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Short Communication

MULTIVARIATE PERSPECTIVE FOR INVESTIGATING RELATIONS AMONG SOME BEHAVIORAL TRAITS AND FEED PROGRAMS

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ABSTRACT

The main objective of this study is to evaluate the effect of different feed restrictions on some behavioral traits of broiler chickens by using a graphical technique namely Multidimensional Scaling Technique. Multidimensional Scaling Technique indicated that the behavioral traits varied based on feed restrictions and observation time of the behaviors. Results of Multidimensional Scaling Technique also showed that the birds in NF group were more active than the birds in the AD and FR groups and this case was more obvious for males.

Key words: Multidimensional scaling technique, multivariate statistics, feed restriction, behavioral traits, correlation.

INTRODUCTION

Many studies in practice aim at investigating relationships between variables. To achieve this, probably the most commonly used methods are known as the Pearson-Moment Correlation and Spearman-Rank Correlation (Winer *et al*., 1991; Tuğran *et al*., 2015). Although these correlation coefficients are widely used in practice to investigate the relations between the variables, they are not appropriate to use in order to investigate the relations between the variables and they cannot give detailed and satisfactory results for many cases in practice. It is because; these correlation coefficients required some assumptions in data sets (especially Pearson correlation coefficient) and enable researchers to investigate only the relationship between two variables (Sheskin, 2000; Mendeş, 2012). Researchers are generally interested in investigating relationships among many variables. For example, one may interest in investigating relations among some behavioral traits and feed regimes. Likewise, one may want to determine relations among different stocking densities and welfare parameters of animals. Thus, for such cases, it is needed to use more sophisticated methods which will be able to give more detailed information and figure out some latent relations. Different multivariate graphical techniques have been developed for investigating and figuring out these kinds of relations (Yiğit and Mendeş, 2016). One of the most commonly used methods is Multidimensional Scaling Technique (MDS) (Kruskal and Wish, 1978; Başpınar *et al*., 2000). Graphical techniques have many advantages over the classical techniques such as bivariate correlation coefficients and multiple regression analysis. Since the methods like Multidimensional Scaling present results as visual, it is easy to understand the results, figure out the relations, and interpret the results. In the light of advantages of the Multidimensional Scaling Technique, we aimed at investigating relations among different behavioral traits and feed restriction programs by using a Multivariate Graphical Technique.

MATERIALS AND METHODS

Data sets of this study have been obtained from an experiment which are carried out to investigate the effect of different feed restriction programs on performance, meat quality and some behavioral traits (i.e. eating orientation, resting and activation) of 60 Ross 308 chickens, in 2007. For this experiment, three groups have been formed namely *ad libitum* (AD), 20% feed restriction based on *ad libitum* groups (FR), and the individuals of third group that were not fed between 9 am and 3 pm (NF). Feed restriction had been applied to the chickens with the age range of 7 days to 21 days. The animals were slaughtered at the 6^{th} week of the investigation. Behavioral traits (i.e. eating orientation, resting and activation) were observed in the morning (9 a.m. to 11 a.m) and in the afternoon (2 p.m to 6 p.m) for three consecutive weeks. Behavioral traits were recorded every 10 minutes whenever seen. Statistical analyses were performed by using SPSS for windows (ver.22.0) statistical package program.

Statistical Analysis: Multidimensional Scaling Technique (MDS) is a graphical technique that is used to visualize proximities or objects in a low dimensional space. In MDS graphs, each object or variable is represented by a point. If two points are close to each other, then it is concluded that these two objects are similar or related to each other. Two different or dissimilar objects, on the other hand, are represented by two points that are apart from each other in a multidimensional space. MDS provides the researchers

to investigate the relations among the variables. It also helps the researchers to figure out some latent relations among the variables, understand and interpret the results easily (Kruskal and Wish, 1978; Başpınar *et al*., 2000; Yiğit and Mendeş, 2016). In this study, MDS has been performed to investigate the relations between feed programs and some behavioral traits, and thus to classify these variables with respect their similarities (Figure 1). Two different goodness-of-fit criteria namely R^2 and stress coefficient have been used to determine the suitability of MDS technique to assess similarities of the observed behavioral trait and feed regimes simultaneously.

RESULTS

Multidimensional Scaling Analysis results are shown in figure 1 in order to determine whether the observed behavioral traits are varied according to gender of animals, feed restriction programs and offering time. Stress coefficient, R^2 and Shepard plot (figure 2) have been considered to evaluate goodness of fit of the MDS solution. Stress coefficient and R^2 were found as 0.08 and 94.6%, respectively. All goodness of fit criteria showed that the MDS solution is a good choice for evaluating relations among the behavioral traits and feed restriction regimes, time and gender.

When Figure 1 is examined, it has been seen that the observed behaviors (activation, resting and eating orientation) were changed in accordance to the time of observation (morning and afternoon) that frequently affected the applied feed restriction programs of the observed behavior. This condition can be accepted as an indication of the presence of the effect of time x feed restriction program (group) interaction, too. Therefore, the effect of feed restriction programs on behavioral traits has varied in according to time. As it is seen from figure 1, the birds in the NF group are very active especially in the morning (NF morning), while the resting behavior is observed for the birds in the AD and FR groups in the afternoon (AD afternoon, FR afternoon). Some important differences have been noticed between genders in terms of the frequency of feed restriction programs. On the other hand, it is observed that the animals in the FR and AD groups are found having more rest in the afternoon (AD afternoon and FR afternoon), while the animals in NF group are found having more rest in the morning (NF morning) in general. It is noticed that there are no differences found between the groups, times, and genders in terms of activation behavior. If a general evaluation is made, it has been observed that the impact of different ways of feed offering in their timings especially such behaviors have been noticed in the morning or afternoon hours along with significant changes. It is possible to conclude that considering the behavior time will be very useful for future study in terms of getting more reliable results. The effect of the feed restrictions, on the other hand, on the observed behavioral traits in males and females are generally found similar. Therefore, the factors to be considered during the preparing the data sets and differences in the statistical tests or methods which will be used for analyzing data sets should not be overlooked that may be able to affect the reliability of the results. Here, the Multidimensional Scaling Technique has been considered with a combination of all the factors taken into account and has been using this technique able to take into account the possible correlation between these factors, as well as the understanding of the obtained results with the help of a graphical method and even easier to interpr*et al*l of them in the same time.

DISCUSSION

Investigating relations among different variables or factors is an important issue for applied sciences (Tuğran *et al*., 2015). There are several statistical tests or techniques that can be used for analyzing the same data sets or investigating relations among variables. However, the most appropriate statistical test or technique should be used for analyzing data sets to get more detailed and reliable results. Multidimensional Scaling Technique is one of the multivariate graphical techniques that can be used to investigate the effect of different feed restriction programs on some behavioral traits of broilers. In this study, it has been aimed to investigate the relations between behavioral traits and feed programs by using Multidimensional Scaling Technique (Kruskal and Wish, 1978; Başpınar *et al*., 2000; Yiğit and Mendeş, 2016).

In poultry farming, like as with other farm animals, breeders generally apply different feed restriction programs in order to get control effect of some of the negativity due to applying free feeding that may occur during their application process. Practically, it has rather been avoided the amount of feed restrictions or feeding time. There are also some disadvantages besides the advantages of feed restriction application that creates stress on the animal because of these restrictions. That is why, it should be kept in mind that there would be some sort of advantages into the different forms of feed restrictions to be applied during assessing and considering the benefits along with having some kind of disadvantages.

Offering free choice feeding to chickens causes large appetite. Large appetite and some other breeding conditions may cause some health and behavioral problems (Bokkers and Koene, 2003; Mendeş *et al*., 2007). Although applying feed restrictions in the early periods may accepted a way to prevent problems due to Ad libitum feeding, different feed restrictions programs can cause stress on the animals that cause some other unwanted problems (Beyni and Habi, 1998; Gonzales *et al*., 1998, Savory and Lariveire 2000; Tumova *et al*.

2002; Nielsen *et al*., 2003; Mendes, 2008; Dinçer *et al*., 2014).

Results of this study showed that the behavior frequencies of the birds in FR and NF groups were generally found similar to the birds in the group AD. Therefore, based on these results, itis possible to conclude that the feed restrictions have not significant negative impact on the health and welfare of the birds. On the other hand, effect of the shape, severity, and duration of the applied feed restriction regimes should not be ignored.

Conclusion: Multidimensional Scaling Technique is a graphical technique that may help the researchers to understand and interpret the results easily as well as figure out potential the latent relations. Therefore, it is possible to conclude that Multidimensional Scaling Technique can be a useful way of demonstrating the relationships between variables and evaluating the effect of different factors on the response variable in animal based studies as well as in other areas. The results of this study showed that although feed restriction applications cause a stress on the birds and a little bit low slaughter weight compared to ad libitum feeding regime, feed restriction may help to provide a quality meat in poultry by reducing fat percentage. At the same time feed restriction practices may also have positive effect by reducing mortality rate and some metabolic disorders due to consuming high amount of feed.

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