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# INFLUNCE OF DATE STONE MEAL PARTICLE SIZE AND FORM OF DIET ON MUSCOVY DUCKLINGS PERFORMANCE

**By**

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**Abstract:** *A total of 180 Muscovy ducklings at 7 days of age were used in an experiment, which lasted 9 weeks. The experiment aimed to investigate the utilization of Date Stone meal (DSM) by using pelleting process and grinding and their interaction effects on growth performance of muscovy ducklings.*

*Birds were divided into 4 equal experimental groups of 45 ducklings each. Every group was sub-divided into three replicates (15 ducklings / rep.). The first and second groups were fed the mash diet of coarse or fine DSM, while the third and fourth groups was fed pelted diets of coarse or fine DSM. The experimental diets were isocaloric and is nitrogenous.*

***Results obtained could be summarized as follows:***

*Muscovy ducklings fed pelleted diets of DSM had significantly ($P < 0.01$) highest average live body weight and body weight gain as compared with those received mash DSM diet. The grinding particle size and the interaction between dietary treatment had insignificant effects on performance. Moreover, Pellets form of DSM improved significantly ($P < 0.01$) feed conversion ratio (g feed/g gain) and fine DSM diet had improved significantly ($P < 0.01$) feed conversion ratio. Digestion coefficients of CP and CF showed a highly significant ($P<0.01$) increase for group fed fine pelleted DSM diet. Duckling fed coarse pelleted DSM diet had significantly ( $P<0.01$) highest digestive tract weight (g), Cecum length (cm), Liver% , Edible giblets % and had the highest insignificant Gizzard % as compared with other treatment groups.*

*The highest value of economic efficiency among all experimental groups was recorded by group fed pellets form with fine grinding of DSM.*

*From the nutritional and economical efficiency stand points of view, pelleting process with fine grinding of DSM could be recommended to be used successfully and safely in formulating diets for growing Muscovy ducklings raising under new reclaiming region without adversely affecting their growth performance.*

## INTRODUCTION

Date Stone meal (DSM) is the residue obtained after the extraction of palm kernel oil from the seed. Because of the industrial uses and export potentials of palm kernel oil, DSM is easily available in large quantities. According to Sundu *et al* (2006), DSM is aflatoxin free, palatable and has considerable potential as carbohydrate and protein sources. Palm kernel cake can contain from 12 to 23 % crude protein depending upon the efficiency of the process used to extract the oil. There is an economic incentive to investigate the use of DSM in broiler diets in four regions of the world (Asia, Pacific, South America and Africa) due to its cost effectiveness, compared to conventional feedstuffs and, there has been a dramatic increase in global production of DSM with annual growth of 15% over the last two decades (FAO,2002). Many results have been reported on the effect of DSM on the performance of broilers (Ezieshi and Olomu, 2004; Sundu *et al.*, 2005a). Also, many current findings suggest that DSM could replace commercial manno-oligosaccharide as a perbiotic to improve chicken health and immunity (Allen *et al.*, 1997; Fernandez *et al.*, 2000 and Fernandez *et al.*, 2002)

One of the first steps in feed processing is the grinding of cereals. The main effect of grinding is to improve feed utilization; this is accomplished by increasing the surface area of the grain portion of the diet by a marked reduction in particle size.

Feed composition and structure are causative factors for maintaining a healthy gastro- intestinal tract of the birds. Technological treatment of diets can modify both the physical and chemical characteristics of feed, physical properties are those associated with e.g. viscosity, uniformity and particle size. Chemical properties are those concerning nutrient digestibility and utilization of e.g. amino acids. These changes occur as a result of combinations of both temperature and pressure during processing. This can occur during primary (diet ingredients) or secondary (complete diet) processing (Plavnik, 2003). A coarse diet structure increases gizzard size and function (Nir,et al.1994) and also strengthens the gastro- intestinal tract defense system (Engberg et al,2003) compared to fine diet structure

Agro-industrial by-products have in recent years become important feed components in poultry diets due to the increase competition for the conventional ingredients by human and the food industries. Those of high fibre contents are being used either as fillers or as energy diluents. For example DSM have been employed in the formulation of poultry feeds(Okon and Ogunmodede,1996; Ezieshi and Olomu,2004)it expected that as the demand for animal products increases with increasing population and improvements in living standards, conventional feed stuffs are likely to be insufficient to sustain poultry production It is expected that as the demand for animal protein increases with increasing population and improvements in living standards, conventional feedstuffs are likely to be insufficient to sustain mongastric animal production. Therefore, the need to carryout more research about how to incorporate unconventional feed ingredients such as DSM in monogastric animal feeding is necessary ,the feed intake of birds fed DSM based diet is usually higher than for a maize- based diet ( Onwudike,1986; Ezieshi and Olomu,2004; Sundu et al., 2005a).This is probably due to its faster passage rate of food in the digestive tract (Onifade and Babatunde,1998) , high bulk density and its low water holding capacity . Sundu et al.(2005b) compared the bulk densities of many poultry feedstuffs and found that the bulk density and the water holding capacity of DSM were 0.57 g/cm $^3$ and 2.93 g water/ g feed respectively, these values were very close to the values to the bulk density and water holding capacity soybean meal . Low bulk density and high water-holding capacity are believed to impair feed intake (Sundu et al., 2005b), this phenomenon indicates that DSM has potential benefit for poultry provided that the diet consumed can be digested and made available for the birds

The main objective of the present work was to study the effect of both diet form (pellets or mash) and particle size (course or fine) of Date Stone meal and their interactions on growth performance, economic efficiency, digestion coefficients and carcass traits of muscovy ducklings.

## MATERIALS AND METHODS

The present work was carried out at south Sinai Experimental Research Station (Ras suder city) which belongs to the Desert Research Center. An experiment was carried out to evaluate the effects of diet form, particle size of palm kernel meal and their interactions on the performance of Muscovy ducklings.

### Birds, dietary treatments

A total number of 180 Muscovy ducklings at 7 days of age were used and kept under similar managerial, hygienic and environmental conditions. Randomized design of four treatments in a 2 x 2 factorial arrangement two form of diets( mash and pellets) x two methods of grinding (coarse and fine). Coarse and fine grinding of palm kernel meal were performed using screen size of 4.75 and2.15 mm, respectively.

Ducklings were randomly divided into 4 equal experimental groups of 45 ducklings in three replicates (15 ducklings / repl.). The first group was fed mash diet with coarse DSM, while the second group was fed mash diet with fine DSM, the third group was fed pelleted diet with coarse DSM and the fourth group was fed pelleted diet with fine DSM.

The experimental diets (Table 1) were manufactured at Nubarria research station all diets were isocaloric and isonitrogenous which are corn-soy bean based and have the same percentage (10%)of DSM which replaced 10% yellow corn and formulated to meet recommendations for Muscovy ducklings (Mona,2006).

Feed and water were offered *ad libitum*.

### Digestibility trail:

At the end of the experimental feeding period, digestion trial was conducted using 16 males ducks (four from each treatment) to determine the digestion coefficients of the experimental diets. Birds were individually housed in metabolic cages. The digestibility trials extended for 9 days; 5 days as a preliminary period followed by 4 days as collection period. The individual live body weights were recorded during the main collection period to determine any loss or gain in the live body weights. During the main period, excreta were collected daily and weighed, dried at 60 C°, bulked, finally ground and stored for chemical analysis. The faecal nitrogen was determined according to Jakobsen *et al.* (1960). Urinary organic matter was calculated according to *Abou-Raya and Galal* (1971). Metabolizable energy was calculated according to the equation of Tiuts and Fritz (1971).

The digestion coefficients % of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated.

### Carcass traits

Four birds from each treatment were chosen randomly for slaughter test.. Carcass parts were weighed and calculated as a percentage of live body weight.

### Chemical analysis

Chemical analysis of the experimental diets and faeces were assayed using methods of the Association Official Analytical Chemists (A.O.A.C, 1990).Proximate analysis (%) of Date Stone meal was listed inTable (2)

### Data collection

Data were collected on live body weight (LBW) and feed intake (FI) were determined. Body weight gain (BWG) and feed conversion ratio (g feed/g gain) were calculated. Mortality rate was also recorded.

### Economy of production

The economical efficiency was calculated from the input-output analysis based on the differences in feed conversion ratio and feeding cost. The amount of money realized from the sale of ducklings minus the cost of feed consumed for each dietary treatment was estimated.

**Statistical analysis**

The Data were statistically analyzed according to *SAS* (1996) using factorial two-way classification. All data percentages were transformed to their arc-sin values before analysis and differences among treatment means were determined by Duncan's New Multiple Range test (*Duncan*, 1955).

The model used for analysis was:

$X_{ijk} = U + F_i + P_j + FP_{ij} + e_{ijk}$

Where,

Xijk = Observation

U = the overall mean.

Fi = Form of the diets (i=1 and 2)

Pj = particle size (j=1 and 2)

FPij = The interaction between Form of the diets and particle size (ij =1,2.....4)

eijk = Random error.

## RESULTS AND DISCUSSION

**Live body weight (LBW) and Body weight gain (BWG)**

The effects of dietary treatments on growing performance are summarized in Table 3. Ducks fed pelted DSM diet had significantly ($P < 0.01$) the highest Average LBW at 70 days of age being 3506.64 g as compared with group fed mash DSM diet diet (3125.72 g ).On the other hand particles size of DSM showed no significant differences on Average LBW during the whole experimental periods. Interaction effects between diet forms and particle size of DSM showed no significant effects on LBW. These results agreed with Mona and EL- Sheikh (2010) who showed that when ducks fed processed diets had significantly (P < 0.01) the highest Average live body weight at 70 days of age being 3805.12 g followed by group fed the mash group which recorded 3167.16 g.

Average body weight gain (BWG) showed a significant ($P < 0.01$) differences during the experimental period (35-70) and (7-70) days of age. The highest BWG was recorded by group fed processed diets as compared with group fed mash DSM diet diet. Neither particle size of DSM nor interactions between dietary treatments showed any significant effects on BWG. Many researchers were in agreement with results that obtained; Parsons (2004) found that broilers fed mash diets exhibited decreased live weight gain compared to broilers fed pelted diets. Firman(2000 ) reported that with steam pelleting ,heat, moisture and pressure were enhance chemical reactions which reflect a positive effects on birds performance. Fairly results were mentioned by Lpez, and Baiao (1990) who found that Processing of diet by intermediary grinding caused an increase in body weight, broilers fed expanded-pellets diet grew faster than broiler fed pellets diet , but these birds performed better as compared with birds fed with unprocessed diet , the coarse pelleted diet body weight and feed intake were higher as compared with mash coarse diet , a dietary particle size did not affect the feed intake ,feed conversion and viability, grinding size of diet has no effect on broilers performance , heat-treatment of diet improve broilers performance.

Feed intake (FI) and feed conversion ratio (FCR).

Feed intake .(FI) values during the whole experimental period gradually increased significantly ($P< 0.01$) with the feeding of processed diets shown in Table 4. The FI of the group fed mash diet was significantly less than that fed pellets DSM. It is clear that feeding on diet had the coarse grinding of DSM recorded higher significant($P< 0.01$) FI values during the whole experimental periods comparable with fine grinding DSM group. Both of groups fed either pellted fine DSM or pelleted coarse DSM had significantly (P< 0.01) the highest FI as compared with other groups at (35-70) weeks of age. The hypothesis of Engberg et al., 2002 may be discuss our obtained results, they hypothesized that for chickens, which consume diets with large particle which enter the gastric region and cause an increase in gut mobility, an increase feed intake is observed; as a consequence, their performance and gut health will be improved and added a coarse diet enhances the development of the foregut. Literature has shown often that feed texture properties have a clear effect on the development of the gastrointestinal tract of the chickens. Birds fed a coarsely ground diet had a gizzard twice a heavy as found in birds fed a fine ground diet (Kakkel *et al.*, 1997). When the chicken is fed with the coarse feed, feed intake increases and body weight gain improves in comparison to birds fed a fine feed (Nir et al, 1994). Similar results were obtained by Mona and Sheikh (2010) reported that processed feed increased feed intake by 7.82 %for pellets form and 9.83 %for granules form than that of the mash group at (7-70) days of age. Reece *et al* (1985) fed fine, medium or coarse mash feeds and observed an increase in feed consumption and less feed wastage with the coarse feed

Results of feed conversion ratio (FCR) revealed a significant difference (P<0.01) among the experimental groups as shown in Table 4. It was observed in this study, that ducks fed pelted DSM diet had better FCR; on the contrary, group fed mash DSM diet recorded the worst FCR. Due to the decrease in feed intake and reduction of daily weight gain during the whole experimental periods. Ducklings fed coarse DSM recorded worst FCR due to the increase in feed intake as compared with group fed fine DSM. Group fed pelted fine DSM diet had significantly (P< 0.01) the best FCR at (35-70days) and the best significant (P< 0.05) at (7-70days) as compared with other treatment groups.

These relationships were In agreement with the results obtained by Mona and EL- Sheikh (2010), CutLip, *et al (2007)* and Jiménez, et al (2003) broilers fed processed diets had increased feed intake and increased live weight gain compared to broilers fed mash diets (P≤0.05). Allred *et al* (1957b) also attributed the inactivation of heat-liable toxins in feed to the pelleting process, other researchers claim the changes in dietary carbohydrates induced by the thermo mechanical pelleting process result in increased metabolizable energy values and increased amino acid bioavailability in poultry (Summers *et al.*, 1968, Saunders *et al.*, 1969, Moran and Summers, 1970). On the other side, Parsons (2004) indicated that as diet particle size increased, feed intake and gizzard yield increased and feed efficiency decreased and added that broiler true metabolizable energy increased then decreased when diet particle size increased, that feeding larger particle corn had a trend towards decreased feed passage time ,increase nutrient utilization and may increase broiler performance.

## Mortality

Results on mortality numbers recorded a non-significant difference between groups and did not exceed 2 birds during the whole experimental periods. There were many possible mechanism may explain how DSM take place as a perbiotic to improve chicken health and immunity ; first, DSM contain Oligosaccharides, which have been substances of choice to replace antibiotics due to their capacity to block the colonization of pathogen bacteria in the intestine of broilers, among oligosaccharides , fructo – Oligosaccharides (Waldroup et al.,1993) and manno-Oligosaccharides (Fernandez *et al.*,2000) The efficacy of mannose based carbohydrates, either as manno-Oligosaccharides(Lyons,2002) or mannose (Oyofo *et al.*,1989) to improve the immune system of animals has been well accepted. β-mannan in palm kernel meal has been reported to have similar properties to the mannan from yeast to increase immunity. either β-mannan or manno- Oligosaccharides in the DSM are fermented in the caeca due to indigestibility of this fraction, which have beneficial effects in promoting the growth of non-pathogenic bacteria ,such as *Bifidiobacteria sp* (Fernandez et al.,2002)

Second possible mechanism of action is that manno- Oligosaccharides from DSM may attract micro – organisms away from the intestinal binding sites by its receptor sites for the fimbriae of *E.coli* and *Salmonella sp* which results in elimination of these particular bacteria as the digesta flows out (Spring *et al.*, 2000); accordingly colonization of the microbes in that organ decreases and thus the birds are less susceptible to these organisms.

**Digestibility and nutritive values of the experimental diets:**

The digestion coefficients and nutritive values of the experimental diets are present in Table (5) .Ducklings fed pelleted DSM diet showed a highly significant ($P<0.01$) increase in digestion coefficients and nutritive values as compared with those fed mash DSM diet. Zelenka (2003) found that pelleting increased apparent digestibility of all organic nutrients but the difference was significant ($P < 0.001$) only in the case of organic matter and crude fat. In the pelleted diet, percentages of classical metabolisable energy and of nitrogen-corrected apparent metabolisable energy in gross energy were higher than in the mash diet. Regardless of the form of the diet ;the particle size of DSM had a significant effect on digestion coefficients and nutritive values , ducklings fed coarse DSM diet had significantly ($P<0.01$) higher digestion coefficients and nutritive values as compared with ducklings fed fine DSM diets. On the other hand, the interaction between dietary diet form and particle size of DSM showed that coarse pelleted diet had a highly significant ($P<0.01$) increased the differences in digestion coefficients of CP and CF while, fine pelted diet recorded the highest significant ($P<0.01$) digestion coefficients of NFE as compared with other treatments, fine mash diet recorded the highest significant ($P<0.01$) nutritive values of ME, TDN and DCP as compared with other treatments. Results obtained reflect that processing (pelleting) by products such DSM and particle size of this by products are very important factors that affect the digestive organs and digestion mechanism of poultry varying with the age of the bird.

Literatures in many ways had demonstrated the effects of these factors on bird as followed. Technological modification of the diet may significantly influence the functional development of some parts of the digestive organs in poultry, influences the mechanical and chemical changes of the ingested feed before nutrients are absorbed in the small intestine. Mechanical changes include swallowing, maceration and grinding of feed in the gizzard. Chemical changes include the secretion of enzymes and, mucus from the crop, proventriculus and pancreas, bile from the liver. In addition, bacterial activities in the crop have an effect on the ingested feed (Duke, 1994). On the other hand, the metabolisable energy of DSM varies widely, from at least 6.19 MJ/kg (Chin, 2002) to 9.46 MJ/kg (Sundu et al, 2005 c), this may due to the fact that the oil content in this feedstuffs varies. Higher metabolisable energy values may due to higher oil content. Remaining in the DSM after the product is processed by expeller machinery; the improvement may due to greater ability of older birds to digest fat and protein and to ingest more fibrous feed (O' Mara *et al.*, (1999); Onifade and Babatunde (1998) and Sundu *et al.*, (2005a) Panigrahi and Powell, 1991). The decrease in the digestibility of the diet was not associated with the viscosity of the diet as the inclusion of DSM decreased jejunal digesta viscosity (Sundu *et al.*, 2005a) .The decrease in feed digestibility may be due to the fact that broiler chicken have a limited ability to digest dietary fibre, such as β-mannan, because of the absence of any mannan degrading enzymes in the digestive tract of birds. Accordingly, two possible ways to cope with this problem are: formulating the diet based on digestible nutrients, digestible amino acids and metabolisble energy and enzyme application to improve DSM digestibility and to reduce the moisture content of excreta.

Pelleting and Coarse size of DSM had significantly improved the function of the digestive system of the duck as shown in our study, there were many opinion may be explain that, a study by Onifade and Babatunde (1998) The gritty lignified shell of DSM may contribute to an increased passage rate of the digesta in the digesta in the digestive tract. Duke (1986) stated that the hard and fibrous feedstuffs may increase the contraction of the gizzard and may speed up the peristaltic movement of digesta in the duodenum and throughout the small intestine. This could account for the increased rate of passage of digesta and could, in turn, result in increased feed intake. Sundu *et al.* (2004) added that factors such as the relative weight of the gizzard and intestines may be influenced by diet structure (coarse) and diet conformation .Some small size particles of nut shell of DSM were found in the small intestine of young birds. This may be due to the fact that the muscular gizzard of young birds is not well developed in young birds. The low digestibility of DSM, coupled with high consumption of DSM based diets, creates a considerable increase in faecal discharge.

## Carcass traits

Results of carcass trails are summarized in table (6). Data in the present study showed that ducklings fed pelletd DSM had significantly ( $P<0.01$) Digestive tract weight (g) ,and Digestive tract length (cm), Liver %, Gizzard%, Edible giblets % and significant increase ( $P<0.05$) in Heart % . There were reversed opinions; Parsons (2004) reported that Broilers fed mash diets exhibited decreased breast yield with increased gizzard, compared to broilers fed pelted diets. While, Mona and EL-Sheikh(2010) showed that Gizzard %decreased ( $P<0.05$) in groups fed granules and pellets form while Digestive tract weight (g) Cecum length (cm) were decreased($P< 0.01$) and($P< 0.05$),respectively as compared with the mash group.

Coarse DSM significantly ($P<0.01$) increased digestive tract length (cm) but significant ($P<0.05$) decreased Heart % as compared with the group fed fine DSM diet. Many research has shown also the importance of particle size distribution of diets during entire growing period ; a coarse diet structure increases gizzard size and function (Nir *et al*,1994) and also strengthens the gastro-intestinal tract defence system (Engberg *et al*.,2003) compared to a fine diet structure. On the other hand, Parsons , et al(2006)Linear regression showed an increasing trend in feed intake and gizzard weight as particle size of mash diet increased ;however ,feed efficiency and breast yield decreased and added that feeding broiler corn particles of smaller size may improve performance and carcass characteristics compared to diets that incorporate larger sized corn particles

Interaction between dietary treatment showed that, duckling fed fine pelleted DSM diet had significantly ( $P<0.05$) the highest carcass%, duckling fed coarse pelleted DSM diet had significantly ( $P<0.01$) the highest Digestive tract weight (g), Cecum length (cm), Liver% , Edible giblets % and had the highest insignificant Gizzard % as compared with other treatment groups.

Many explanations were obtained; According to Duke (1994), the properties of the fowl's foregut enable broiler diets in the form of pellets to be dissolved within a short time in the crop into very fine particles. It has been shown that finely ground diets may inhibit the contraction of the gastro-intestinal tract including the refluxing activity of the gut in commercially raised broiler chicken. It can be hypothesized that for chickens, which consume diets with large particle which enter the gastric region and cause an increase in gut mobility, an increase feed intake is observed. As a consequence, their performance and gut health will be improved (Engberg et al., 2002).A coarse diet enhances the development of the foregut. A good foregut will maintain pH barriers throughout the gut; this is beneficial for health and performance throughout the grower period. Feeding coarse diets during the starter phase improves the functional development of the proventriculus-gizzard system (Engberg *et al.*, 2003)...

**Economic efficiency :**

The collective data showed the effect of interaction between the form with particle size of DSM diets on feed cost, net return and economic efficiency (Ee) % are presented in table (7). Data indicated that pellets form with fine grinding of DSM increased net return (14.43 LE) of experimental diets as compared with other groups.

The pellets form with fine grinding of DSM showed the lowest feed cost of Kg meat (5.57 LE) due to the reduction of its FC., this level produced the highest net return and the highest economic efficiency259.07% compared with other groups. There were many literature discuss the economic efficiency of processing diets; Mona and EL-Sheikh (2010) found that pellets diets recorded the highest net return and lowest feed cost of Kg meat as compared with mash diets .Additionally,Deaton *et al* (1977) pointed out that the energy required for grinding grain is the second largest energy cost after the pellet mill

**Table (1):** Composition and proximate chemical analysis of the experimental diets

| | Mash | | Pellets | |
|---|---|---|---|---|
| Ingredient % | Starter (7-35) | finisher (35-70) | Starter (7-35) | finisher (35-70) |
| Yellow corn | 50.00 | 60.80 | 50.00 | 60.80 |
| Soybean meal (44%) | 29.50 | 19.80 | 29.50 | 19.80 |
| Corn gluten meal (60%) | 6.00 | 5.00 | 6.00 | 5.00 |
| Palm kernel meal | 10 | 10 | 10 | 10 |
| Di-calcium phosphate | 3.00 | 3.00 | 3.00 | 3.00 |
| Lime stone | 0.50 | 0.50 | 0.50 | 0.50 |
| Sodium chloride | 0.30 | 0.30 | 0.30 | 0.30 |
| Vit. and min. mix** | 0.30 | 0.30 | 0.30 | 0.30 |
| Dl- methionine | 0.20 | 0.20 | 0.20 | 0.20 |
| L- lysine | 0.20 | 0.10 | 0.20 | 0.10 |
| Total | 100 | 100 | 100 | 100 |
| Proximate chemical analysis % | | | | |
| Crude protein (CP) | 21.15 | 18.00 | 21.10 | 18.47 |
| Crude fiber (CF) | 3.74 | 3.15 | 3.29 | 2.93 |
| Ether extract (EE) | 1.90 | 2.50 | 2.65 | 3.04 |
| ASH | 6.17 | 6.00 | 6.11 | 6.06 |
| Calculated values : | | | | |
| Metabolizable energy (Kcal/kg)*** | 2801.50 | 2909.79 | 2801.50 | 2909.79 |
| Crude protein (CP) | 22.42 | 18.51 | 22.42 | 18.51 |
| Calcium % | 1.00 | 0.98 | 1.00 | 0.98 |
| Available phosphorus % | 0.53 | 0.50 | 0.53 | 0.50 |
| Lysine % | 1.27 | 1.00 | 1.27 | 1.00 |
| Methionine +Cysteine % | 0.96 | 0.84 | 0.96 | 0.84 |

** Each3 kg Vitamins and minerals contain: Vit. A120000IU,Vit. $D_3$ 22000 IU, Vit.E100 mg, Vit.$K_3$ 20mg, Vit. $B_1$ 10 mg, Vit. $B_2$ 50mg, Vit. $B_6$ 15 mg, Vit.$B_{12}$ 100 µg, Pantothenic acide 100mg, Niacin 300mg, Folicacid10mg, Biotin500 µg, iron300mg, Manganese 600 mg, Choline chloride 500 mg, Iodine 10 mg, Copper 100 mg, Selenium 1 mg, Zinc 500 mgand 1200 mg Anti-oxidant.

***Calculated according to *Mona* (2006) recommendation of muscovy ducks and determined according to the digestion trials of DSM.

pelleting process depending upon heat and pressure only without using any pellets binder -

**Table (2):** Proximate analysis (%) of Palm Kernel Meal

| fractions | % |
|---|---|
| Dry matter | 90.42 |
| Crude protein | 14.00 |
| Crude fiber | 13.00 |
| Ether extract | 5.60 |
| Ash | 3.00 |
| Calcium | 0.62 |
| Total phosphorus | 0.54 |
| Nitrogen-free extract | 46.70 |
| Neutral detergent fiber | 66.80 |
| Metabolisable energy (kcal /kg ) | 2287.00 |

**Table (3)** Effect of diets form and particle size of DSM and their Interactions on Live body weight and weight gain (Mean ±SE) of ducklings.

| Live body weight(g) (LBW) | | | | |
|---|---|---|---|---|
| | treatments | 7 (days) | 35 (days) | 70 (days) |
| Form | Mash ( M ) | 69.37 ± 0.60 | 1198.19 ± 35.45 | 3125.72 ± 51.47 $^{B}$ |
| | Pellets ( P) | 69.53 ± 0.61 | 1274.79 ± 34.94 | 3506.64 ± 50.90 $^{A}$ |
| Particle size | Coarse ( C) | 68.99 ± 0.58 | 1210.82 ± 35.49 | 3323.22 ± 55.58 |
| | Fine ( F ) | 69.90 ± 0.63 | 1239.37 ± 35.37 | 3309.30 ± 54.55 |
| Form x Size (interactions) | M x C | 68.82 ± 0.76 | 1197.82 ± 50.56 | 3123.48 ± 73.21 |
| | M x F | 69.91 ± 0.93 | 1198.56 ± 50.28 | 3127.91 ± 73.19 |
| | P x C | 69.16 ± 090 | 1269.72 ± 49.81 | 3522.95 ± 72.71 |
| | P x F | 69.89 ± 0.84 | 1280.18 ± 72.00 | 3490.69 ± 72.00 |
| Probabilities | | | | |
| Form | | ns | ns | ** |
| Size | | ns | ns | ns |
| Form x Size | | ns | ns | ns |
| Weight gain (g)/bird/ period( WG) | | | | |
| | | (7-35) (days) | (35-70) (days) | (7-70) (days) |
| Form | Mash ( M ) | 1128.78 ± 35.26 | 1927.53 ± 26.83 $^{B}$ | 3056.30 ± 51.26 $^{B}$ |
| | Pellets ( P) | 1205.99 ± 34.63 | 2254.33 ± 36.76 $^{A}$ | 3460.31 ± 51.30 $^{A}$ |
| Particle size | Coarse ( C) | 1165.25 ± 35.56 | 2089.67 ± 42.51 | 3254.92 ± 55.61 |
| | Fine ( F ) | 1169.47 ± 34.82 | 2092.16 ± 29.86 | 3261.62 ± 50.65 |
| Form x Size (interactions) | M x C | 1128.91 ± 50.82 | 1925.66 ± 38.35 | 3054.57 ± 73.36 |
| | M x F | 1128.64 ± 49.49 | 1929.36 ± 37.97 | 3058.00 ± 72.46 |
| | P x C | 1201.59 ± 49.71 | 2253.68 ± 67.74 | 3455.27 ± 72.57 |
| | P x F | 1210.29 ± 48.29 | 2254.96 ± 31.00 | 3465.24 ± 73.31 |
| Probabilities | | | | |
| Form | | ns | ** | ** |
| Size | | ns | ns | ns |
| Form x Size | | ns | ns | ns |

a,b: Means within a column with different superscripts are significantly different .
Sig= Significance, * ($P<0.05$), ** ($P< 0.01$), ns= not significant

**Table (4)** Effect of diets form and particle size of DSM and their Interactions on Feed intake and Feed conversion ratio (Mean ±SE) of ducklings.

| Feed intake(g)/ bird /period (FI) | | | | |
|---|---|---|---|---|
| | treatments | (7-35) (days) | (35-70) (days) | (7-70) (days) |
| Form | Mash ( M ) | 3200.00 ± 53.23 $^{B}$ | 5800.00 ± 96.71 $^{B}$ | 9000.00 ± 152.75 $^{B}$ |
| | Pellets ( P) | 3280.00 ± 41.07 $^{A}$ | 6450.00 ± 40.58 $^{A}$ | 9730.00 ± 110.15 $^{A}$ |
| Particle size | Coarse ( C) | 3330.00 ± 32.96 $^{A}$ | 6250.00 ± 116.90 $^{A}$ | 9580.00 ± 161.97 $^{A}$ |
| | Fine ( F ) | 3150.00± 28.87 $^{B}$ | 6000.00 ± 182.57 $^{B}$ | 9150.00 ± 214.09 $^{B}$ |
| Form x Size (interactions) | M x C | 3300.00 ± 57.74 | 6000.00 ± 57.74 $^{B}$ | 9300.00 ± 115.47 |
| | M x F | 3100.00 ± 28.87 | 5600.00 ± 58.59 $^{C}$ | 8700.00 ± 115.07 |
| | P x C | 3360.00 ± 34.64 | 6500.00 ± 50.00 $^{A}$ | 9860.00 ± 147.42 |
| | P x F | 3200.00 ± 28.87 | 640000 ± 56.86 $^{A}$ | 9600.00 ± 105.47 |
| <u>Probabilities</u> | | | | |
| Form | | * | ** | ** |
| Size | | ** | ** | ** |
| Form x Size | | ns | ** | ns |
| **Feed conversion ratio (FCR)** | | | | |
| | | (7-35) (days) | (35-70) (days) | (7-70) (days) |
| Form | Mash ( M ) | 2.84 ± 0.04 $^{A}$ | 3.01 ± 0.05 $^{A}$ | 2.95 ± 0.05 $^{A}$ |
| | Pellets ( P) | 2.72 ± 0.04 $^{B}$ | 2.86 ± 0.01 $^{B}$ | 2.82± 0.03 $^{B}$ |
| Particle size | Coarse ( C) | 2.86 ± 0.03 $^{A}$ | 3.00 ± 0.05 $^{A}$ | 2.96 ± 0.04 $^{A}$ |
| | Fine ( F ) | 2.70 ± 0.03 $^{B}$ | 2.87 ± 0.02 $^{B}$ | 2.81 ± 0.02 $^{B}$ |
| Form x Size (interactions) | M x C | 2.93 ± 0.03 | 3.12 ± 0.02 $^{A}$ | 3.04 ± 0.03 $^{A}$ |
| | M x F | 2.75 ± 0.03 | 2.90 ± 0.02 $^{B}$ | 2.85 ± 0.02 $^{B}$ |
| | P x C | 2.80 ± 0.01 | 2.88 ± 0.01 $^{BC}$ | 2.87 ± 0.04 $^{B}$ |
| | P x F | 2.64 ± 0.02 | 2.84 ± 0.01 $^{C}$ | 2.77 ± 0.02 $^{C}$ |
| <u>Probabilities</u> | | | | |
| Form | | ** | ** | ** |
| Size | | ** | ** | ** |
| Form x Size | | ns | ** | * |
| **Mortality numbers (7-70 days)** | | | | |
| Form | Mash ( M ) | 1 | | |
| | Pellets ( P) | 2 | | |
| Particle size | Coarse ( C) | 2 | | |
| | Fine ( F ) | 1 | | |
| Form x Size (interactions) | M x C | 1 | | |
| | M x F | 0 | | |
| | P x C | 1 | | |
| | P x F | 1 | | |

a,b: Means within a column with different superscripts are significantly different.
Sig= Significance, * (P<0.05), ** (P< 0.01), ns= not significant

**Table (5):** Effect of diets form and particle size of DSM and their Interactions on digestion coefficients and nutritive values (Mean± SE) of Ducklings...

| digestion coefficients | | | | | | |
|---|---|---|---|---|---|---|
| | treatments | OM | ASH | CP | CF | EE |
| Form | Mash ( M ) | 77.53 ± 0.32 $^{B}$ | 60.96 ± 0.38 $^{B}$ | 80.88 ± 0.25 $^{B}$ | 33.79 ± 1.05 $^{B}$ | 89.41 ± 0.30 $^{B}$ |
| | Pellets ( P) | 79.38 ± 0.92 $^{A}$ | 69.82 ± 0.50 $^{A}$ | 85.98 ± 0.56 $^{A}$ | 40.97 ± 0.39 $^{A}$ | 91.28 ± 0.14 $^{A}$ |
| Particle size | Coarse ( C) | 79.23 ± 0.36 $^{A}$ | 66.31 ± 0.03 $^{A}$ | 84.28 ± 1.13 $^{A}$ | 38.97 ± 1.27 $^{A}$ | 90.80 ± 0.38 $^{A}$ |
| | Fine ( F ) | 77.67 ± 0.39 $^{B}$ | 64.47 ± 0.94 $^{B}$ | 82.58 ± 0.98 $^{B}$ | 35.79 ± 1.95 $^{B}$ | 89.89 ± 0.49 $^{B}$ |
| Form x Size (interactions) | M x C | 78.20 ± 0.15 | 61.78 ± 0.13 | 81.37 ± 0.18 $^{C}$ | 36.13 ± 0.19 $^{C}$ | 90.00 ± 0.89 |
| | M x F | 76.85 ± 0.18 | 60.13 ± 0.19 | 80.40 ± 0.21 $^{D}$ | 31.44 ± 0.12 $^{D}$ | 88.82 ± 0.16 |
| | P x C | 80.27 ± 0.15 | 70.83 ± 0.44 | 87.20 ± 0.25 $^{A}$ | 41.80 ± 0.15 $^{A}$ | 91.60 ± 0.06 |
| | P x F | 78.48 ± 0.27 | 68.80 ± 0.15 | 84.77 ± 0.15 $^{B}$ | 40.13 ± 0.19 $^{B}$ | 90.97 ± 0.03 |
| <u>Probabilities</u> | | | | | | |
| Form | | ** | ** | ** | ** | ** |
| Size | | ** | ** | ** | ** | ** |
| Form x Size | | ns | ns | ** | ** | ns |

| nutritive values | | | | | |
|---|---|---|---|---|---|
| | treatments | NFE | DCP% | TDN% | ME Kcal/kg |
| Form | Mash ( M ) | 72.18 ± 0.44 $^{B}$ | 10.87 ± 0.30 $^{B}$ | 50.65 ± 0.26 $^{B}$ | 2145.55 ± 10.69 $^{B}$ |
| | Pellets ( P) | 78.38 ± 0.56 $^{A}$ | 13.21 ± 0.21 $^{A}$ | 61.85 ± 0.74 $^{A}$ | 2620.37 ± 0.89 $^{A}$ |
| Particle size | Coarse ( C) | 75.13 ± 0.90 $^{B}$ | 11.58 ± 0.62 $^{B}$ | 55.17 ± 2.27 $^{B}$ | 2336.70 ± 95.90 $^{B}$ |
| | Fine ( F ) | 75.43 ± 1.88 $^{A}$ | 12.50 ± 0.46 $^{A}$ | 57.33 ± 2.75 $^{A}$ | 2429.22 ± 116.43 $^{A}$ |
| Form x Size (interactions) | M x C | 73.13 ± 0.19 $^{C}$ | 13.47 ± 0.09 $^{A}$ | 63.47 ± 0.26 $^{A}$ | 2689.65 ± 0.89 $^{A}$ |
| | M x F | 71.23 ± 0.15 $^{D}$ | 12.95 ± 0.03 $^{B}$ | 60.23 ± 0.15 $^{B}$ | 2551.09 ± 2.02 $^{B}$ |
| | P x C | 77.13 ± 0.18 $^{B}$ | 11.53 ± 0.07 $^{C}$ | 51.19 ± 0.16 $^{C}$ | 2168.79 ± 3.98 $^{C}$ |
| | P x F | 79.62 ± 0.06 $^{A}$ | 10.20 ± 0.06 $^{D}$ | 50.10 ± 0.10 $^{D}$ | 2122.31 ± 3.95 $^{D}$ |
| <u>Probabilities</u> | | | | | |
| Form | | ** | ** | ** | ** |
| Size | | * | ** | ** | ** |
| Form x Size | | ** | ** | ** | ** |

a,b: Means within a column with different superscripts are significantly different .
Sig= Significance, * (P<0.05), ** (P< 0.01), ns= not significant

**Table (6):** Effect of diets form and particle size of DSM and their Interactions on Carcass traits of slaughtered ducklings (Mean ± SE).

| Carcass traits | | | | | | |
|---|---|---|---|---|---|---|
| | treatments | Pre-slaughter weight (g)) | Carcass % | Digestive tract weight (g) | Digestive tract length (cm) | Cecum length (cm) |
| Form | Mash ( M ) | 3692.50 ± 70.32 | 71.32 ± 0.23 | 2.50 ± 0.24 $^{B}$ | 110.00 ± 22.08 $^{B}$ | 33.50 ± 0.94 |
| | Pellets ( P) | 3097.00 ±67.56 | 73.35 ± 2.33 | 4.13 ± 0.23 $^{A}$ | 162.50 ± 12.64 $^{A}$ | 34.50 ± 0.57 |
| Particle size | Coarse ( C) | 3350.00 ± 69.95 | 70.56 ± 0.38 | 3.39 ± 0.51 | 165.00 ± 20.09 $^{A}$ | 34.25 ± 0.73 |
| | Fine ( F ) | 3439.50 ±71.39 | 74.11 ± 2.17 | 3.25 ± 0.94 | 107.50 ± 14.30 $^{B}$ | 33.75 ± 0.86 |
| Form x Size (interactions) | M x C | 3535.00 ± 2.89 | 71.51 ± 0.02 $^{B}$ | 2.04 ± 0.13 $^{D}$ | 170.00 ± 2.89 | 35.00 ± 1.14 $^{A}$ |
| | M x F | 3850.00 ±80.83 | 71.13 ± 0.42 $^{B}$ | 2.97 ± 0.31 $^{C}$ | 150.00 ± 34.64 | 32.00 ± 1.15 $^{B}$ |
| | P x C | 3165.00± 2.99 | 69.61 ± 0.21 $^{B}$ | 4.74 ± 0.01 $^{A}$ | 180.00 ± 23.09 | 35.50 ± 0.29 $^{A}$ |
| | P x F | 3029.00±34.93 | 77.09 ± 3.99 $^{A}$ | 3.53 ± 0.07 $^{B}$ | 145.00 ± 2.89 | 33.50 ± 0.87 $^{AB}$ |
| Probabilities | | | | | | |
| Form | | ns | ns | ** | ** | ns |
| Size | | ns | ns | ns | ** | ns |
| Form x Size | | ns | * | ** | ns | ** |

| Carcass traits | | | | | |
|---|---|---|---|---|---|
| | treatments | Liver % | Gizzard % | Heart % | Edible giblets* % |
| Form | Mash ( M ) | 1.66 ± 0.12 $^{B}$ | 2.26 ± 0.04 $^{B}$ | 0.68 ± 0.04 $^{B}$ | 4.60 ± 0.18 $^{B}$ |
| | Pellets ( P) | 2.10 ± 0.16 $^{A}$ | 2.90 ± 0.15 $^{A}$ | 0.81 ± 0.06 $^{A}$ | 5.81 ± 0.25 $^{A}$ |
| Particle size | Coarse ( C) | 2.07 ± 0.19 $^{A}$ | 2.65 ± 0.20 | 0.68 ± 0.05 $^{B}$ | 5.40 ± 0.42 |
| | Fine ( F ) | 1.70 ± 0.08 $^{B}$ | 2.51 ± 0.10 | 0.81 ± 0.05 $^{A}$ | 5.02 ± 0.13 |
| Form x Size (interactions) | M x C | 1.70 ± 0.16 $^{B}$ | 2.27 ± 0.03 | 0.74 ± 0.03 | 4.71 ± 0.13 $^{BC}$ |
| | M x F | 1.62 ± 0.19 $^{B}$ | 2.26 ± 0.09 | 0.62 ± 0.08 | 4.50 ± 0.36 $^{C}$ |
| | P x C | 2.51 ± 0.01 $^{A}$ | 3.05 ± 0.29 | 0.74 ± 0.08 | 6.30 ± 0.37 $^{A}$ |
| | P x F | 1.69 ± 0.06 $^{B}$ | 2.75 ± 0.06 | 0.89 ± 0.07 | 5.33 ± 0.08 $^{B}$ |
| Probabilities | | | | | |
| Form | | ** | ** | * | ** |
| Size | | ** | ns | * | ns |
| Form x Size | | ** | ns | ns | ** |

a,b: Means within a column with different superscripts are significantly different .
Sig= Significance, * (P<0.05), ** (P< 0.01), ns= not significant
* Edible giblets = liver, heart and gizzard weights.

**Table (7):** Economic evaluation

| Items | Mash | | Pellets | |
|---|---|---|---|---|
| | Coarse | Fine | Coarse | Fine |
| Feed conversion ratio | 3.04 | 2.85 | 2.87 | 2.77 |
| Cost of Kg feed (LE) | 1.95 | 1.99 | 1.97 | 2.01 |
| Feed cost of kg meat (LE) | 5.93 | 5.67 | 5.65 | 5.57 |
| Market price of one Kg meat (LE.) | 20 | 20 | 20 | 20 |
| Net return (LE).* | 14.07 | 14.33 | 14.35 | 14.43 |
| Economic efficiency % (Ee) of feed ** | 237.27 | 252.73 | 253.98 | 259.07 |
| Relative economic efficiency of feed** | 100.00 | 106.52 | 107.04 | 109.19 |

*Net return price of one Kg meat(LE.)- Cost of Kg feed (LE)
**Economic efficiency %= Net return/ Cost of Kg feed (LE)
***Relative economic efficiency% of mash x coarse , assuming that relative EE of mash x coarse =100. Cost of pelleting 100 kg = 15.0 LE , Cost of grinding 100 kg = 10.0 LE

## Conclusion

From the nutritional and economical efficiency of stand points of view, could be recommended to be used successfully and safely in the formulated diet for growing muscovy ducks without adversely affect their performance we conclude that pelleting process with fine grinding of DSM improves productive performance of Muscovy ducklings raised under desert conditions.

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## الملخص العربي

## تأثير حجم حبيبات نوى البلح وشكل العليقة على أداء البط المسكوفي

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استخدم في هذا البحث عدد ١٨٠ كتكوت بط مسكوفي عمر ٧ أيام و حتى عمر ٧٠ يوما. بهدف تحديد مدى تأثير شكل العليقة( مصنعة في صورة مكعبات أوغير مصنعة) وحجم حبيبات (خشن أو ناعم) مسحوق نوى البلح كأحد مخلفات التصنيع في المناطق الصحراوية والتداخل بينهما على اداء البط النامي .

قسمت الكتاكيت إلى أربعة معاملات تجريبية متساوية. اشتملت كل معاملة على ٤٥ كتكوت ( ٣ مكررات بكل منها ١٥ كتكوت ). غذيت كتاكيت البط النامي حتى حد الشبع على ٤ معاملات غذاية كالاتي: عليقة غير مصنعة مع حبيبات نوى بلح خشنة – عليقة غير مصنعة مع حبيبات نوى بلح ناعمة- عليقة مكعبات مع حبيبات نوى بلح خشنة- عليقة مكعبات مع حبيبات نوى بلح ناعمة .

العلائق المستخدمة متساوية في نسبة البروتين الخام والطاقة الممثلة ( كيلو كالورى /كيلوجرام)و لها نفس نسبة استخدام نوى البلح وهي ١٠%

ويمكن إيجاز أهم النتائج في النقاط التالية :

سجلت المعاملة التي غذيت على العليقة المصنعة في صورة مكعبات تحسنا معنويا ( عند المستوى١ % ) فى كل من وزن الجسم على عمر ٧٠ يوما ومعدل النمو على عمر ٣٥ و ٧٠ يوم مقارنة بالمعاملة الغير مصنعة.

- - لم يظهركل من حجم الحبيبات او التداخل بين شكل العليقة و حجم الحبيبات اى تأثيرات معنوية على وزن الجسم ومعدل النمو

- لوحظ ازدياد معدل استهلاك الغذاء خلال فترة التجربة زيادة معنوية (عند مستوى ١%) وذلك عند التغذية على العلائق المصنعة في صورة مكعبات مقارنة بالصورة التقليدية الغير مصنعة، كما اظهر حجم حبيبات النوى الخشنة اعلى معدل استهلاك للغذاء (عند مستوى ١%) ، اظهر التداخل بين العليقة المصنعة مكعبات كل من الطحن سواء الخشن او الناعم لنوى البلح اعلى(عند مستوى ١%) معدل استهلاك للغذاء على عمر (٣٥-٧٠ يوما)

- حققت المعاملة التي غذيت على العليقة المكعبات أفضل معدل تحويل غذائي (عند مستوى ١%) ، كما اظهر حجم حبيبات النوى الناعم اعلى معدل تحويل غذائي (عند مستوى ١%) ، اظهر التداخل بين العليقة المصنعة مكعبات و الطحن الناعم لنوى البلح اعلى معدل تحويل غذائي .

- اوضحت الطيور المغذاه على العليقه المصنعة مكعبات زيادة معنوية لوزن القناة الهضمية وطول القناة الهضمية ،وزن القونصة، وزن الكبد، وزن القلب و الاحشاء المأكولة ، كما اظهر اظهر حجم حبيبات النوى الخشن اعلى وزن للكبد واعلى طول للقناة الهضمية مع اقل زن معنوي للقلب مقارنة بالمعاملة المحتوية على حجم حبيبات النوى ناعم ، اظهر التداخل بين العليقة المصنعة مكعبات و الطحن الخشن لنوى البلح اعلى وزن معنوي للقناة الهضمية، وزن الكبد، وزن الاحشاء المأكولةو طول الاعورين .

اوضحت الطيور المغذاه على العليقه المصنعة مكعبات زيادة معنوية(عند مستوى ١%) في معاملات الهضم و القيم الغذائية مقارنة بالصورة التقليدية الغير مصنعة، كما ادت التغذية على العليقة المحتوية على حبيبات نوى البلح الخشنة الى تحسن معنوي في معاملات الهضم و القيم الغذائية مقارنة بالعليقة الناعمة ، اظهر التداخل بين العليقة المصنعة مكعبات و الطحن الخشن لنوى البلح اعلى زيادة معنوية لهضم البروتين الخام والالياف الخام .

- تحقق أعلى عائد اقتصادي عند التغذية على العليقة المصنعة مكعبات مع الطحن الناعم لمسحوق نوى البلح خلال فترة التجربة مقارنة بباقي المعاملات .

يمكن التوصية من الوجهة الغذائية والاقتصادية بإمكانية استغلال فوائد عملية تصنيع العليقة في صورة المكعبات لتحقيق اعلى استفادة من نوى البلح مع اجراء الطحن الجيد له قبل اجراءعملية التصنيع لعلائق البط المسكوفي النامي عند التربية تحت ظروف المناطق الصحراوية .