal in 22 to 25% protein rations without any depression in growth or feed efficiency (Tsang et al., 1963).

Vogt and Stute (1969) reported that feeding of broiler with rations equal in calories and nitrogen with 0,2.5,5.0 and 7.5 HPM, all the rations were supplemented with methionine concluded that addition of up to 5% FM has no negative effect on weight gain or feed conversion. Morris and Balloun (1973 b) reported that when feather meals provided protein at 2.5% or 6%, methionine, lysine supplementation was not necessary when FM-protein provided 2.5% of the diet.

2.4 Nutritional value and level of inclusion of Poultry By-Product Meal in broiler diets:

Few work on the feeding of PBM attest to the success of the rendering industry in producing a good, universally accepted product. It is feeding value has not been studied to the extent that would be warranted, although it was established in the middle 1950s that PBM is a valuable ingredient in broiler diets, with growth promoting properties
responsible for growth promotion have not been identified. Hydrolyzed Feather Meal "HFM" and PBPM were shown to be satisfactory sources of animal protein in typical broiler and layer rations when used to replace up to approximately 1/6 of the crude protein (Wiseman et al. 1958). Haber et al. (1961) used PBPM which included feathers, blood and offal in their naturally occurring proportions at level of 5% in chick diets the diet had a higher nutritive value than diets containing feather meal. The natural occurring proportions of the feather, and offal meal contained feathers, blood and viscera at a ratio of approximately 40 : 40 : 20 respectively. Gerry (1956) investigated combinations of feathers and by-product meal protein in a ration of 1:4,2:3,3:2; but not 4:1, a satisfactory increase in growth and feed efficiency was observed.

Potter and Fuller (1967) devised methods where-by the by-product offal and feathers can be processed in natural proportions, yielding a product having the proximate composition represented by a mixture of PBPM 45% HFM 40% or poultry fat 15%. The level of inclusion of the Poultry Offal Meal "POM" was 8% and for the fish meal it was 5%. Also they reported that all combinations or levels of FM yielding gains equal to that produced by fish meal, this level of 8% POM was

(1)
selected as being sufficiently high to reflect any problems and it represent the maximum common usage of PDM when used as individual component. Keppens and Reyntiens (1969) compared PDM with Anchovy Fish Meal (AFM), where POM was made of blood, guts, gizzards, heads, feet and HFM, it has 67.3% crude protein and 14.55% fat. The AFM had 64% crude protein and 8% fat. The POM replaced 0, 2, 5, 10, 15 or 20% of the fish meal in the diet. Depressed growth and feed conversion were observed at 5% or more offal when it replaced fish meal in the diet. Jackson and Fulton (1971) reported when FM and POM were incorporated into broiler ration at levels of 0, 3.4, 10.2, 13.6 as the first trial and 17% as the second trial where FM and POM were used to replace Peruvian Fish Meal (PFM), food intake was depressed at the 17% level of inclusion of FM and POM. Vassels (1972) studied the protein quality of POM used in chick rations with or without supplementation of the amino acids, improvement in growth was observed when the first and the second limiting amino acids were supplemented.

Bhargava and O'meall (1975) indicated that 10% Poultry By-product- Hydrolyzed Feather Meal (BPBFM) in the broiler diet chicks could replace a protein equivalent of soybean meal without deleterious effects, provided that lysine was supplemented in a diet containing adequate methionine level. Addition of 10.0% BPBFM, which replaced all the soybean in the starter broiler diet when supplemented with methionine and

(12)
lysine, resulted in equal performance as measured by gain in body weight, feed efficiency, and eviscerated meat ratio (EMR). Supplementary isoleucine or threonine fed singly or in combination, did not stimulate the growth of chicks fed diets containing 10.9% PBPM. The addition of 15 or 20% PBPM significantly depressed growth and adversely affected feed efficiency.

Escolona et al. (1986) conducted experiments to compare several methods of determining the protein quality of PBPM. Protein Efficiency Ratio "PER", Net Protein Ratio "NPR" and Net Protein Utilisation "NPU" were calculated for each diet. The PER was the most discriminating method for estimating protein quality at lower levels. At higher levels, no difference could be detected. The 6% protein level was chosen for further studies because there were large differences in PER and the chicks were in positive nitrogen balance.

Escolona and Pestl (1987) investigated the value of PBPM when incorporated into practical diets at low levels of (5 to 10%). When it is incorporated at the 5% level into iso-caloric iso-nitrogenous diets, no differences in 20-day weight gain or feed efficiency were detected. Chick growth and feed efficiency were significantly depressed at 10%. Pestl et al. (1986) estimated the Metabolizable Energy "ME" of PBPM incorporated into diets at level of 20 and 40% by using
Matter-sen's method. M.E. values were determined to be 12.1% greater when PBPM was included at the rate of 20% than at 40%, values were 3.33 and 2.97 Kcal/ g DM respectively. This difference in ME could be attributed to differences in GE and percentage of gross energy metabolized, ash, calcium content of the diets. Kundu et al. (1987) indicated that when the Hatchery By-Product Meal "HPBM", was used to replace 10.0, 7.5, 5.0, 2.5, or 0.0% fish meal, satisfactory growth weight and feed conversion ratio were obtained.

Elamin and Mushtaq (1987) examined the nutritive value of locally processed Poultry Offal Meal (POM) in broiler diets in the Sudan. Diets containing 2,4 and 5% offal were compared with diets containing imported super-concentrated feed, synthetic lysine and methionine were added. At age of 8 weeks all levels of POM produced statistically equal or better weight gains than the super-concentrated-diets.

Mendonca and Jensen (1988) determined the effects of including PBPM for broiler diets with differing energy levels and the reflection of this on the performance and Abdominal Fat Content (AFC). Diets contained 10% PBPM with assigned ME values of 2,670, 2,985, 3,300, 3,615 or 3,930 Kcal/kg. Again no significant differences were observed in weight gain, but the feed conversion was significantly better for birds fed 2,670, 3,300 and 3,615 ME-PBPM diets.
Biswas (1947) observed when poultry feathers were hydrolyzed under pressure to yield a product which was high in digestible protein, (85%) and deficient in lysine, histidine and tryptophan.

2.5 Effect of processing methods on the nutritive value and utilization of poultry by-product meal by broiler chicks:

Poultry by-product meal has been used extensively as a recycling product of the poultry industry. The meal is a valuable animal protein source and it has the characteristics which make it satisfactory for incorporation into poultry diets, although the final product may vary in composition as a result of variation in proportions of the starting materials. During the manufacture of the PBPM's heat and pressure are used to reduce moisture, and produce friable product. Any overheating during the processing of PBPM has a deleterious effects upon the nutritive value and utilization of this by-product. (Clandinin et al., 1946, 1947; Food and Shurrock, 1971; Varnish and Carpenter, 1975). Lillie et al. (1956) and Anderson et al. (1957) reported that the uncooked offal meal serve as a significant source of vitamins, as well as being potential source of unidentified growth factor. Due to public consideration the bacterial counts can be reduced by efficient
washing (cooking) without materially affecting other qualities.

Binkely and Vasak (1950) described a method for heating feathers, which was a wet cooking process, where the feathers were treated with saturated steam pressure of 40 to 60 pounds per square inch gauge (p.s.i.g.) for 30 to 60 min., with constant agitation. Commercial processing of PM resulted in extensive cystine degeneration, with little effects on other amino acids (Gregory et al., 1956). Lee et al. (1960) reported that when temperature of heating was raised to 115 °C or 120 °C, binding of lysine epsilon amino acid groups were greatly increased causing decreased absorption of lysine. Carpenter et al. (1962) reported a decrease of up to 75% of the initial value of lysine, methionine, arginine and tryptophan by increasing the temperature from 85 to 145 °C. Morris and Balloun (1971) cooked feathers at either 40 or 50 p.s.i.g. steam pressure for 30 min., or 60 min. and obtained satisfactory growth rates. Bhargava and O'Neill (1972) processed the PMPM, including blood, feathers, heads, shanks, feet and inedible viscera at 40 p.s.i.g. steam pressure for 30 min. and then cooked the material for 3 hrs., to reduce the moisture content to 7 or 8%. Mann and Searcy (1976) cooked the blood at 85 °C for 10 min., or 126 °C (20 s. p. i.g.) for 60 min., then dried the blood samples under various conditions at temperatures ranging from 23 °C to 193 °C and concluded that...
as the temperature and time of exposure increased, available lysine decreased. McNaughton et al. (1977) reported that maximum chick weight, feed efficiency and lysine availability were obtained by processing HFM at either 15 p. s. i. g. or 20 p. s. i. g. steam pressure for 15 min., when the corresponding temperatures were 121 and 126 °C respectively.

Kunatu et al. (1987) used processed HBFM by boiling in water for 30 min., cooking, shelling off and breaking them, then drying them for 20 hrs. at 100 °C.

2.6 Effect of processing methods on the nutritive value and utilization of hydrolyzed feather meal by broiler chicks:

The increase production of Hydrolyzed Poultry Feather (HFF) coupled with changing economy promoted research workers for conducting research in this field. The advantages of HFF lies in its high content and when it is used in broiler diets it takes less HFF than any other source of protein. Hydrolyzed poultry feathers as proteinaceous material appears to be nutritionally desirable. However, its low digestibility has rendered it in the past of little value. In fact, enzymatic supplementation might increase the digestibility of dried blood and HFM above the maximum reported values of 30% (Lortiecher et al., 1957; McKerns and Ritterspach, 1938).

Recently much interest has been shown in the processing of feathers for utilization in poultry feeds. Processing methods of HFM based on various steam pressure cooking procedures has
for 60 min., there was no significant difference between weight gain. Feather meal cooked for 60 min. at 50 pounds pressure produced significantly greater weight gain than did FM cooked for 30 min. at the same pressure and the cooking times, at either pressure, did not significantly affect feed conversion. In both trials 7.5% FM-protein depressed growth rate and feed conversion. Morris and Balloun (1973 a) found the standard method for processing FM (35 p. s. i. for 10 min., with constant agitation) and compared with a "new" method of processing (50 p. s. i. for 60 min., with intermittent agitation, agitate 1 min.). The "new" method of processing resulted in the best biological responses and more of its amino acids are available for utilization.

Morris and Balloun (1973 b) studied the net protein values and nitrogen retention to evaluate feathers processed under different conditions. Feather meal processed at 50 p. s. i. with intermittent agitation (agitate 1 min. stop 2 min.), resulted in the highest net protein value of all the feather meals. The same feather meal, contained the highest level of available lysine, methionine, and histidine, when compared to other feather meal. Nitrogen retention decreased linearly when FM-protein was increased in the diet from 3 to 9%. Feather meals processed under more severe conditions, have slightly higher pepsin digestibility values. Of the lysine present, the feather meals on the average 72% was "available lysine".

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The more severely processed feather meals contained more available lysine than did the feather meals processed under mild conditions.

Papadopoulos et al. (1985) observed that when feather meal was heated for 30, 50 or 70 min., or treated with or without 0.4% NaOH or 0.42 proteolytic enzymes in order to determine the individual amino acid digestibility by chicken assay, apparent and true digestibility of all amino acids were influenced by the processing conditions. There were significant differences in digestibility coefficients due to method of treatments, for lysine, tyrosine, phenylalanine, serine and alanine. These amino acids values obtained by enzymatic and NaOH were lower than without additions. Digestibility values for individual amino acid varied substantially, with apparent digestibility values ranging from 22.5% for lysine to 82.4% for isoleucine, and true digestibility values from 36.3% for aspartic acid to 86.5% for isoleucine. The amino acids, lysine, methionine and histidine in increasing order, were particularly low in digestibility. Papadopoulos (1986 a) found that there was a considerable variation in the true digestibility between amino acids ranging from 36% for aspartic acid to 87% for isoleucine. Mean true digestibility of lysine was 49% Amino acids were increased in the ileum and decreased in plasma as processing time of FM was increased from 30, 50 or 70 min. and it was
concluded that quantitative digestibility estimations by excreta analysis of the individual amino acid to be used for evaluation of quality of feather meal. Papadopoulos (1986 b) studied the total amino acid profile of feather meal, as affected by different processing methods. The un-natural amino acid, lanthionine, present in the feather meals, but not in feathers, can be used as a reasonable indicator of the treatment damage due to over-processing methods.
Excessive level of carcass fat in broiler especially the abdominal is becoming a problem and presents a reduction in efficiency of production. Many nutritional factors are known to influence the carcass fat such as, age, sex, genetic make up and dietary energy, protein manipulation (Summers et al., 1958; Marison and Woodroof, 1966; Kubena et al., 1974 b; Vala and Baker, 1974). Increasing the dietary protein without decreasing the energy reduces fat, but generally increases the cost of production. However, altering the energy:protein ratio and imposing some form of feed restriction during part of the life of the bird is also investigated.

Marison and Woodroof (1966) reported that the composition of carcass fat can be altered by dietary fatty acids. The protein to fat in the carcass can be influenced by environmental temperature, type of sex (Kubena et al., 1972; 1974 a; Edwards et al., 1974 and Evans et al., 1976)

placing limited quantities...
feather meals are depending on the methods of processing of feather meals (Gregory et al., 1958; Sullivan and Stephenson, 1957; Moran et al., 1966; Morris and Balloun, 1973 a and Papadopoulos et al., 1985).

The dietary energy concentration had no significant effect on abdominal fat size, although decreasing the calorie-protein ratio of the diet resulted in a significant reduction in the proportion of abdominal fat size. Reducing the calorie-protein ratio by addition of feather meal to the diet was found to be effective in reducing fat size (Griffith et al., 1977). Cabel et al. (1987) conducted two models of experiments. In the first one, feather meal was added at 0, 2, 4 or 6% assuming 100, 50 or 0% amino acid availability, addition of feather meal, resulted in an increase in dietary protein content, a significant difference in weight gain, feed efficiency and dressing percentage, while the birds were processed at 49 days old. In the second model the diets were fed either from 35 to 49 days of age with 0, 2, 4, 6 or 8% feather meal or from 42 - 49 days of age with 0, 2, 4, 6, or 10% feather meal. All diets were formulated assuming 50% amino acids availability. A significant reduction in abdominal fat was again observed in birds fed feather. Differences in body weight, efficiency of food utilization and dressing percentage were reported.

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levels of feather meal - Corn - soybean diets were also formulated with protein levels corresponding to those of feather meal diets. The diets were fed from 35 to 49 days or from 42 to 49 days of age. No significant differences in weight gain and feed efficiency. The addition of glycine resulted in significant reduction in abdominal fat content. Increasing the dietary protein level also significantly reduced abdominal fat regardless of protein source. It has been shown that certain amino acids involved in the regulating lipogenesis and may have the ability to act as regulators of synthesis or degradation of certain enzymes (Reibel and Warner, 1980).

There is also an indication that glycine exerts an influence on lipogenesis in chicken as the protein content of the diets was increased to 24% or when the protein content of the well balanced diets increased by a maximum of 5%, resulted in significant reduction in the Abdominal fat content. (Summers and Leeson 1985).
2.8 Yields and composition of edible and inedible by-products of broilers

The proportion of dressed carcass weight to live weight is often a measurement of meat production in poultry. The interrelationships among these weights should give an estimate of the trends and relationships that would be encountered in several classes of market poultry. It is possible to use these interrelationships later as a yardstick for tentative comparisons of meat production, such comparisons might include a comparison of breeds, effect of different rations and different management practices (McNally and Spicknall, 1969).

Crowley et al. (1980) studied the percent yield and nutrient composition of inedible by-product and giblets of broilers. The percent yield was determined as a function of live weight. Wet yields were: blood, 3.1% feathers, 22.3%; feet, 4.3%; heads, 3.0%; necks, 3.6%; gizzards, 3.0% for the 7-week-old birds. Moisture content of poultry offal was approximately 70% for the most products, approximate lipid composition was 17% for necks; gizzards and hearts; 11% for feet and viscera; 8% for heads and livers; 1.5% for blood and feathers. On a wet basis, protein content for hearts, blood and viscera averaged 12%; heads, necks and gizzard, 15%; feet and livers, 20%; feathers, 25%.
Chapter (3)

3.0. MATERIALS AND METHODS

The experiment was conducted during summer season, it started in the 19th of March and continued for 9 weeks till the 20th of May 1989.

3.1. Experimental design:

A complete randomized design was used in this trial.

3.2. Experimental diets:

50 kgs of the poultry by-product meal was brought from Arab Company for Agricultural Production and processing, poultry production sector (table 2). The three experimental diets were offered from the second week till the end of the experiment, they were iso-nitrogenous and iso-caloric.

The composition of the diets was given in table (1). Requirements were calculated according to the National Research Council, (NRC, 1971) recommendations and the diets were analysed for crude protein, either extract, ash and dry matter content by the Association of Official Analytical Chemist (A.O.A.C., 1980) methods.

Metabolizable energy values, chemical compositions of the ingredients used in the diet formulation was calculated according to Scott et.al. (1982) Tables. The three experimental diets were supplemented with synthetic L-lysine monohydrochloride.

(26)
- Calculated analysis of the experimental diets.

<table>
<thead>
<tr>
<th>Item</th>
<th>Diet (A) 0% BPM</th>
<th>Diet (B) 5% BPM</th>
<th>Diet (C) 7.5% BPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude fiber</td>
<td>5.09</td>
<td>5.03</td>
<td>5.14</td>
</tr>
<tr>
<td>Crude protein (N x 6.25)</td>
<td>23.78</td>
<td>23.35</td>
<td>23.63</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.72</td>
<td>1.92</td>
<td>1.91</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>-0.88</td>
<td>1.06</td>
<td>0.91</td>
</tr>
<tr>
<td>Lysine</td>
<td>1.20</td>
<td>1.20</td>
<td>1.20</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.53</td>
<td>0.50</td>
<td>0.55</td>
</tr>
<tr>
<td>Metabolizable energy (MJ/Kg)</td>
<td>12.39</td>
<td>12.72</td>
<td>12.91</td>
</tr>
</tbody>
</table>
Table (1) : Complete chemical analysis of the experimental diets.

<table>
<thead>
<tr>
<th>Item</th>
<th>Diet (A) 0% PFBM</th>
<th>Diet (B) 5% PFBM</th>
<th>Diet (C) 7.5% PFBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>5.13</td>
<td>4.85</td>
<td>4.61</td>
</tr>
<tr>
<td>Crude protein</td>
<td>22.42</td>
<td>22.48</td>
<td>24.70</td>
</tr>
<tr>
<td>Ether extract</td>
<td>7.66</td>
<td>6.18</td>
<td>6.14</td>
</tr>
<tr>
<td>Ash content</td>
<td>8.61</td>
<td>7.67</td>
<td>5.78</td>
</tr>
</tbody>
</table>

- Super vitamins and minerals (Far vet.) composition per 1000 g.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>7500 000 I.U. vit A</td>
<td>3000 mg calcium pantothenate</td>
</tr>
<tr>
<td>3000 mg vit E acetate</td>
<td>8000 mg Nicotinamide</td>
</tr>
<tr>
<td>1500 000 I.U. vit D₃</td>
<td>15000 mg Iron sulphate</td>
</tr>
<tr>
<td>1500 mg vit K₃</td>
<td>25000 mg Manganese sulphate</td>
</tr>
<tr>
<td>2500 mg vit B₂</td>
<td>2500 mg Copper sulphate</td>
</tr>
<tr>
<td>300 mg vit B₅</td>
<td>10000 mg Zinc sulphate</td>
</tr>
<tr>
<td>6 mg vit B₁₂</td>
<td>- on water soluble carrier</td>
</tr>
<tr>
<td>11200 mg vit C</td>
<td></td>
</tr>
</tbody>
</table>

Note: The table and text are extracted from a document, and the content is presented in a readable format.
3.3 Experimental birds:

Two hundred day-old broiler chicks "Lohmann" were brought from Arab Company for Livestock Development, Hegran Al-Nilain Poultry production Project-Jabalmulir - 40 Km south western to Khartoum.

The birds were divided randomly into three groups each one contained 6 replicates, 10 chicks per replicate.

A mixture of the three experimental diets was afforded to all birds during the first week of age as adaptation period.

3.4 The experimental house:

The house was situated in an east-west direction with two high walls constructed completely from bricks on the east and west sides to avoid the direct effect of the sun radiation. The house was built of bricks to about one meter from the ground level, iron posts with wire netting sides were used. This wire netting sides were covered with mats on east and west sides. The roofing material was made up of corrugated iron. Each pen was separated by wire-netting frame and the dimensions of each pen was 1x1 meter to accommodate 10 chicks.

The floor was made up of bricks and covered with concrete. The height of the house was 3 meters.
3.5 Light regime:

Light was provided for 24 hrs during the period of the experiment.

3.6 Management and collection of data:

The experimental diets were offered daily in the morning. Records of feed offered and the residues were weighed daily and the feed intake was calculated by subtracting the residues from the feed offered. Daily mortality was recorded.

3.7 Slaughtering procedure and preparations of carcass:

At the end of the 9th-week of the experiment, 5 birds were selected from each pen randomly, then each bird was wing banded. Birds selected for slaughtering were offered water, but not feed for 24 hrs before slaughter. Then each bird was weighed individually and slaughtered. After the birds were allowed to bleed, they were scalded in hot water and feather was plucked.

Evisceration process was performed by a posterior ventral cut and then complete removal of the internal organs, offals and abdominal fat.

The eviscerated carcasses were allowed to chill in an air chilling refrigerator at 4 °C for 24 hrs. Then the carcasses were re-weighed again to calculate the eviscerated cold carcass weight.
3.8. Dissection procedure:

Two random samples from the carcasses were selected for further dissection and chemical analysis. The neck was removed from its base. The left side of each carcass was cut by scaples into different commercial cuts namely, wings, half breast, drum stick and thigh. Then each cut was weighed separately and expressed as percentage of the eviscerated cold carcass weight. Then the breast, drum stick and the thigh were deboned into meat (which includes skin, fat, connective tissues, tendons and bones). After that the meat and bone of each portions, were weighed separately and expressed as percentage of its cuts.

3.9. Preparation for chemical analysis:

Each two samples were used for further chemical analysis, after the meat was firstly minced by electric mincer and then mixed again. The meat was analysed for moisture, crude protein, ether extract and ash content.

3.10. Statistical analysis:

The collected data were analysed using statistical analysis according to Steel and Torrie (1980).
Table (2):-
- Approximate analysis of the poultry by-product meal (PBPM).

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td>46%</td>
</tr>
<tr>
<td>Crude fat</td>
<td>31%</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.75%</td>
</tr>
<tr>
<td>Phosphorus available</td>
<td>0.50%</td>
</tr>
<tr>
<td>Lysine</td>
<td>1.78%</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.63%</td>
</tr>
<tr>
<td>Methionine + Cystine</td>
<td>2.32%</td>
</tr>
<tr>
<td>Metabolizable energy (MJ/Kg)</td>
<td>17.91</td>
</tr>
</tbody>
</table>

Source:

- Determined chemical analysis of the poultry by-product meal.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>02.00</td>
</tr>
<tr>
<td>Crude protein</td>
<td>48.30</td>
</tr>
<tr>
<td>Ether extract</td>
<td>29.40</td>
</tr>
<tr>
<td>Ash content</td>
<td>09.32</td>
</tr>
</tbody>
</table>
Table (3): Official data from meteorological office (Shamah) giving monthly averages of max. & min. air temperature and relative humidity (R. H.).

<table>
<thead>
<tr>
<th></th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temp:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max.</td>
<td>34.7</td>
<td>39.7</td>
<td>41.3</td>
<td>41.3</td>
</tr>
<tr>
<td>Min.</td>
<td>16.6</td>
<td>20.1</td>
<td>27.2</td>
<td>26.6</td>
</tr>
<tr>
<td><strong>R.H.:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max.</td>
<td>24.0</td>
<td>23.0</td>
<td>32.0</td>
<td>41.0</td>
</tr>
<tr>
<td>Min.</td>
<td>13.0</td>
<td>11.0</td>
<td>18.0</td>
<td>19.0</td>
</tr>
</tbody>
</table>
Chapter (4)

4.0. RESULTS

4.1. Performance of the experimental chicks:

The results for the performance are given in table (4.1.). The data showed that the dietary treatments had no significant \( (P > 0.05) \) effect on feed intake, final body weight, gain in body weight and feed conversion ratio.

4.1.1. Live weight gain:

The weekly data and over-all gain in live body weight of the birds, are shown in table (4.2.) and figure (1) respectively. Dietary treatments had no significant \( (P > 0.05) \) effect on the live weight gain, with exception of the live weight gain in the 6th week, which was significantly \( (P < 0.05) \) reduced in diet (C) and diet (B), (7.5\% and 5.0\% PBPM).

4.1.2. Feed intake:

The weekly data for feed intake and the over-all feed intake during the experimental period are given in table (4.3), (4.1) and figure (2) respectively. The dietary treatments had no significant \( (P > 0.05) \) effect on feed intake, with exception for the first, second and the third week where intake of diet (C) "7.5\% PBPM" was significantly higher.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Diet (A) 6% PBRM</th>
<th>Diet (B) 5% PBRM</th>
<th>Diet (C) 7.5% PBRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial number of chicks</td>
<td>60.0</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Initial weight of chicks</td>
<td>77.2±7.045</td>
<td>77.1±7.045</td>
<td>77.0±7.045</td>
</tr>
<tr>
<td>Final body weight</td>
<td>1681±693.53</td>
<td>1540±629.10</td>
<td>1511±395.47</td>
</tr>
<tr>
<td>Live weight gain</td>
<td>1603±693.41</td>
<td>1463±628.92</td>
<td>1434±65.26</td>
</tr>
<tr>
<td>Feed intake</td>
<td>4090±243.45</td>
<td>3878±453.28</td>
<td>3940±247.52</td>
</tr>
<tr>
<td>Feed conversion ratio</td>
<td>2.46±0.79</td>
<td>2.60±0.97</td>
<td>2.64±0.76</td>
</tr>
<tr>
<td>Total protein intake</td>
<td>1.00</td>
<td>0.91</td>
<td>0.93</td>
</tr>
<tr>
<td>Total energy intake</td>
<td>50.68</td>
<td>49.35</td>
<td>50.87</td>
</tr>
<tr>
<td>Mortality rate</td>
<td>10.00</td>
<td>11.67</td>
<td>11.67</td>
</tr>
</tbody>
</table>

(a) Values are mean of 60 chicks/treatment ± standard error.
(b) None of the means were statistically significant (P>0.05).
Table 4.2: Weekly gain in live body weight of the broiler chicks "g/bird/week".

<table>
<thead>
<tr>
<th>Diet</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% PBPM</td>
<td>87.09</td>
<td>149.28</td>
<td>161.56</td>
<td>164.27</td>
<td>301.87</td>
<td>272.28</td>
<td>238.23</td>
<td>229.29</td>
<td>+25.35</td>
</tr>
<tr>
<td>5% PBPM</td>
<td>88.20</td>
<td>147.42</td>
<td>170.95</td>
<td>136.87</td>
<td>288.16</td>
<td>197.07</td>
<td>239.40</td>
<td>195.05</td>
<td>+21.99</td>
</tr>
<tr>
<td>7.5% PBPM</td>
<td>92.09</td>
<td>151.61</td>
<td>168.30</td>
<td>135.06</td>
<td>278.24</td>
<td>178.83</td>
<td>219.92</td>
<td>223.59</td>
<td>+20.64</td>
</tr>
</tbody>
</table>

Values are means of 60 chicks/treatment ± standard error "SE".
None of the means were statistically significant (P > 0.05).
Fig. 1. Weekly gain in body weight, g/bird/week.
Table 4.3.: Weekly feed intake of the birds "g/ bird/ week".

<table>
<thead>
<tr>
<th>Diet</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ox</td>
<td>153.44</td>
<td>265.91</td>
<td>280.47</td>
<td>459.46</td>
<td>630.54</td>
<td>645.86</td>
<td>756.84</td>
<td>898.22</td>
<td>93.24</td>
</tr>
<tr>
<td>3%</td>
<td>159.37</td>
<td>257.99</td>
<td>278.64</td>
<td>424.84</td>
<td>574.13</td>
<td>615.14</td>
<td>700.77</td>
<td>868.11</td>
<td>86.76</td>
</tr>
<tr>
<td>7.5%</td>
<td>168.40</td>
<td>293.28</td>
<td>308.75</td>
<td>439.90</td>
<td>634.53</td>
<td>548.15</td>
<td>723.25</td>
<td>818.27</td>
<td>80.57</td>
</tr>
</tbody>
</table>

(a) Values are means of 60 chicks/treatment ± standard error "SE".
(b) None of the means were statistically significant (P>0.05).
Fig. 2. Weekly feed intake g/bird/week
4.1.3. Feed Conversion Ratio (FCR):  
The data for FCR are presented in Table 4.4 and Fig. (3). The data indicated that the FCR was not significantly ($P > 0.05$) affected by the dietary treatments.

4.1.4. Final body weight:  
Data in Table 4.1 show the final body weight of the experimental birds. Dietary treatments had no significant ($P > 0.05$) effect on the final body weight. However, diet (A) "0% PPN" produced relatively the highest final weight.

4.1.5. Mortality rate:  
The data in Table 4.1 give the mortality rate of the experimental birds during the study, indicating insignificant difference among the different dietary regimes.

4.1.6. Dressing percentage of the hot and cold carcass:  
The data for dressing percentages of hot and cold carcasses are given in Table 4.5. Dietary treatments had no significant ($P > 0.05$) effect on the dressing percentages.

4.1.7. Abdominal fat content:  
The results for the abdominal fat content are shown in Table 4.5. The results show that the dietary treatment had no significant ($P > 0.05$) effect on the abdominal fat content. However, abdominal fat content tends to decrease with increasing the level of PPN in the diet.
4.1.8. The total protein intake and the total energy intake:
Table (4.1.) shows the results for total protein intake and total energy intake. Data indicate that the dietary treatment had no significant ($P > 0.05$) effect on the total protein and total energy intake.

4.1.9. Edible and inedible by-product yields of the broiler chicks:
Data for the edible and inedible by-product yields of the broiler chicks as percentage of the slaughtered weight of the carcasses are shown in table (4.6.). The data indicate that the dietary treatment had no significant ($P > 0.05$) effect on edible and inedible by-product yields of broiler chicks.

4.1.10. Chemical analysis of the broiler carcass:
Data for the chemical composition of the broiler meat are shown in table (4.7.). The results of the percentages of moisture, protein, fat and ash content indicated that the dietary treatments had no significant ($P > 0.05$) effect on the chemical composition of the broiler carcasses.
Table 4.4: Feed conversion ratio (FCR) "Kg feed intake/ Kg gain in body weight".

<table>
<thead>
<tr>
<th>Diet</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK PBPM</td>
<td>1.76</td>
<td>1.78</td>
<td>1.74</td>
<td>2.80</td>
<td>2.09</td>
<td>2.37</td>
<td>3.18</td>
<td>3.92</td>
<td>±0.28</td>
</tr>
<tr>
<td>5% PBPM</td>
<td>1.81</td>
<td>1.75</td>
<td>1.63</td>
<td>2.10</td>
<td>1.99</td>
<td>3.12</td>
<td>2.93</td>
<td>4.45</td>
<td>±0.35</td>
</tr>
<tr>
<td>7.5% PBPM</td>
<td>1.83</td>
<td>1.89</td>
<td>1.83</td>
<td>3.26</td>
<td>2.28</td>
<td>3.07</td>
<td>3.33</td>
<td>3.63</td>
<td>±3.63</td>
</tr>
</tbody>
</table>

The values are the means of 60 chicks/treatment ± standard error. None of the means were statistically significant (p > 0.05).
Table 4.4: Feed conversion Ratio (FCR) "Kg feed intake/ Kg gain in body weight".

<table>
<thead>
<tr>
<th>Diet</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>1.76</td>
<td>1.78</td>
<td>1.74</td>
<td>2.08</td>
<td>2.08</td>
<td>2.37</td>
<td>3.18</td>
<td>3.92 ±0.28</td>
</tr>
<tr>
<td>5%</td>
<td>1.81</td>
<td>1.75</td>
<td>1.63</td>
<td>3.10</td>
<td>1.99</td>
<td>3.12</td>
<td>2.93</td>
<td>4.45 ±0.35</td>
</tr>
<tr>
<td>7.5%</td>
<td>1.83</td>
<td>1.89</td>
<td>1.83</td>
<td>3.26</td>
<td>2.28</td>
<td>3.07</td>
<td>3.33</td>
<td>3.63 ±1.63</td>
</tr>
</tbody>
</table>

The values are the means of 60 chicks/treatment ± standard error. None of the means were statistically significant (P > 0.05).
Table 4.5: Carcass characteristics of broiler chicks.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0% PBPM</td>
</tr>
<tr>
<td>Hot dressing %</td>
<td>67.1±0.47</td>
</tr>
<tr>
<td>Cold dressing %</td>
<td>65.3±0.46</td>
</tr>
<tr>
<td>Abdominal fat content</td>
<td>1.04±0.30</td>
</tr>
</tbody>
</table>

The values are the means of 12 chicks/ treatment ± standard error.

None of the means were statistically significant (P >0.05).
Fig. 3. Feed conversion ratio (FCR), g/bird/week
Table 4.6. Edible and inedible by-products yields of the broiler as percentage of the slaughtered weight.

<table>
<thead>
<tr>
<th>Body component</th>
<th>Treatment A (OZ PUPM)</th>
<th>Treatment B (5% PUPM)</th>
<th>Treatment C (7.5% PUPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast and shanks</td>
<td>7.96±0.64</td>
<td>8.15±0.37</td>
<td>8.37±0.41</td>
</tr>
<tr>
<td>Total viscera</td>
<td>14.207±0.72</td>
<td>13.617±1.12</td>
<td>13.74±1.55</td>
</tr>
<tr>
<td>Gizzard</td>
<td>2.99±0.24</td>
<td>3.17±0.26</td>
<td>3.02±0.33</td>
</tr>
<tr>
<td>Liver</td>
<td>1.99±0.13</td>
<td>2.20±0.13</td>
<td>2.25±0.12</td>
</tr>
<tr>
<td>Heart</td>
<td>0.47±0.07</td>
<td>0.49±0.03</td>
<td>0.58±0.04</td>
</tr>
<tr>
<td>Abdominal fat</td>
<td>1.04±0.30</td>
<td>0.97±0.33</td>
<td>0.82±0.25</td>
</tr>
<tr>
<td>Lungs &amp; Trachea</td>
<td>0.80±0.10</td>
<td>0.71±0.10</td>
<td>0.74±0.12</td>
</tr>
<tr>
<td>Intestine</td>
<td>7.91±0.87</td>
<td>6.83±0.67</td>
<td>6.73±0.93</td>
</tr>
</tbody>
</table>

This data do not include the feathers and the blood %. The values are means of 30 chicks/treatment ± standard error. None of the means were statistically significant (p > 0.05).

(42)
Table 4.7: Analysis of the meat of the broiler carcass of the nine week old.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment A 0% PPN</th>
<th>Treatment B 3% PPN</th>
<th>Treatment C 7.5% PPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>70.47±1.19</td>
<td>69.12±1.39</td>
<td>68.87±1.33</td>
</tr>
<tr>
<td>Crude protein%</td>
<td>25.38±1.12</td>
<td>25.81±1.41</td>
<td>24.80±1.57</td>
</tr>
<tr>
<td>(N X 17.59)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ether extract</td>
<td>8.28±1.31</td>
<td>9.68±1.16</td>
<td>10.61±1.73</td>
</tr>
<tr>
<td>Ash content</td>
<td>1.14</td>
<td>1.14</td>
<td>1.13</td>
</tr>
</tbody>
</table>

The values are means of 12 chicks/treatment ± standard error.
None of the means were statistically significant (p > 0.05).
Table 4.7: Analysis of the meat of the broiler carcass of the nine week old.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment A 0% PDBM</th>
<th>Treatment B 3% PDBM</th>
<th>Treatment C 7.5% PDBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>70.47±1.19</td>
<td>69.12±1.39</td>
<td>68.87±1.33</td>
</tr>
<tr>
<td>Crude protein%</td>
<td>25.38±1.12</td>
<td>25.81±1.41</td>
<td>24.80±1.57</td>
</tr>
<tr>
<td>(N x 17.50)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ether extract</td>
<td>8.23±1.31</td>
<td>9.88±1.16</td>
<td>10.61±1.72</td>
</tr>
<tr>
<td>Ash content</td>
<td>1.14</td>
<td>1.14</td>
<td>1.13</td>
</tr>
</tbody>
</table>

The values are means of 12 chicks/treatment ± standard error.

None of the means were statistically significant (p > 0.05).
It is difficult to compare the overall results of this study with other literature values because of the differences in the strain of broiler chicks used, level of inclusion of the PBPM, processing methods of PBPM, ingredients used for the diets formulation, system of housing and the environmental conditions.

The work done on the chemical composition and the carcass characteristics of broiler chicks raised on the diets containing different levels of PBPM was few. However, a lot of work had been done on the utilization of hydrolyzed feather meal.

**Feed intake:**

The trend of the feed intake indicates that there was no significant differences among the dietary treatments (Table 4.1; 4.2.). Although the feed intake during the first, second and the third week was found significantly higher for diet (C) "7.5% PBPM". Birds raised on diet (C) consumed significantly 5%, 7% and 6.3% respectively more feed than the grand mean of the three diets during the first, second and third week for the feed intake, consequently these higher level of intakes produced relatively higher gains in body weight during this period.
This may be attributed to the fact that PBPM contains unidentified growth promoters, which initiate the feed intake, also high feed intake in chicks has been associated with feeding diets containing high level of PBPM. This finding is in agreement with Fuller (1956); Corry et al. (1956); Kelly and Potter (1971); Lessen and Summers (1980).

Gain in body weight:

No significant differences among the different dietary treatments were observed in relation to the gain in body weight table (4.2. and 4.1.). However, the gain in body weight for the first, second and third week of birds fed on diet (C) "7.5% PBPM" was significantly superior, this may be attributed to high feeding intake during this period. The reduction in gain in body weight of birds fed diet (B) and (C) "5% and 7.5% PBPM", during the 6th week, may be attributed to the high environmental temperature which reduces the feed intake during this period. These findings were in agreement with those observed by Keppens and Reyniers (1969); Kubans et al. (1972); Kelly and Potter (1971) and Escalona and Pesti (1987).

Feed Conversion Ratio "FCR":

The pattern of the FCR among the different dietary regimes was not significantly affected (table 4.4.). However, one can say that it is satisfactory value for diet (A) "0% PBPM"; moderate value in diet (B) "5% PBPM" and relatively
Final body weight:

The final body weight of the experimental birds was insignificantly different with respect to the different dietary treatments (table 4.1.). These findings are similar to those observed by Potter and Fuller (1967) where the level of inclusion of PBPW was 8%; Escalona and Pesti (1987) where the level of inclusion of PBPM was 3%; Kundu et al. (1987) where the levels of inclusion were 0.0; 2.5; 5.0; 7.5; 10.0%, the maximum final body weight at age of 8 weeks was the same as the weight observed by Elamin and Hushara (1987) where the level was 2.0; 4.0; 5.0% and Mendonca and Jensen (1959) where the level of inclusion was 10%. These findings are different from those observed by Keppens and Reyntens (1969) who observed a significant difference in the growth of the body and the level of inclusion of PBPM 0.0; 2.5; 5.0; 7.5; 10.0% PBPM; Leeson and Summers (1980); Escalona and Pesti (1987) where the level of inclusion was 10%.

Hot and cold carcass dressing percentages:

The dressing percentages of the carcasses expressed as percentage of the live weight “slaughtered weight” were not significantly different (table 4.5.). These results are in line with findings observed by Merkely et al., (1980); Leeson and Summers (1980).
Abdominal Fat Content "AFC":

The AFC was not significantly affected by the different dietary regimes (table 4.5.), but it tended to decrease with increasing level of inclusion of the PPBM in the diets. This reduction in AFC may indicate the presence of feather meal in PPBM. In the literature, there are some reports which investigate the use of Hydrolyzed Feather Meal (HFM) for reduction of the AFC in broiler chicks during the finishing periods. The low AFC findings are in line with results reported by Griffith et al. (1977); Cabal et al. (1987); and Cabal et al. (1988).

Chemical analysis of the carcass contents:

Data presented in (table 4.7.) were not significantly affected by the dietary regimes. The results may indicate that the carcass water decreased and the carcass lipid increased as the level of inclusion of PPBM increased. These findings are in agreement with results reported by Yoshida et al. (1962).

Edible and inedible by-product yields of the broiler chicks:

The trend of this by-product yields indicates that there were significant differences with respect to the different dietary treatments (table 4.7.). These findings are in line with those Crawley et al. (1980); and Lesson Summers (1980).
Abdominal Fat Content "APC":

The APC was not significantly affected by the different dietary regimes (table 4.5.), but it tend to decrease with increasing level of inclusion of the PBPM in the diets, this reduction in APC may indicates the presence of feather meal in PBPM. In the literature, there are some reports which investigate the use of Hydrolyzed Feather Meal (HFM) for reduction of the APC in broiler chicks during the finishing periods. The low APC findings are in line with results reported by Griffith et al. (1977); Cabel et al. (1987); and Cabel et al. (1988).

Chemical analysis of the carcass contents:

Data presented in (table 4.7.) were not significantly affected by the dietary regimes. The results may indicate that the carcass water decreased and the carcass lipid increased as the level of inclusion of PBPM increased. These findings are in agreement with results reported by Yoshida et al. (1962).

Edible and inedible by-product yields of the broiler chicks:

The trend of this by-product yields indicates that there were significant differences with respect to the different dietary treatments (table 4.7.). These findings are in line with those Crawley et al. (1980); and Lessan Summers (1980).
Mortality rate:

No significant differences were observed in mortality rate, which may not be related to the dietary regimes (table 4.1.). However, the relatively high mortality rate, maybe attributed to the high environmental temperature.
Accordingly to the results of the present experiment, the following conclusions could be drawn:

1) PBPM was accepted by the broiler chicks and could be incorporated into diets up to 7.5% without exhibiting any adverse effects.

2) PBPM is a cheap and available source of animal protein, which would help in reduction of the production cost of poultry products.

3) Higher rates of inclusion of PBPM should be considered in future work.
خلاصة الأطروحة

بهدف هذه البحث التي دراسة امكانية استخدام محللرات مُجسِّمات الدم، كمصدر جودة موضعي، وليست دراسة محتوى نسبة أخلاقية في غلاكسيات الدجاج.

بدأت التجربة بـ 200 كنقطة ماء سوم (كوبان) في تقسيم تبادلي بالشمعة أنساعшен المَلِمِلَة بـ 20 ماء سوم من الفضية في غلاكسيات كمصدر ماء سوم الطاقة والكتاني، لذا، بتخسيس نسبة تركيز محللرات مُجسِّمات الدم، فلم يتحوي الغلاكسيات الأولية على نسبة من المَلِمِلَة، وأثبتت النتائج للمَلِمِلَة بـ 100% localization وجاذبية وكتانيات أحسنت مراقبة مُجسِّمات مُجسِّمات مُجسِّمات، والكلبين قسمت الجماعات على كميات مستمرات وكتائيات مجموعات، وانتقلت مجموعات الثلاث، مجموعات معقولة على 9 أسماء مع 200 كنقطة، وتحتوي عملية، بلغ متوسط أقصى وأدنى درجات الحرارة 39.5 م 0.3، كما يُنتج متوسط أقل من أعلى نسبة الرطوبة الجوية نحو 30% و 15.35%. أزاحت النتائج أنه ليس هناك فيهما معاملة احساسات في كميات النسيج، البافت، وكميات مُجسِّمات للغلاكسيات.

رغم أن، لم تتأثر كم من نسبة التحلقيك وكثرة المهبل البشري، وليست
ايرز محللرات بكمية المَلِمِلَة، وفقاً في المُجسِّمات، إذ لم تتأثر جميعاً تأثيرها بنظرية نتيجة لافتلاك تركيز نسبة محللرات الدجاج في الغلاكسيات الثلاثة، كذلك، وجد أنه ليس هناك فرقاً معنويَّاً في نسبة المُجسِّمات، والجسم، والذين
والمساء بين المَلِمِلَة.

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CHAPTER 7

7- REFERENCES


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