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Efficacy study of nano meter particle size (NMPS) colloidal minerals and PUFA in Aseel birds under field condition

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Abstract
The present study was carried out to study the efficacy of Nano Particle Size Colloidal minerals and PUFA in Aseel bird's production performance. A total number of 200 chicks were taken and two groups were formed by covering 100 birds each. The selected Poultry farmers were trained on the importance of Mineral Mixture practices in poultry before the experiment. Production parameters (livability, weight gain, and feed consumption) and carcass traits were recorded at the end of 4, 8, 12, 16, and 20 weeks in both groups. The present study demonstrated that feeding of NMPS included feed has improved all the production and carcass characters. Birds getting sufficient minerals such as calcium, phosphorus, trace minerals and polyunsaturated fatty acids at regular time intervals to get maximum productivity.

Keywords: nano meter particle size, colloidal minerals, PUFA, Aseel birds

Introduction
In recent years the nano-sized which are multifaceted usage in agriculture and animal husbandry activities (Sindhura *et al.*, 2014) [4]. Though the trace minerals are used in very minute quantities in animal nutrition it limits their efficiency due to their low bioavailability, antagonism, and higher excretion rates. Nano-technology is given an opportunity to resolve these issues, as nano-particles possess different physical and chemical properties than the other forms of minerals. High physical activity and chemical neutrality are present in the nano-particles that enhance the bioavailability thereby increasing the surface area of respective minerals. Nano-trace elements not only exhibited their enhanced bioavailability but also reduced total dietary requirements leads to lesser excretion in the environment which can make them environment friendly. Further, nano-particles improve the retention of respective trace minerals in poultry meat and eggs that creates a new platform for the development of enriched products and functional foods for humans (Hassan *et al.*, 2020) [2]. Hence, an attempt was made with feeding of nano meter particle sized colloidal minerals and poly unsaturated fatty acids in native desi birds under field condition to assess it production performance.

Materials and Methods
Experimental design
The present study was conducted to assess the efficacy of Nano meter particle size (NMPS) colloidal Minerals and PUFA in the Aseel breed for its production performance. A total number of 200 Aseel day old chicks were taken and divided into two groups (Control group - CG and Trial group - TG) having 100 birds in each. Feed formulations were prepared for CG and TG as designed based on the age advance of the birds. The weight of each chick was recorded on day 1. Livability, the weight of each bird, and feed consumed were recorded at the end of 4, 8, 12, 16, and 20 weeks in both groups. The selected backyard Poultry farmer trained on the importance of minerals feeding in poultry and mixing of NMPS products in regular feed. The experiment lasts for 20 weeks period.

Description of Nano meter particle size (NMPS) colloidal Minerals and PUFA
NMPS nutrition supplements are colloidal solutions of stabilized bioassimilable nano particles of minerals and PUFA having an average particle size of 100 – 350 nm. NMPS nutrients are in highly pure form and cover exponentially high surface area due to nm particle size. The bioassimilable form is required for absorption in the gut. NMPS technology enables near 100 percent absorption of nutrients with vastly enhanced efficacy at very low serving doses.

a. **NMPS Min:** Stabilized blends of colloidal minerals embedded in matrices of amino acids and reduced to nano meter size, encapsulated with a food-grade polymer. The formulation consists of NMPS Manganese (Mn), Zinc (Zn), Iron (Fe), Copper (Cu), Cobalt (Co), Iodine (I), Selenium (Se), Molybdenum (Mo), Chromium (Cr), Silica (Si).
b. **NMPS Ca:** Stabilized colloidal calcium embedded in matrices of amino acids and reduced to nano meter particles, encapsulated with a food-grade polymer
c. **NMPS P:** Stabilized colloidal phosphorus embedded in matrices of amino acids and reduced to nano meter particles, encapsulated with a food-grade bio-polymer
d. **NMPS PUFA:** Stabilized colloidal PUFA embedded in matrices of amino acids and reduced to nano meter particles, encapsulated with a food-grade polymer.

Details	Form and particle size	pH range	Dosage
NMPS Min	50 to 250 nm	pH 2 to 3	0.5 ml / Kg of feed
NMPS Ca	50 to 250 nm	pH 2 to 3	1 ml / Kg of feed
NMPS P	50 to 250 nm	pH 2 to 3	1 ml / Kg of feed
NMPS PUFA	100 to 350 nm	pH 2 to 3	1 ml / Kg of feed

e. **Control group (CG):** Standard feed formulations for Starter, Grower & Finisher as per farmers practice were prepared, used in the control group (CG).
f. **Trial group (TG):** NMPS Ca 1 ml, NMPS P 1 ml, NMPS Min 0.5 ml, and NMPS PUFA 1 ml is mixed per Kg of starter, grower, and finisher feed, used in Trial group (TG).

Table 1: Feed formulation and NMPS inclusion in Aseel birds

S. No.	Ingredients	Starter (0-3 Weeks)		Grower (3-8 Weeks)		Finisher (> 8 Weeks)	
		CG	TG	CG	TG	CG	TG
1	Maize	50 Kg	50 Kg	45 Kg	45 Kg	45 Kg	45 Kg
2	Wheat Bran	15 Kg	15 Kg	20 Kg	20 Kg	20 Kg	20 Kg
3	Broken Rice	10 Kg	10 Kg	15 Kg	15 Kg	15 Kg	15 Kg
4	Rice Bran	15 Kg	15 Kg	10 Kg	10 Kg	10 Kg	10 Kg
5	Deoiled Groundnut cake	7.5 Kg	7.5 Kg	7.5 Kg	7.5 Kg	7.5 kg	7.5 kg
6	Mineral mixture + Salt (NaCl)	1.5 Kg	1.5 Kg	1.5 Kg	1.5 Kg	1.5 Kg	1.5 Kg
7	Dicalcium Phosphate	1.0 Kg	1.0 Kg	1.0 Kg	1.0 Kg	1.0 Kg	1.0 Kg
8	NMPS Ca – 1 ml/Kg	-	100 ml (7.5 gm)	-	100 ml (7.5 gm)	-	100 ml (7.5 gm)
9	NMPS P – 1 ml/Kg	-	100 ml (6 gm)	-	100 ml (6 gm)	-	100 ml (6 gm)
10	NMPS Min – 0.5 ml/Kg	-	50 ml (2 gm)	-	50 ml (2 gm)	-	50 ml (2 gm)
11	NMPS PUFA – 1 ml/Kg	-	100 ml (35 gm)	-	100 ml (35 gm)	-	100 ml (35 gm)
	Total	100 Kg	100 Kg	100 Kg	100 Kg	100 Kg	100 Kg

Observation parameters

1. Livability
2. Bodyweight gain
3. FCR
4. *Carcass characters*: The following carcass characteristics were recorded in the present study

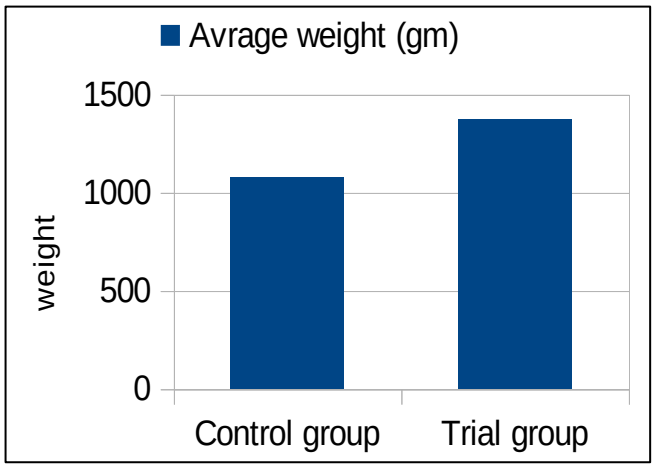
i. **Pre – Slaughter Live weight:** The Pre – Slaughter Live weight (g) of each bird was recorded just before slaughter.
ii. **Dressed weight with viscera:** Weights of the carcass were recorded after defeathering and removal of head and shanks.
iii. **Eviscerated weight**: Weight of carcass was taken after evisceration (removal of visceral organ, shank, feet, and head)
iv. **Dressing percentage:** The dressing percentage was measured by dividing dressed weight (eviscerated weight) to the live weight and multiplied by 100

Result and Discussion

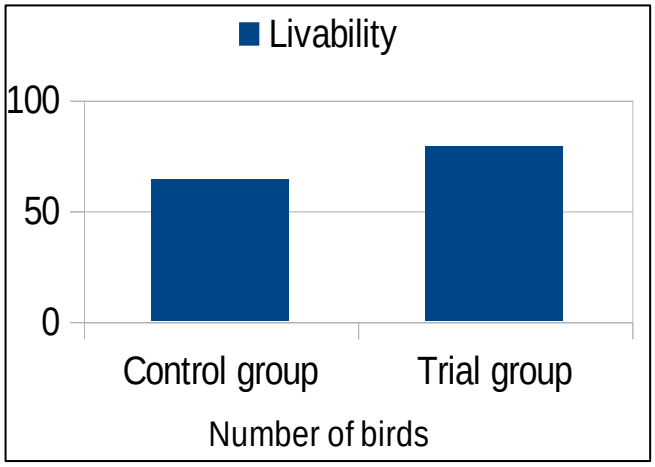
The experimental bird's livability, average body weight, and FCR were given in Table2. In the initial 4 weeks period mortality has occurred in both the groups and later there was no mortality in both the groups. However, TG had low mortality (6%) than the control group (16%).

Table 2: Effect of NMPS feeding on body weight, Livability, and FCR in Aseel birds

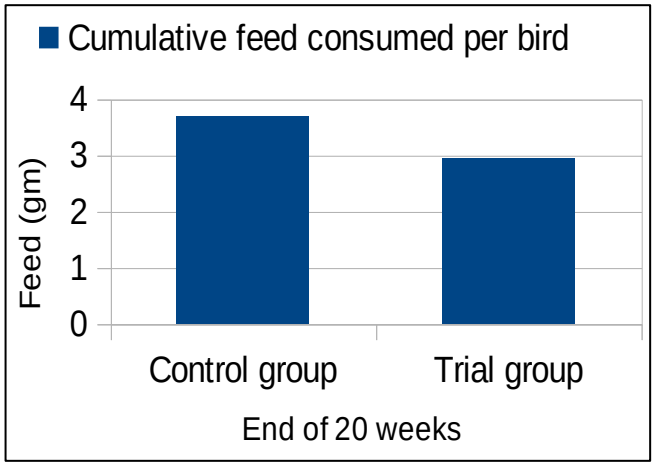
S. No	Parameters	Control Group	Trail Group
1.	Livability percentage (0-4th week)	84%	94%
2.	4th week body weight (g)	100 g	112 g
4.	8th week body weight (g)	365 g	420 g
6.	12th week body weight	750 g	956 g
8.	16th week body weight	938 g	1174 g
10.	20th week body weight	1078 g	1374 g
11.	FCR up to 20 weeks	4.67	3.67



Average weight



Livability



Cumulative feed consumed per bird

Feed Conversion Ratio

In the present study, Trial group birds showed better FCR (3.67) when compared to the control group (4.67) overall period. FCR is the ratio of feed taken by a bird to the live weight and a ratio of 1:1 is considered to be ideal in poultry. A bird with low FCR is considered to be efficient in producing live weight and also benefits the farmers. FCR is a guideline that helps farmers to save the feed cost and gets maximum live weight.

Carcass Traits

The mean carcass traits and retail cut parts (%) of the birds in the experimental groups are presented in Table 3. The pre-slaughtered live weight, eviscerated weight, and dressed weight were 1374 g, 896 g and 1021 g in the treatment group whereas the corresponding weights in the control group were 1078 g, 698 g, and 786 g respectively. The dressing percentage of the treatment group (74.3%) was higher than the control group (72.91%). Considering the economic importance of the dressing percentage and a relatively higher value in the treatment group than the control group, it could be considered as a favorable trait for the crosses under study. A slight difference between the groups among cut-up part yields such as the neck, wing, back, breast, thigh and drumstick when expressed as the percentage yield of eviscerated weight.

Table 3: Effect of NMPS feeding on Carcass traits in Aseel birds (20 weeks of age)

Traits	Control	Trail Group (NMPS)
Pre-slaughtered live weight (g)	1078	1374
Eviscerated Weight (g)	698	896
Dressed Weight (g)	786	1021
Heart (g)	6.23	6.45
Liver	34.34	37.21
Gizzard (g)	41.45	45.32
Giblet (g)	82.45	89.56
Neck (g)	79.45	95.43
Wing (g)	128.12	132.23
Breast (g)	198.45	223.45
Thigh (g)	114.54	163.89
Drumstick (g)	102.43	124.76
Spleen (g)	1.89	2.02
Dressing Percentage	72.91	74.3

Discussion

The present study proved that NMPS has improved all the production, carcass characters, and no adverse effect in meat parameters. The remarkable results in nano material may be explained as the nano materials are ultrafine in size lead to a great improvement in the properties attributed to the higher surface area caused increase absorption and reactivity. Similarly, Weiss *et al.* (2006) [6] reported that nano particle-sized ingredients might increase the functionality or bioavailability of ingredients and nutrients and thereby minimize the concentrations needed in the food product. The advantages of synthetic calcium phosphate materials in nano-size have a higher specific surface area and surface roughness compared to conventional calcium phosphate materials (Poinern *et al.*, 2009) [3].

Conclusion

In this present study birds getting sufficient minerals such as calcium, phosphorus, trace minerals and poly unsaturated fatty acids at a regular time interval to get maximum productivity. Apart from this, feather pecking among desi birds is a major constraint for the farmers and reduces the market preference. A major reason for the feather pecking is due to mineral deficiency. NMPS trail group birds did not faced any feather picking problems when compared to the control group. It is an advantage for farmers to get a better market price and reduces the mortality percentage on their farm. It could be concluded that nano minerals are having great potential as feed supplements at very lower doses than

conventional sources. Supplementation of minerals in poultry diets in nano particle size allows reducing the excreted minerals in bird's excretion which reduces environmental pollution.

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