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# Effect of linear and random non-linear programming on environmental pollution caused by broiler production

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**ABSTRACT:** Environmental pollution takes place from various sources, which domestic animal is one of them. Current main environmental concern about animal manure is phosphorus and nitrogen. Extensive poultry production system produces huge amount of manure that contains large quantities of phosphorus and nitrogen. With simple diet formulating based on minimizing the cost, irreversible damage to the environment will be entered. Although today's diet formulating is based on economical and nutritional goals, environmental goals must be concerned as well. The aim of this study was to provide a novel method of diet formulating that supply poultry needs aswell as creating the least environmental pollution. Thus, 300 Ross 308 broilers were divided into five treatments with four replicates and 15 birds in each replicate. Experiment was carried out during starter, grower and finisher periods. Experimental dietary treatments in each period were including linear programming (LP50, LP69) and random non-linear programming diets (SP69, SP95, SP99 percent). Experimental data were subjected to analysis of variance based on completely randomized design and means were compared by Duncan's multiple range test. The results of this Experiment revealed that diets formulated with random non-linear programming method had significant effect on phosphorus and nitrogen excretion by broiler. method of determining livestock nutrient requirement is very practical and comprehensible.

***Keywords*:** Diet, Broiler, Environmental pollution, Phosphorus, Nitrogen.

## INTRODUCTION

With the technological advancement, the progress of human civilization and increased population, the world is faced with the environmental pollution that threatens the living creatures on the earth, so the Environmental Protection in the center of attention of the authorities in different countries. Since the poultries weakly absorb the organic phosphorus, significant amounts of it exists in their excreta (2). Huge amounts of phosphorus enter into the environment by the poultries. Moreover phosphorus is the third costly nutrient in poultries' diet formulation after the energy and protein (4). Therefore, any approach that reduces phosphorus excretion has a significant impact on the reduction of environmental pollution by phosphorus excretion and reduces production costs. On the other hand, much of the protein consumed by birds is excreted in from of uric acid in their fecal and enter the atmosphere and another part of it enter into surface and groundwater and in any case it is capable of endangering the human health and environment. About 70-75% of the total nitrogen is lost or excreted (6). One of the strategies to reduce nutrients in excretion is the appropriate diet formulation for poultries that in addition to a reduction in environmental pollution, leads to the reduction of cost and maximum profit. One of the ways is to reduce nutrients in excretion that besides the reduction of environmental pollution, leads to reduced feed costs and gaining maximum profit.

## MATERIALS AND METHODS

300 1 day old chicks Ross 308 chicks were purchased. For each test phase, which includes the Starter, grower and finisher phases, 5 differentdiets ( LP50 , LP69 , SP69 ,SP95 And SP99 ) were prepared. The experimental diets were formulized using two methods of linear and nonlinear programming.

### *Linear Programming (LP)*

Due to the fact in a particular aviculture system the cost of livestock feed are the major part of the costs, thus the linear programming method can be used to minimize the cost of livestock feed (3). Satisfying the nutritional needs of animals are the main constraints of linear programming (1). Typically this method is used to maximize the profit or return or in order to minimize the cost of a unit of production.

### *Mathematical model of linear programming*

The model used for linear programming is as follows: (10)
The objective function

$$Minimise \sum_{j=1}^{n} c_j x_j \rightarrow (j = 1, 2, 3, \ldots\ldots n)$$

Limitations

$$\sum_{j=1}^{n} a_{ij} x_j \geq b_i$$

Where:

***$C_j$:***

indicates the objective function coefficients (cost of food); $a_{ij}$:Coefficients technique of linear programming model(different combinations of food); bi: The limitation that includes essential requirements of poultries. ***$X_j$ :***

Represents the number of food in the objective function.

In the Stochastic programming if the user wants to change the jth nutrient to a higher or lower level than $b_i$ P>Ø . thus the following limit is set.

$$P\left(\sum_{j=1}^{n} a_{ij} x_j \leq b_i\right) \geq \varphi_i$$

In linear programming it is assumed that the input variables (levels of nutrients, animal needs and price elements) have a linear trend and are well known. But since the variance of the dietary nutrients are the square of the standard deviation [variance = $(SD)^2$], dietary programming becomes a non-linear problem. Thus, since the variability of the nutrients is an non linear input, the linear program is violated (2). Since the violation of certain assumptions in LP cause some problems in diet formulation, it is better to use a non-linear model (10). Nowadays the nonlinear program “STCH " is considered a more appropriate tool in the variability in nutrients in diet formulation (8). It sets the margin of safety for diet formulation and considering the diversity of dietary nutrients at different stages of diet formulation provides the animal's requirements with certainity about the amount supplied (11).

### *Statistical Analysis*

This experiment was performed as a completely stochastic design with 5 experimental groups with 4 replications. Thus chicks were distributed in 20 cages and each cage contained 15 broilers. Phosphorus and nitro samples were measure at the end of each phase of the breeding and analyzed by SAS software by GLM method.

## RESULTS AND DISCUSSION

The results showed that the pattern of providing nutrient requirements using a stochastic formulation was associated with the birds' needs and imposed little metabolic burden for the disposal of excess phosphorus on birds (Figure.1).

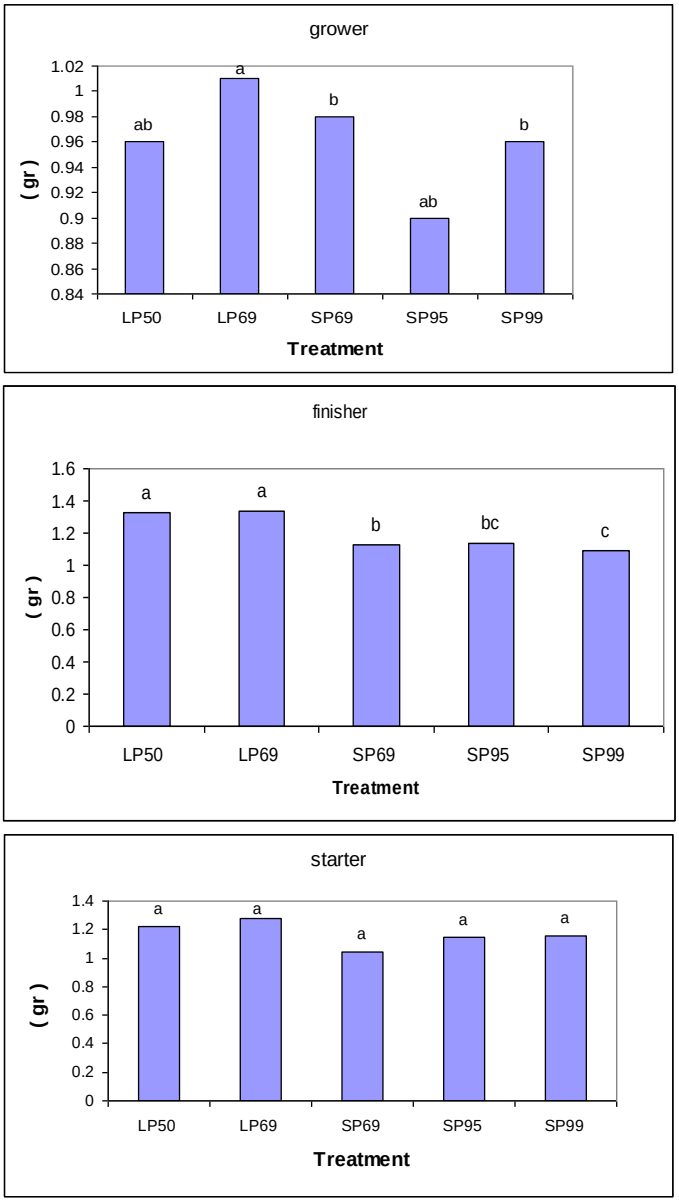


Figure 1. Mean phosphorous excretion in different periods of the breeding

The analysis results of variance in phosphorus excretion of broilers during the starter period had significant difference among the treatments ($P < 0.05$). The highest phosphorus excretion was related to LP69 treatment and the lowest was associated with SP69. Magvier et al (2005) reported that phosphorus nutrition close to the needs of the poultries can reduce the phosphorous in the manure by more than 33 percent. Castrodeza et al (2005) stated that the simple coding diet formulation based on the least cost can have irreparable damage to the the environment.

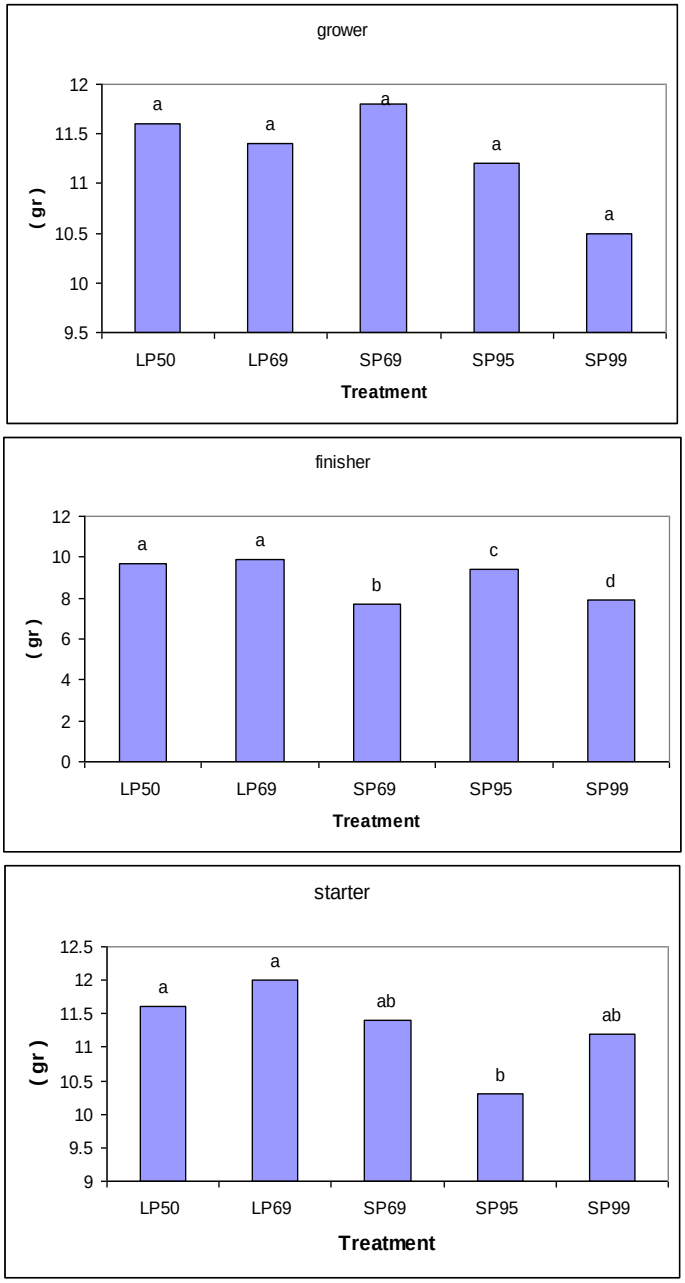


Figure 2. Mean fecal nitrogen in treatments studied in different periods of the breeding

In this factor the reducing trend of nitrogen excretion was observed as well as phosphorus which is due to changing the diet formulation from linear to stochastic method. This indicates more accurate providing of the birds needs by the stochastic method. The highest nitrogen excretion was associated with SP50 and the lowest one was associated with LP99 treatment however the differences between treatments were statistically insignificant.

***Conclusion***

Stochastic nonlinear programming significantly reduces phosphorous and nitrogen excretion and it is considered as and affordable way to reduce potential environmental pollution resulted caused by the poultry industry. Therefore there is a requirement for poultry feeding specialists' attention toward applications of the most optimaldiet formulation programs to reduce the excretion of nutrients.

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