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# Effects of Pre-Starter Feeds Prepared Using Different Sugar Sources on Performance, Carcass Parameters, Internal Organ Development, Intestinal Development and Microbial Load in Broilers

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ABSTRACT

The purpose of the study is to determine the effects of pre-starter feed prepared using different sugar sources on the performance, carcass parameters, internal organs and intestinal development, microbial load in broilers. In total, 360 newly hatched chicks divided into 4 treatment groups with 5 replicates. 18 chicks with similar live weights (9 male, 9 female) were used for each replicate. Control or pre-starter feeds (containing %14 saccharose, %14 dextrose, or %7 saccharose+ %7 dextrose) were used for the feeding of the groups. For the feeding of the control group, standard chick starter feed was used for the first 5 days; for the treatment groups, the pre-starter feeds prepared were used. For the rest of the trial period, all groups were subjected to standard feeding. A significant difference was observed among groups with regards to live weight gain and feed conversion rate during the first four weeks of the study; however, this effect disappeared over the last week. In addition, it was determined that any differences observed with regards to carcass parameters other than hot and cold carcass weights, internal organ development aside from proventriculus, intestinal development and microbial load were not significant. It was concluded that the pre-starter feed prepared with saccharose and/or dextrose did not show the expected effect.

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## Introduction

Pre-starter feed is a special feed given to chicks at the early period (0-5 days) consisting of highly digestible feed materials. For getting sufficient performance with regards to numbers and quality from chicks until the slaughter, the first week after hatching is of paramount importance. Because the early feeding stage, which makes up the first week of the 35 to 42 days of feeding for the chicks is very important for many vital aspects that will affect later stages, such as the development of the digestive, immune and skeletal systems (Durmuş, 2018). The role of early stage feeding practices is significant with regards to the form, digestibility, nutritional content and problem free transition from yolk sac feeding (lipid form) absorbed during the embryonic period to solid feeding (proteins and carbohydrates). It is known that at hatching the digestive systems of the chicks are not developed yet, enzyme activity is limited, and especially protein digestion activity increases after 4 days of age, and the feed consumption capacity is quite low, at around 35 grams a day 7 (Geyra et al., 2001). However, feeding of the chicks over the first 7 days would affect the productivity in the future, so the feed provided during this time should be in a form that would benefit the chicks at the highest possible level. Thus, increasing feed consumption, expediting immunity development, using highly digestible feedstuff, providing special nutritional contents and feeding practices suitable in form and quality for high performance can increase the performance values of broilers (Durmuş, 2018).

Crypts are not visible in the intestines of newly hatched chicks (Geyra et al., 2001; Uni and Ferket, 2004). Crypt depth in the duodenum and jejunum increased significantly between days 0 and 21 in broiler chicks (Iji et al., 2001). Crypts in the small intestine develop quickly after hatching depending on the increase in cell size and number Uni et al., 1995). Crypt development affects villus development and intestinal absorption levels (Geyra et al., 2001). Intestines gain weight faster compared to other parts of the body, and this rapid development reaches its highest level

on days 6-10 (Sell et al., 1991; Akiba and Murakami, 1995). Gastrointestinal tract forms during the embryonic development (Romanoff, 1960) and gains functionality over days 17-19 during which amniotic fluid is consumed orally (Uni and Ferket, 2003; Uni and Ferket, 2004). Relative intestinal weight starts at 1% on day 17 of the incubation period, increases rapidly over the last three days, and reaches 3.5% at hatch (Uni ve Ferket, 2003). Intestinal development continues during post hatch period. It was reported that while the chick grows 4 times its live weight at hatching over the first few weeks, the gastrointestinal weight increases 12 times (Uni et al., 1995). This means most of the nutrition provided over the first few weeks is spent on the development of the digestive system. Development of internal organs in animals is related to the digestibility of feed, similar to body development. There are studies suggesting that pre-starter feeds with different raw materials affect the development of the intestinal system (Longo et al., 2007; Lamot, 2017; Sousa et al., 2021). However, there are also studies that different types of pre-starter feeds with different raw material compositions have no effect on internal organ development (Bellaver et al., 2005; Laboisssiere, 2008; Ullah et al., 2012; Xavier et al., 2012). Healthy live and productivity of animals are associated with microbial development of the intestines as much as it is associated with digestive system development. Studies have intensified on the subject of early stage feeding practices and their effects on animal performance and intestinal health (Noy and Sklan, 1998; Ao et al., 2012). It was stated that intestinal microbiota can be changed by environmental factors like nutrition (Jha et al., 2019). Some researchers have mentioned that different pre-starter feeds had significant effects on the intestinal microbial load (Fagundes et al., 2017; Nabizadeh et al., 2017; Nabizadeh et al., 2018; Qaid et al., 2021). Feeding with highly digestible feeds in the early period increases the digestive enzyme activity (Durmuş, 2020), sugar-like nutrients increase microbiome of the intestine and provides the development of intestine and immune system (Utzschneider et al., 2016).

In this study, it was aimed to determine the effects of pre-starter feeds prepared with different high digestible energy sources (saccharose, dextrose, saccharose +dextrose) on the performance, carcass parameters, internal organ and intestinal development, microbial load in broilers.

## Materials and Methods

### *Ethical Statement*

This study was conducted by the approval of the Local Ethics Board for Animal Experiments of Çukurova University (ÇÜHADYEK, Research Code: ÇÜ-HADYEK-2022/2), Adana, Türkiye

### *Animals, Feeds and Performance Measurements*

After hatching, Ross 308 broiler chicks had their sexes determined and divided into 4 treatment groups with 5 replicates each. 18 chicks with similar live weights (9 male, 9 female) were used for each replicate. Control or pre-starter feeds were used for the feeding of treatment groups. Feedstuff content and nutritional composition of the feed types used in the trial are given in Table 1 and 2.

Table 1. Feedstuff content of the feeds used in the trial (%)

| Ingredients | Pre-starter Feed | | | Standard Feed | | |
|---|---|---|---|---|---|---|
| | Saccharose | Dextrose | Saccharose + Dextrose | Control | Grower | Finisher |
| Saccharose | 14 | - | 7 | - | - | - |
| Dextrose | - | 14 | 7 | - | - | - |
| Yellow corn | 39.689 | 39.689 | 39.689 | 47.93 | 53.64 | 63.24 |
| Soybean meal (%47.5 CP) | 18.681 | 18.681 | 18.681 | 23.69 | 17.00 | 11.36 |
| Fullfat soybean (%35 CP) | - | - | - | 14.17 | 15.02 | 15.33 |
| Soy protein concentrate (%63 CP) | 10 | 10 | 10 | - | - | - |
| Corn gluten meal (%60 CP) | - | - | - | 6.46 | 6.64 | - |
| Sunflower meal((%35 CP ) | - | - | - | 3.00 | 3.00 | 5.00 |
| Beef Protein(% 30.8 CP) | 6 | 6 | 6 | - | - | - |
| Wheat Bran (small) | 7 | 7 | 7 | - | - | - |
| Meat-Bone (%35 CP) | - | - | - | 2.00 | 2.00 | 1.89 |
| Soybean oil | 0.3 | 0.3 | 0.3 | - | - | 0.84 |
| DCP (%18 P) | 1.55 | 1.55 | 1.55 | 0.74 | 0.57 | 0.35 |
| Sodium bicarbonate | 0.4 | 0.4 | 0.4 | 0.08 | 0.18 | 0.15 |
| Salt | 0.177 | 0.177 | 0.177 | 0.18 | 0.15 | 0.18 |
| L-lysine (60%) | 0.143 | 0.143 | 0.143 | 0.26 | 0.33 | 0.29 |
| L-Thronine | 0.12 | 0.12 | 0.12 | - | - | - |
| Limestone | 1.179 | 1.179 | 1.179 | 0.90 | 0.92 | 0.84 |
| Dl-methionine | 0.3 | 0.3 | 0.3 | 0.29 | 0.24 | 0.23 |
| Vitamin Premix | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Organic Trace mineral premix | 0.05 | 0.05 | 0.05 | - | - | - |
| Organic acid mix (Biacid) 9 | 0.05 | 0.05 | 0.05 | - | - | - |
| Prosel (Natural Antioxidant) | 0.05 | 0.05 | 0.05 | - | - | - |
| Trace mineral premix | 0.1 | 0.1 | 0.1 | 0.10 | 0.10 | 0.10 |
| Choline | 0.06 | 0.06 | 0.06 | 0.05 | 0.06 | 0.05 |
| Anticoccidial (Monensin) | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |

Table 2. Nutritional composition of the feeds used in the trial

| Nutrients (%) | Pre-starter Feeds | | | Starter | Grower | Finisher |
|---|---|---|---|---|---|---|
| | Saccharose | Dextrose | Saccharose + Dextrose | | | |
| Dry Matter | 88.15 | 88.60 | 88.00 | 88.79 | 88.73 | 88.55 |
| ME (Kcal/kg) | 3180 | 3160 | 3170 | 3100 | 2900 | 2800 |
| Crude Protein | 23.65 | 22.90 | 23.50 | 25.14 | 22.00 | 18.00 |
| Ether extract | 8.80 | 8.40 | 8.80 | 5.09 | 8.59 | 7.74 |
| Crude fiber | 2.40 | 2.80 | 2.50 | 3.02 | 3.39 | 3.90 |
| Crude ash | 6.40 | 6.40 | 6.40 | 5.10 | 4.54 | 4.58 |
| Lysine | 1.40 | 1.40 | 1.40 | 1.49 | 1.24 | 0.97 |
| Methionine | 0.60 | 0.60 | 0.60 | 0.64 | 0.54 | 0.49 |
| Methionine +cystine | 0.90 | 0.90 | 0.90 | 0.99 | 0.89 | 0.73 |
| Tryptophane | 0.20 | 0.20 | 0.20 | 0.24 | 0.21 | 0.18 |
| Calcium | 0.90 | 0.90 | 0.90 | 0.96 | 0.90 | 0.80 |
| Available phosporus | 0.50 | 0.50 | 0.50 | 0.48 | 0.44 | 0.38 |
| Sodium | 0.20 | 0.20 | 0.20 | 0.17 | 0.16 | 0.16 |

Table 3. Effects of Pre-Starter Feeds on Performance

| Parameter | Experimental Groups | | | | SED | P |
|---|---|---|---|---|---|---|
| | Control | Saccharose | Dextrose | Saccharose +Dextrose | | |
| BW0 (g/bird) | 34.56 | 34.54 | 34.52 | 34.52 | 0.01 | 0.741 |
| Cumulative Body Weight Gain (BWG,g/bird) | | | | | | |
| BWG1 | 149.47a | 134.48b | 118.18c | 130.69b | 1.45 | <0.001 |
| BWG2 | 458.07a | 423.83b | 415.66b | 416.10b | 3.97 | 0.005 |
| BWG3 | 956.46a | 890.04b | 865.08b | 869.13b | 8.69 | 0.007 |
| BWG4 | 1574.40a | 1502.40ab | 1455.20b | 1453.40b | 14.03 | 0.025 |
| BWG5 | 2248.91 | 2089.13 | 2141.51 | 2093.15 | 21.42 | 0.061 |
| Cumulative Feed Intake (FI,g/bird) | | | | | | |
| FI1 | 186.24a | 179.51a | 167.31b | 177.80ab | 1.84 | 0.018 |
| FI2 | 577.23 | 544.04 | 547.01 | 547.54 | 5.02 | 0.104 |
| FI3 | 1257.60 | 1195.74 | 1191.25 | 1192.17 | 10.65 | 0.116 |
| FI4 | 2277.20a | 2113.00b | 2075.00b | 2114.80b | 17.00 | 0.003 |
| FI5 | 3493.78a | 3291.61ab | 3304.38ab | 3187.75b | 33.91 | 0.039 |
| Cumulative Feed Conversion Ratio (FCR, g/g) | | | | | | |
| FCR1 | 1.25d | 1.34c | 1.36b | 1.42a | 0.00 | <0.001 |
| FCR2 | 1.26b | 1.28ab | 1.32a | 1.30a | 0.00 | 0.015 |
| FCR3 | 1.31b | 1.34ab | 1.38a | 1.37a | 0.00 | 0.009 |
| FCR4 | 1.45a | 1.41b | 1.43ab | 1.45a | 0.01 | 0.019 |
| FCR5 | 1.55 | 1.58 | 1.54 | 1.53 | 0.01 | 0.583 |
| Cumulative Mortality Number (MN,piece) | | | | | | |
| MN1 | 0.60 | 0.60 | 0.60 | 0.60 | 0.18 | >0.999 |
| MN2 | 0.80 | 0.60 | 0.60 | 0.80 | 0.22 | 0.977 |
| MN3 | 1.00 | 0.60 | 0.60 | 1.00 | 0.24 | 0.873 |
| MN4 | 1.20 | 0.60 | 0.60 | 1.20 | 0.25 | 0.701 |
| MN5 | 1.40 | 1.60 | 1.40 | 2.00 | 0.33 | 0.909 |

a. b: Significant effect on group averages indicated by different letters (P<0.05). SED: Standard error of difference between group averages

Table 4. Effects of Pre-Starter Feeds on Carcass and Organ Characteristics

| Parameter | Experimental Groups | | | | | |
|---|---|---|---|---|---|---|
| | Control | Saccharose | Dextrose | Saccharose +Dextrose | SED | P |
| Carcass Parameters | | | | | | |
| Slaughter Weight (g) | 2191.60 | 2110.65 | 2181.85 | 2113.55 | 14.24 | 0.083 |
| Hot Carcass Weight (g) | 1653.35a | 1532.80c | 1626.35ab | 1579.25bc | 12.27 | 0.005 |
| Cold Carcass Weight (g) | 1632.75a | 1497.55b | 1598.85a | 1559.15ab | 13.21 | 0.004 |
| Carcass Yield (%) | 75.47 | 72.73 | 74.56 | 74.72 | 0.39 | 0.087 |
| Abdominal Fat Weight (g) | 23.20 | 22.50 | 24.20 | 22.30 | 0.58 | 0.648 |
| Relative Abdominal Fat (%) | 1.42 | 1.51 | 1.52 | 1.43 | 0.04 | 0.713 |

a. b: Significant effect on group averages indicated by different letters (P < 0.05). SED: Standard error of difference between group averages

Table 5. Effects of Pre-starter Feeds on the Development of Internal organs

| Parameter | Experimental Groups | | | | | |
|---|---|---|---|---|---|---|
| | Control | Saccharose | Dextrose | Saccharose +Dextrose | SED | P |
| Organ Weight (g) | | | | | | |
| Crop Weight | 3.87 | 3.46 | 3.39 | 3.30 | 0.13 | 0.464 |
| Proventriculus Weight | 7.22 | 6.05 | 7.47 | 6.77 | 0.22 | 0.142 |
| Gizzard Weight | 21.35 | 22.06 | 25.51 | 20.34 | 0.90 | 0.241 |
| Pancreas Weight | 4.49 | 3.60 | 3.93 | 3.57 | 0.23 | 0.492 |
| Duodenum Weight | 5.07 | 6.66 | 8.58 | 6.13 | 0.61 | 0.262 |
| Jejunum Weight | 17.76 | 16.81 | 15.66 | 15.89 | 0.76 | 0.754 |
| Ileum Weight | 17.51 | 16.48 | 16.48 | 15.85 | 0.70 | 0.868 |
| Cecum Weight | 5.06 | 4.48 | 4.27 | 4.24 | 0.25 | 0.629 |
| Colon Weight | 2.60 | 2.38 | 2.10 | 2.20 | 0.21 | 0.842 |
| Liver Weight | 44.60 | 39.64 | 40.75 | 41.29 | 1.65 | 0.743 |
| Heart Weight | 11.92 | 10.48 | 10.64 | 10.36 | 0.50 | 0.672 |
| All Organs Weight | 188.76 | 175.08 | 187.96 | 173.32 | 3.82 | 0.356 |
| Organ Lenght (cm) | | | | | | |
| Crop Length | 5.90 | 5.66 | 5.96 | 6.26 | 0.25 | 0.868 |
| Proventriculus Length | 4.34ab | 4.28b | 4.98a | 4.06b | 0.11 | 0.046 |
| Gizzard Length | 5.56 | 5.46 | 6.16 | 5.38 | 0.16 | 0.313 |
| Gizzard Caliber | 3.70 | 4.10 | 4.16 | 4.06 | 0.14 | 0.668 |
| Pancreas Length | 15.50 | 14.34 | 14.42 | 14.90 | 0.70 | 0.931 |
| Duodenum Length | 36.10 | 33.32 | 42.40 | 30.77 | 1.76 | 0.153 |
| Jejunum Length | 73.40 | 74.40 | 58.96 | 74.60 | 2.28 | 0.075 |
| Ileum Length | 72.50 | 74.00 | 67.80 | 78.00 | 2.16 | 0.439 |
| Cecum Length | 33.44 | 35.80 | 29.80 | 30.80 | 1.24 | 0.343 |
| Colon Length | 7.20 | 9.66 | 9.02 | 9.26 | 0.40 | 0.179 |

a. b: Significant effect on group averages indicated by different letters ($P < 0.05$). SED: Standard error of difference between group averages

Table 6. Effects of Pre-Starter Feeds on Intestinal Microbial Load and Histomorphology

| Parameter | Experimental Groups | | | | | |
|---|---|---|---|---|---|---|
| | Control | Saccharose | Dextrose | Saccharose +Dextrose | SED | P |
| Intestinal Microbiology ($log_{10}$ CFU/g) | | | | | | |
| Lactic Acid Bacteria count | 5.27 | 5.33 | 5.16 | 5.61 | 0.06 | 0.084 |
| Total Coliform Bacteria count | 4.08 | 4.08 | 4.18 | 4.18 | 0.07 | 0.898 |
| Total Mesophilic Aerobic General Liver count | 5.40 | 5.17 | 5.38 | 5.17 | 0.09 | 0.666 |
| Intestinal Histomorphology (mm) | | | | | | |
| Villus Width | 0.40 | 0.41 | 0.40 | 0.42 | 0.03 | 0.979 |
| Villus Length | 2.59 | 3.16 | 2.64 | 3.07 | 0.13 | 0.323 |
| Cript Depth | 0.48 | 0.46 | 0.37 | 0.32 | 0.03 | 0.157 |

SED: Standard error of difference between group averages

Saccharose, dextrose or saccharose +dextrose as different energy sources were used for the preparation of pre-starter feeds. For the feeding of the control group chicks, standard starter feed was used for the first 5 days; for the treatment groups, the pre-starter feeds prepared were used. For the rest of the trial period, all groups were subjected to standard feeding. Feed and water were provided *ad libitum*. Chicks were reared according to the recommendations of the Ross 308 breeder company (Aviagen, 2018). Feed consumptions of the animals were determined by subtracting the leftover feed from the amount of given feed, and body weight gains were detected by subtracting the initial live weight from weekly weighing; the number of dead animals was recorded weekly. Feed conversion rate was calculated by dividing the weekly feed consumption by the change in live weight, using the formula below.

Feed conversion rate = cumulative feed consumption (g)/body weight gain (g)

***Carcass Characteristics, Organ and Intestinal Development***

Chicks in the trial were sent for slaughter at the end of the 35-day production period. 2 males and 2 females closest to the average live weight from each subgroup, 20 chicks from every treatment group, a total of 80 chicks were slaughtered. After slaughter, the carcasses of male/female chicks were separately weighed by subgroup and hot carcass weights were obtained. In addition, the total weight of internal organs removed during the preparation of the carcass, the length and weight of certain internal organs were recorded. Afterwards, carcasses were stored in cold storage at +4°C for 24 hours, and the carcasses of male/female chicks were weighed again to get cold carcass weight and calculate the carcass performance using the formula below.

Carcass performance= (Cold carcass weight (g)/Weight at slaughter (g)) × 100

The abdominal fat weights of the chicks were measured after cold carcass weights, and relative abdominal fat was calculated using the formula below.

Relative abdominal fat = (Abdominal fat weight (g)/Cold carcass weight (g)) × 100

***Microbiological Analysis***

After the animals were slaughtered, microbiological and histomorphological testing was conducted using a 2 cm sample taken from the section of jejunum closer to Meckel's diverticulum on the small intestine. Growth mediums used for the microbiological analysis were Man Rogosa and Sharpe Agar (MRS), Violet Red Bile Agar (VRB) and Plate Count Agar (PCA), used to determine the numbers of lactic acid bacteria, total coliform bacteria and total mesophilic aerobic organism, respectively. MRS and PCA growth mediums prepared to determine the lactic acid bacteria count and mesophilic aerobic organism count were sterilized in the autoclave at a temperature of 121°C and a pressure of 15 lbs. After growth media cooled down to 45-50°C, they were homogenized and transferred to sterile petri dishes. After that, 0.1 mL of sample solution was taken from dilutions prepared as $10^{-2}$ for the MRS growth medium and $10^{-3}$ for the PCA growth medium, and growth mediums were inoculated in three parallel lines. MRS petri dishes were left to incubate at 37°C for 24-48 hours and lactic acid bacteria numbers were calculated by counting the number of bacteria colonies that form (Seale et al., 1990). PCA petri dishes were left to incubate at 30°C for 24-48 hours and the bacteria colonies that formed were counted (ICMSF, 1982). VRB growth medium prepared was sterilized in an autoclave at 121°C under a pressure of 15 lbs. Growth media were cooled down to 45-50°C, 0.1 mL of sample solution was taken from the prepared $10^{-2}$ dilution and VBR agar was inoculated in three parallel lines with the two-level pour-sandwich method. The petri dishes were left to incubate at 37°C for 24 hours and the bacteria colonies that formed were counted (ICMSF, 1982). The number of bacteria colonies counted were transformed into the logarithmic ($\log_{10}$ CFU/g) value. Histomorphologic (villus height, villus width, crypt depth) measurements were done according to Sakamoto et al. (2000).

***Statistical Analysis***

Data obtained from the trial was evaluated using the SAS package software (SAS, 1996). Variance analysis of the data was conducted according to Randomized Parcels Experiment Design on the General Linear Model (PROC GLM). Duncan test was used for the multiple comparisons of the averages.

## Results and Discussion

***Performance Findings***

The effects of pre-starter feed prepared by using different sugar sources on the performance of broilers were given in Table 3. Except for the last week of the experiment, it was determined that body weight gain and feed conversion rate were lower for the groups that received pre-starter feeds compared to the control group, and the difference among groups was found significant ($P<0.05$). With regards to feed consumption, no statistically significant difference was observed on weeks 2 and 3; however, on other weeks, it was found that the control group had higher feed consumption value ($P<0.05$). In addition, no statistically significant difference was found among groups with regards to the number of dead animals ($P>0.05$).

The negative effect on the pre-starter feed used in the experiment on body weight gain might be associated with low feed consumption especially on the first week due to the hardness of the pellets. While the experiment fictionalized, the pellet hardness was not taken into consideration and so it was not measured. However, it was observed that the pellets prepared with saccharose and/or dextrose were harder than the control feeds. It has been reported that the use of extra hard feed for poultry especially for the first week right after hatching affects feed consumption negatively and might cause performance losses (Evren, 2020; Kutlu and Kutay 2020). Pellet hardness is a result of ingredient composition; and it is also affected by the amount of Non-Starch Polysaccharides (NSP) in the diet. High pellet hardness of the pre-starter feed prepared by using saccharose and/or dextrose has limited the consumption of these feeds given during the first week. Tabeidian et al. (2015), in their study where they provided pre-starter feed prepared by using casein, gluten, starch and dextrose to chicks wetted with water (0.3 l/kg feed) and unwetted, report that wetting the feed increased the daily body weight gain between days 1-42. On the other hand, hot steam used for pellet forming increases the digestion rate of ingredients in the diet especially by expanding starch molecules (Kutlu and Kutay, 2020). In this study, it is thought that the lack of hot steam treatment during pellet formation caused a drop in performance due to the lack of enhancement of feed benefit.

Feed consumption at the beginning of broiler production affects final performance levels significantly. At the start of the growth period, when the digestive system is adapting to the exogenic nutrition coming from the feed, broiler chicks require high amounts of nutrition for growth, immune system development and thermoregulation (Maiorka et al., 2006; Ebling et al., 2015). Feeding broiler chicks using high nutritional content and highly digestible pre-starter feed during this transitionary period allows higher benefit from the feed (Garcia et al., 2006; Leeson, 2008). In fact, Leeson (2008) reported that live weight of chicks fed using high digestibility pre-starter feed instead of commercial corn-soy based feed can increase from 160-170 g to 200 g by the end of day 7. It was recommended that during the transitionary period before the digestive system becomes functional, chicks should be fed with high digestible pre-starter feed (Noy and Uni, 2010). According to Saki (2005), starting feeding within the first hour for newly hatched broiler chicks improves performance. On the other hand, Ünsal (2004) reported that while early stage feeding practices have a positive effect on chick development; but this effect does not reflect on the weight gain at the end of the trial (42 days of age).

Mahdavi et al. (2017), reported that the use of pre-starter feed for the chicks over the first 10 days does not affect feed intake. It was determined that the difference among groups receiving pre-starter feed with alternative additives (control, control+cassava starch,

control+sucrose, control+corn gluten, control+blood plasma, and control+corn gluten flour+sucrose) and control feed with regards to feed intake was not significant (Longo et al., 2007). In a study it was reported that there was no significant difference among groups fed with pre-starter feeds with different levels of soy protein (0, 50 and 100 g/kg) over 35 days with regards to feed consumption, body weight gain and feed conversion rate (Omede and Iji, 2018).

It was seen that feeding practices did not have any significant effect on the death rates during the experiment (P>0.05). It was determined that the death rates observed in this study are similar to results reported by Durmuş (2018) and Evren (2020).

***Carcass, Organ and Intestine Findings***

Carcass data obtained from the study can be seen in Table 4. According to this, the difference between hot and cold carcass weights are significant (P<0.05), however the differences regarding other carcass characteristics are not significant (P>0.05).

The findings of this study regarding weight at slaughter after the use of pre-starter feed is similar to the findings of other studies (Ünsal, 2004; Durmuş, 2018; Omede and Iji, 2018; Evren, 2020). However, researchers pointed out that the differences among groups with regards to hot and cold carcass weights were not significant, and the results of this study do not support these conclusions. It is thought that the differences among groups with regards to hot and cold carcass weights are due to the amount of non-carcass wastes (internaol organs, heads, feathers, feet, etc.) and water loss during the chilling period. Results with regards to carcass performance and abdominal fat content were found to be similar to other studies (Mahdavi et al., 2017; Durmuş, 2018; Evren, 2020).

Measurements taken regarding internal organs taken out after slaughter are given in Table 5. Among treatment groups, only the pre-starter feed containing dextrose was found to have an effect on the proventriculus length (P<0.05); however, no significant effect of feeding practices was found on the measurements of other organs (P>0.05).

In this study in general, body weight gains of groups receiving pre-starter feeds were found lower, but no significant difference was detected with regards to the development of internal organs. It is thought that over the first few weeks, in groups receiving pre-starter feed, digestive system development was not sufficient due to low feed consumption, but there had been a rapid increase in digestive system development after transitioning to normal feed in later weeks. Ficinine et al. (2017), reported that the use of low digestible amino acids in the diet for the first 10 days reduced total digestive system and small intestine length, pancreas weight. Overall, it was stated that feed digestibility and internal organ development are correlated. It is thought that since technological procedures could not be applied, enzymes were not used and pellet hardness were high for the pre-starter feed used in this study, organ development over the first few weeks were negatively affected. In later weeks, it is thought that feeding long term with high benefit feed expedites internal organ development and closes the gap.

***Microbial Load***

In this study, it was found that intestinal microbial load and histomorphology were not affected significantly from feeding practices (P>0.05) (Table 6).

Intestinal microbial load can be affected by age, nutrition, diseases and other environmental factors (Shang et al., 2018). With regards to feeding, diet content, nutritional composition, feed processing and microbial contamination of the feed can change the number and variety of microorganisms in the intestine (Utzschneider et al., 2016). In fact, Apajalahti (2004) reported that intestinal microbial load of animals fed by feed consisting of different ingredients varied. It is thought that in this study, thanks to similar digestibility of the various sugar sources in the pre-starter feed provided and feeding with the same feed until slaughter afterwards, intestinal microbiota did not show any variance. It was reported that in broilers optimum microbial balance in the intestines were achieved on day 3 and maintained over the next 30 days (Apajalahti et al., 2002).

Mahdavi et al. (2017), stated that pre-starter feed has no influence on villus length and crypt depth, and this conclusion matches that of this study However, the same study showed that villus width was affected by pre-starter feed, and this result does not coincide with that of this study. The results of a similar study by Ivanovic et al. (2017), matches that of this study. On the other hand, Ficinine et al. (2017), reported that feed containing high levels of digestible aminoacids increased villus width and surface area, and reduced crypt depth. Similarly, Tabeidian et al. (2015), reported that pre-starter feed with different ingredients affect intestinal histomorphology. Jeurissen et al. (2002), stated that villus development is dependent on the amount of feed with high digestibility and absorbability. In this study, it is thought that pre-starter feed given over the first 5 days have a similar digestibility level compared to the commercial starter feed or the higher digestibility of standard feed provided for the remaining 30 days allowed the closing of the gap that appeared in the development of intestinal histomorphology over the first 5 days.

## Conclusion

In conclusion, using saccharose and/or dextrose increases the pellet hardness of the pre-starter feeds. This causes a decrease in feed consumption especially over the first week in the groups receiving pre-starter feed. In addition, lack of hot steam treatment during pellet formation negatively affected the feed's digestibility of pre-starter feed. As a result, the performance values of groups receiving pre-starter feeds over the first four weeks decreased. After day 5, with the transition to standard feed, groups receiving pre-starter feeds demonstrated growth that closed the gap. As a result, in later weeks, the gap between live weight increases closed, and disappeared completely over the last week. On the other hand, it was also found that the use of saccharose and/or dextrose has no effect on intestinal microbial load and histomorphology. In conclusion, it was found that the use of saccharose and/or dextrose in the preparation of pre-starter feeds increases pellet hardness and reduces feed digestibility, however, it did not have any effect on performance or other

parameters. This should be taken into consideration while preparing pre-starter feed and other energy sources should be considered.

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**Conflict of Interest**

The author declared no conflict of interests.

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