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Influence of supplementary feeding on weight gain of ostrich chicks (*Struthiocamelus,* Linnaeus,1758) under farm conditions in Rupendehi, Nepal

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Abstract

Ostrich (*Struthiocamelus,* Linnaeus, 1758) farming is an emerging enterprise in Nepal. Only one breeding farm was started in Nepal in 2008. The present study was conducted to examine the impact of supplementary diet on the weight gain of Ostrich. Formulation and preparation of feeds was done by direct involvement in the farm. A total eight unsexed Ostrich chicks were selected in the present study by feeding two types of diet. Farm feed (normal diet) and supplementary diet were given to the Ostrich chicks for about four months in 2018 to measure the weight gain. In this study,both feeds showed little weight gain, the mean weight gain of first 15 days of study on normal diets was 7.6±0.2309 kg and 10.9±0.0186 kg on supplementary diets and it was significantly greater (P<0.0001)compared to the following weeks which showed less fluctuation and more stability through the study. Ostrich chicks reached a final weight of 35.4 ± 0.163 kg on normal diets and 44.35 ± 0.1914 kg on supplementary diets after four months, which was significantly greater (P <0.0001). The growth rate of ostriches fed a supplementary diet, was significantly higher and more rapid compared to those receiving the farm diet during the same age period. These findings suggest the inclusion of supplementary feed which positively influences growth performance in Ostrich.

Key words: Farm diet, Normal diet, Supplementary diet, Weight gain

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Introduction

Ostrich *(Struthiocamelus*) is the largest and heaviest living bird and is the only bird with just two toes and sole representatives of the Order *struthioniformes* (Alden *et al*., 1996). The Ostrich or the 'camel bird' because of its similarities with dromedaries was named in 1758 by Linnaeus as *Struthiocamelus*, based on the Greek and Latin name *Strthiocamelus* (Bertram, 1992). A male Ostrich is referred to

as a rooster, the female as hen and a young Ostrich as chick and group is called as herd. Ostrich primarily consume plants, roots, and seeds but also eat insects, lizards or other creatures available in their rugged habitat. The first successful artificial hatching took place in Algeria (Smit, 1963). The invention of the artificial incubator for ostrich eggs by Arthur Douglass in 1869 provided a major stimulus for Ostrich farming (Smit, 1963). Ostrich farming has been commercially practiced from 1860's at the Cape colony of South Africa and has been breed successfully now in various countries like in Canada, The United State, Spain, Italy, Australia and many European Countries (Huchzermeyer, 1994). The commercial farming of Ostrich has started in Nepal in 2008 with the motive of introduction of Ostrich products in the market by Ostrich Nepal Pvt. Ltd.

In intensive farming conditions, feed is the most expensive cost in poultry farming, often accounting for about 70% of total variable expenses (Suh and Moss, 2017). Feed conversion has a great impact on the growth performance. Feeding costs are the largest expanse in Ostrich production system and protein is one of the most expensive components of the diet (Carstens *et al.*, 2014). On the other hand, the availability of a wide variety of feedstuffs for poultry nutrition is limited, which indicates the main problem threatening the sustainability of poultry production worldwide. Such a problem can be minimized byusing grains locally available resources (Poławska *et al.*, 2011).Maize (*Zea mays*) is an important cereal crop and ranks second after rice in terms of area and production in Nepal. Maize is grown for food, feed, and fodder purposes in both irrigated and non-irrigated land across different eco-zones of Nepal (Paudyal and Paudel, 2001). Final sugar cane molasses could be used as feasible feed additives in improving the feeding value along with other vitamin of grain for poultry production and in ostrich farming as well. Furthermore, molasses a by-product in sugar manufacturing industries is rich in highly digestible carbohydrates and minerals, exerts a tonic effect, induces palatability and could eliminate dustiness in poultry feeds also molasses in poultry feeding is well documented (Keshavarz *et al.,*1980; Kakengi *et al.,* 2007 and Katanga 2013). Nutrition of Ostrich chicks must be accurate, because they are most vulnerable up to the age of 3 months (Cooper, 2004). A deficiency or imbalance of the nutrients will impair growth and production, resting in poor utilization of feed (Polat *et al*., 2003). It has often observed that initial growth rate of chicks is very important in establishing subsequent growth. Mushi *et al.,*(1998) observed that the chicks tend to lose about 20% of their body mass within five to seven days of hatching. Supplementary diet of Ostrich chicks must be precise because they are more susceptible up to the age of 3 months as compared to other stages of their lives. Inaccurate nutrition has significant impact on the chick's deveined (Cooper, 2004). Ostrich are exotic species in case of Nepal. Nature and environmental condition directly hamper the Ostrich farming industry. As of now, there are no any studies carried out regarding ostrich growth performance using supplementary diet for Ostrich in the farm (Tilottama – 17, Rupandehi). Hence, this study aims to compare the weight gain of Ostrich on farm feed (normal) and supplementary diets. The finding of the work may help to develop the idea for the supplementary diet for rapid growth of Ostrich.

Materials and Methods

Study area

Ostrich Nepal Pvt. Ltd has been established in the year 2008 in Tilottama – 17 Rupandehi situated 3 km. east from Madhawaliya, Siddhartha highway and approximately 18km north of Bhairahawa Airport. The GPS coordinates of the farm are approximately 27.47027° N latitude and 83.2849° E

longitude.It has started the farming with an initial investment of USD 2.26 million in around 13.54 hectares (20 bighas) areas of land and has tropical climate. Summer is characterized as warm with monsoon while winter is cool, dry and humid. The typical temperature ranges from 25^0 C to 40^0 C. Ostrich along with Emus are reared for commercial purpose in the farm.

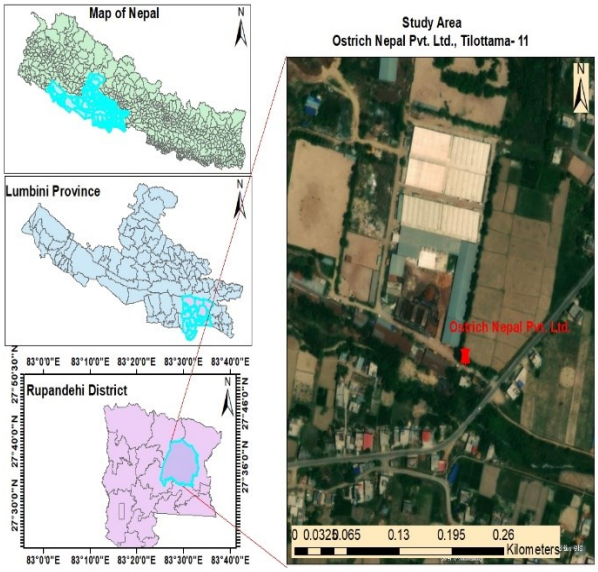

Figure 1. Study area Ostrich Nepal Pvt. Ltd.

Data collection

In first phase, preparation of feed is included, in which the raw materials are mixed, milled and pelleted at the farm by using local product. Two types of feed are prepared one with simple diet and other with adequate amount of vitamins and minerals. Farm feed contained maize, wheat, Soya bean, D.C.P.(Di calcium Phosphate), Toxivender, Wheat (Bran), Grass, Oil, Salt(Suleiman *et al*., 2015). Supplementary diet consists of soya bean, grass, wheat, molasses, vit-min premix, L-lysine, salt, DL-methionine, limestone, oil, liver tonic. With the help of workers of farm, grass, molasses and maize are grained which were afforded by local people and bran, soya meal and wheat were purchased from the local market. This method was adopted by following (Tiwari *et al*., 2006) and (Suleiman *et al*., 2015).

Table 1. Ingredients component and feed composition of Ostrich chick farm feed (normal diets)

S.N.	Particular	Weight (in kg)
1.	Maize	24
2.	Wheat	17
3.	Soybean	24
4.	D.C.P	3.5
5.	Toxivender	1
6.	Wheat (Bran)	15
7.	Grass	13.5
8.	Oil	1.5l
9.	Salt	0.5
10.	Total	100

Table 2. Ingredients component and feed composition of Ostrich chicks (supplementary diets)

S.N.	Particular	Weight (in kg)
1.	Maize	37kg
2.	Soybean	36kg
3.	Grass (hay)	7kg
4.	Wheat (bran)	10kg
5.	Molasses	5.7kg
6.	Vit-min premix	1.25kg
7.	L-lysine	0.40kg
8.	Salt	0.25kg
9.	DL-methionine	0.20kg
10.	Limestone	0.50kg
11.	Oil	1.5l

12.	Livertonic	0.20kg
13.	Total	100kg

Table 3. Growth vitamin and minerals premix, each 1.5kg consist of **ProBio-Tech Industries (Nimbus Group)**

Types of Nutrients	Occupancy of nutrients (in percentage)	Weight (in gm)
Vitamin A (min)	Vitamin A 1000	12.0
Vitamin D3 (min)	Vitamin D3 500	3.6
Vitamin E (g)	Vitamin E-50 (50%)	150
Thiamine(B1) (g)	Thiamine monoitrate (98%)	1.8
Riboflavin(B2) (g)	Riboflabin (80%)	4.8
Niacin(B3) (g)	Niacin (99.5%)	12
PantothenicAcid (g)	D-CALPAN (98%)	4.2
Pyridoxine(B6) (g)	Pyridoxine HCL (99%)	1.2
Folic Acid (B9) (g)	Folic Acid (97%)	0.9
Cyanoc(B12) (g)	Vitamin B12 (1%)	0.01
Biotin(H2) (g)	Biotin HP (10%)	0.12
Menodine(K) (g)	Menodione (31.2%)	0.18
Cobalt (g)	Cobaltsulphate 21%	0.06
Iodine (g)	Potassium iodide 68%	0.21
Iron (g)	Ferrous sulphate 30%	7
Manganese (g)	Maganous oxide 51%	24
Copper (g)	Copper sulphate 25%	1.2
Selenium (g)	Selenium 2%	0.06
Zinc (g)	Zinc Sulphate 35%	18
Magnesium (g)	Magnesium Oxide 56%	12
Choline Chloride(g)	Choline Choride 60%	100
Lysine (g)	Lysine Mono HCL	300
Methionine (g)	DLMethionine	225
Anti-oxidant) (g)	Eurotiox-32	25
Vitamin C		100

In the second phase, as the study was conducted to study weight gain of Ostrich in the farm from 15th May to 4th September, 2018.A group of totaleight African black unsexed Ostrich chicks were selected for the experimental purpose. They were selected by following simple randomized design as randomization was applied to minimize bias as well as ensure baseline comparabilityand consistent management practices which help to maintained throughout the trial period to examine the weight from One month to four months of age.Ostrich chicks of one-month age were randomly divided into two groups (four individuals in each) (Mahrose *et al.,*2015) as using small sample size help in limitation to logistical constraint, with short time boundaries also economic limitation and the availability of birds, housing capacity, and resource especially when working with large, high-maintenance species like ostriches was quite challenging. One group of chicks was fed as farm feed (normal diet) and other groups of chicks were fed as supplementary diet. Each group was kept in separate place under similar management and hygienic condition during the experimental period. The space requirement was 0.20m^2 per chicks at two weeks of age and extended by 10% (Hallem, 1992). Glucose was added to drinking water for two weeks of chicks. During the study, each ostrich chick was individually weighed at 15-day intervals using an electronic balance from one month to four months of age. Weight gain was calculated as the difference between the initial and final body weights. Adequate amount of water was provided three to four times a day. The method was adopted by following (**Shafey *et al*., 2011).**

Data analysis

The collected readings were calculated and analyzed by the use of statistical tools t-test

(significance (P<0.0001) on Microsoft Excel 2007.

Results

Growth performance of Ostrich

The average initial weight of two groups of Ostriches (sample Ostriches) at one month was 5±0.1825 kg and 4.775± 0.1632 kg (initial weight).The mean weight gain of first 15 (May 15-May31) days of study on normal diets was 7.6±0.2309 kg and 10.9±0.0186 kg on supplementary diets and it was significantly greater (P<0.0001).Similarly, on second month (May 31- Jun 16) of experimental study on normal diets was 10.2±0.2309 kg and 17.8±0.08165kg on supplementary diets was significantly greater (P<0.0001).The mean weight of third month of study on normal diets was 19.5±0.0816 kg and 26.5±0.1414 kg on supplementary diets. It was significantly greater (P<0.0001) than the weight of Ostrich on normal diet.Ostrich chicks reached up to 35.4±0.163 kg on normal diets and 44.35±0.1914 kg which was significantly greater (P < 0.0001) by supplementary diets as final weight. The result shows that the body weight of Ostrich with supplementary diets was increased differently.

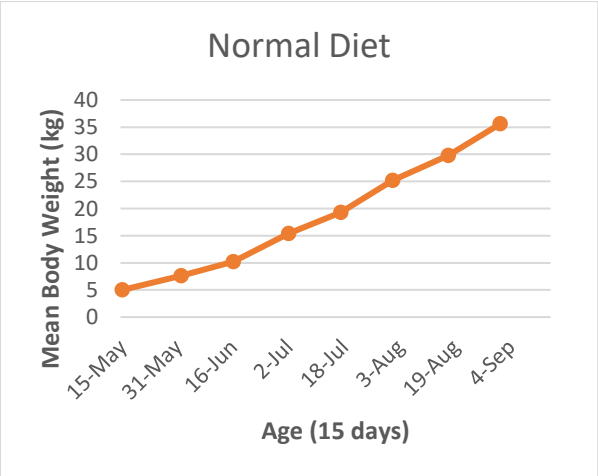

Figure 2. Mean weight gain by farm feed (normal diet) in Ostrich chicks

The above graph illustrates the mean weight (kg) of a normal diet from 15 May to 4 Sep, having initial mean weight 5±0.1825 kg, and observed steady increase in weight particularly after mid-June which reached around10.2±0.2309 kg and at the end of period gain weight approximately 35.4±0.163 kg.

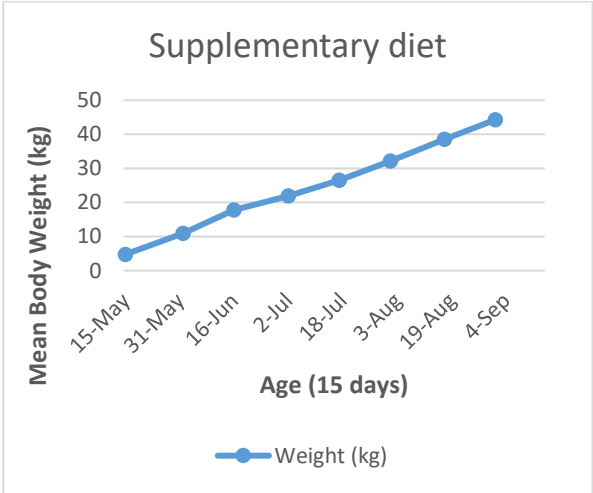

Figure 3. Mean weight gain by Supplementary diet in Ostrich chicks

This graph explain consistent and remarked increase in the mean weight throughout the same time period which is approximately 4.775± 0.1632 kg (initial weight) and reaching about 44.35±0.1914 kg (final weight) and experience continue and sustain weight gain.

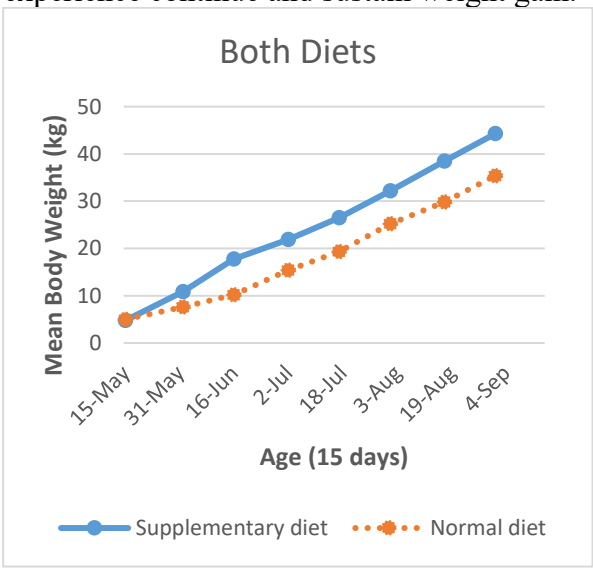

Figure 4. Mean weight gain by both diets in Ostrich chicks

This figure indicates the comprising of normal diet and supplementary diet given in the same time period, Ostrich chicks reached up to 35.4±0.163 kg on normal diets and 44.35±0.1914 kg by supplementary diets as final weight. The result shows that Ostrich with supplementary diets demonstrate better outcomes than normal diet and maintain sustain weight gain.

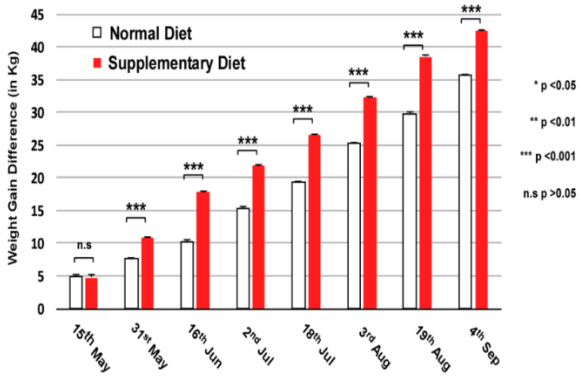

Figure 5. Comparing the weight gain difference in both diets

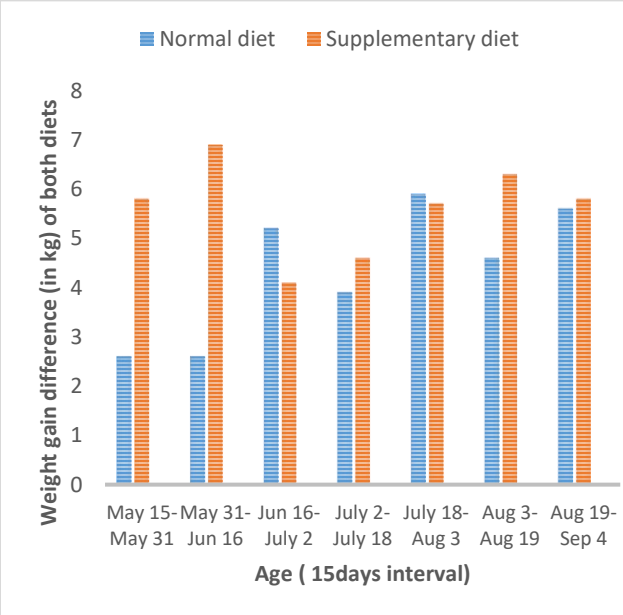

Figure 6. Difference of weight gain in both diets

From the above figure supplementary diet show greater weight gain in ostrich as compare to that of normal diet, the weight gained of both diet show fluctuation overtime, as the time period between May 31st and June 16th shows the most significant difference between the two diets, with the supplementary diet higher than normal one.

Discussion

For the first months

We documented that the mean weight gainedfor the first 15 days (May 15-May31) of study on normal diets as 7.6±0.2309 kg and 10.9±0.0186 kg on supplementary diets. For the second months the weight gain by chicks on normal diets was 10.2±0.2309 kg and on supplementary diet 17.8±0.08165 kg.The mean weight of third month of study on normal diets was 19.5±0.0816 kg and 26.5±0.1414 kg on supplementary diets.Ostrich chicks reached up to 35.4±0.163 kg on normal diets and 44.35±0.1914 on supplementary diets after four months.

The inventions of the artificial incubator for Ostrich eggs by Arthur Douglass in 1869 provided a major stimulus for Ostrich farming (Smit, 1963). Ostrich are adapted from varying temperatures from -50^0 C to +50^0 C. For successful ostrich farming in Nepal 50-55% humidity and 90-99ºF temperatures are essential. Ostrich Nepal Pvt. Ltd has been established in the years 2008 in Tilottama – 17 Rupandehi with primary startup capital of USD 2.26 million in around 13.54 hectors (20 bighas) areas of land. At the study time there were 900 adult Ostrich, approximately 1000 chicks and 200 Emus are kept at the farm.

As a result of their adaption to arid areas with a narrow range of fibrous material, Ostrich have relatively large digestive tracts which create an ideal environment for the fermentation of plant material (Ullrey and Allen, 1996; Brand and Gous, 2006). Brand and Gous (2006) pointed out the vitamin and requirements of Ostrich are minimal, and premixes are formulated with of data published from other species. The nutrients requirements changes over time due to

changes observed in the body composition in terms of the protein to fat ratio (Brand and Olivier, 2011). Ostrich are reared extensively where they totally dependent on natural grassland or planted pasture, semi- intensively where they roam on natural grassland with the addition of concentrate as supplementary feed, or intensively where they receive a fully balanced formulated diet (Brand, 2006).

We documented that the mean growth gainedfor the first 15 days (May 15-May31) of study on normal diets as 7.6±0.2309 kg and 10.9±0.0186 kg on supplementary diets. For the second months the weight gain by chicks on normal diets was 10.2±0.2309 kg and on supplementary diet 17.8±0.08165 kg.The mean growth of third month of study on normal diets was 19.5±0.0816 kg and 26.5±0.1414 kg on supplementary diets. Ostrich chicks reached up to 35.4±0.163 kg on normal diets and 44.35±0.1914 on supplementary diets after four months.Body weight of the new ratite hatching dependent on the initial egg weight from the bird emerges (Deeming and Ar 1999). Ratite chicks lose up to 20% of their mass within five to seven days of hatching before beginning a steady climb in the body mass (Leblanc, 1987; Degen *et al*.,1991). Poor or negative weight gain in young Ostrich chicks during the first few days of life recorded in this study could be due to the loss of body fluid and the utilization of yolk material which usually takes place within the first one to three weeks post hatch (Smit, 1963; Jensen *et al.,* 1992). Deeming *et al*., (1993) also reported considerable variability in growth rate of ostrich chicks of the same batch that were sharing the same room and feed. As there is significance different between in feed composition between the two group, there is progressive growth in weight gain is documented in the first week of life of group B Ostrich chick compared to the weight gain by group A mayresult due to difference in dietary preferences as well . Our findings resembled to most of the previously done experimental works too. The improved growth performance observed in ostrich chicks supplemented with molasses-based feed aligns with earlier findings in poultry. As Zavala *et al.,* (1969) reported that birds fed diets containing up to 20 % molasses maintained production performance similar to controls. The mean weekly and monthly gain of ostrich chick of feeding farm feed is lower than that of supplementary feed. The influence of Ostrich feed supplementary feed on bird growth rate respond remarkable to the extent of farm diet. In this study, the maximal rate of growth of supplementary feed was found to be between 60 and 98 days (almost 3 month) of life as 26.5±0.1414 kg by type B and 25.2±0.1632kg which is similar to the age reported by Angel (1996) in Ostrich chick in Indiana Farm (Indiana, USA).In agri-business especially in poultry, the addition of molasses as supplementary diet with vitamin at appropriate levels can enhance feed efficiency and act as a digestive stimulant in poultry and ratites as well (Swart *et al.,* 1993; Hassan *et al.,* 2016).Despite the growth rate of farm feed was less than supplementary feed can be easily affected by many factors.

Conclusion

As the growth of experimental Ostrich by supplementary shows steady increase in first 15 days and show similar pattern in end of fourth month. The Ostrich chick (during four month of age) could grow by mean weight of 44.3 kg by supplement diet whereas 35.4 kg by farm diet. It is concluded that the farm diet can be replaced in the diet of grower by supplementary feed without any significant effect on feeds selection. Supplementary diet with additional nutritional can be more beneficial than farm diet. Result from this research may contribute to the formation of a new market by using locally available raw materials as well as boosting the financial margin of ostrich farming. The current

research points the need for further studies on the nutrients requirement for Ostrich.

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