Effect of feeding starter diets treated with formaldehyde, sex and age on some reproductive and blood parameters of the local calves until weaning

Q Z Shams Al-dain¹, A K Nasser ², N Y Abou²
and Aywad B Mahmood²

¹ Technical Agricultural College, Mosul. Northern Technical University
² Ministry of Agriculture. State Board of Agricultural Research , Department of Agriculture Research, Nineveh, Iraq.

Abstract. This study was conducted on twelve (6 male and 6 female) local calves aged 3.5-4 months and weights 50.10 ± 2.70 kg., calves were divided into 2 main groups (6 calves /group), each main group was divided into 2 subgroup according to their sex (3 males or 3 females calves /group), and fed ad libitum on iso-nitrogenous and iso-caloric rations, ¹st main group was fed on the first ration consist mainly of barley, soybean meal, yellow maize and wheat bran (control), while ²nd main group was fed on the second ration the same control ration , but barley and soybean meal were treated with acidic formaldehyde, in addition to feeding milk until weaning age at 8 months. Results indicated that there were no significant effect of formaldehyde treatment and calves sexes on productive performance (feed consumptions, daily and total weight gain, final body weight, and all body measurements), hematological (red & white blood counts, hemoglobin, packed cell volume and platelets counts), biochemical parameters (total protein, albumin, globulin, cholesterol, triglycerides, glucose and blood urea) and concentration of some mineral elements (calcium, phosphorus, sodium, potassium and manganese) in the blood serum. While the results indicated that of red and white blood count, packed cell volume, hemoglobin, total protein, globulin and urea were increased (P≤0.05) significantly, while the blood glucose, glycerol and triglyceride were decreased significantly (P≤0.05) by increasing the calves age.

1. Introduction

Growth of animals requires the provision of all the necessary compounds and nutrients from amino acids, fatty acids, vitamins and minerals, the body is usually equipped with amino acids through the absorption from the intestines after the microbial digestion of the protein and part of the food protein from the rumen according to the source of food [1]. Since the process of forming the microbial protein in the rumen is not an absolute process, but is determined by several factors, the most important of which is the amount of dissolved organic matter and decomposed nitrogen as well as mineral elements [2]. Therefore, it is expected to shorten the processing of the body needs of amino acids, especially in animals with rapid growth, so there is a clear improvement in performance when the addition of high protein sources in the content of non-decomposed protein in the rumen to the components of the other diet and this is due to increased utilization of amino acids and energy [3]. In order to optimize the use
of feed, the nutritional value is improved by reducing the degree of decomposition in the rumen after satisfying the needs of microorganisms and increasing the availability of them for digestion and absorption in the intestines by using different methods. It has long been known that treatment with formaldehyde (HCHO) is able to protect the protein from microbial degradability by microscopic organisms in the rumen. Treatment with formaldehyde is one of the easiest treatments and has a good effect on reducing protein and energy degradation by microbial in rumen [1]. Food is treated with formaldehyde in order to provide an environment suitable for the growth of microorganisms in the rumen and the processing of animals with a greater quantity of amino acids or others [3]. Animal production is affected by many factors including genetic susceptibility, dehydrate used in the treatment [4]. Due to the lack of studies on the use of formaldehyde treatment in starter diets and its effect on certain production and blood characteristics, this study was designed to investigate the effect of formaldehyde treatment, age and sex on some reproductive and blood parameters and concentration of some minerals in local Sharabi calves until weaning.

2. Materials and Methods
This work was carried out at cattle farm of Al-Rashedia station, Department of Agricultural Research in Mosul from 1/10/2013 to 15/2/ 2014. 12 (6 males and 6 females) local sharabi calves aged 3.5-4 months and weights 50.10 ± 2.70 kg., were assigned randomly into 2 main groups (6 calves/group) according to their live weight, each main group was divided into 2 subgroup according to their sex (3 males or 3 females calves / group). and housed in 4 semi-shaded well ventilated pen (10 x 5 m) containing a stage for calves movement and exposure to sunlight. The main feed ingredients were analyzed according to[5], which supply from factory at Al-Rashidiya station from the feedstuffs which available at the station, to cover the need for the growing calves of protein and energy represented by the [6], the experimental ration (control ration) (table 1) was fed for all groups for 15 days as a preliminary period, at the end of the of the preliminary period all calves reweighted again in the morning, these weights were considered the initial weights for the two main calves groups. The 1st main groups were fed control ration (barely, soybean meal, wheat bran and yellow maize), while the 2nd main groups were fed control ration but barely and soybean meal was treated by formaldehyde (table 1) according to method by [1]. The experimental rations were provided at two meals at 8:00 am. and 5:00 pm. and fed ad libitum, while wheat straw and milk were provided at rate 0.25-0.5% and 8-10% of the live body weight of the calves, respectively, until they are 8 months old. The mineral salts are placed in each fold with the water available in front of the animals continuously. Calves were subject to a periodic veterinary prophylaxis program, where calves were routinely vaccinated against internal parasites and infectious diseases.

The body length and measurements of the body dimensions (chest girth, abdomen girth, front height, and wither height) for all calves were taken at the end of the experiment at the age of 8 months and before the morning meal was served by using a measuring tape and instrument for measuring the dimensions of the body according to the method mentioned by [8].

Table 1: Feedstuffs (gm./kg. feed) and chemical analysis (%) of experimental ration.

| Feed Stuffs(gm./kg.feed) | T.1(N.T.R.) | T.2(T.R.) | Chemical analysis determined (DM% basis)** |
|--------------------------|-------------|-----------|------------------------------------------|
| Barley grain             | 450         | 450*      | Dry matte(%) **                          | 91.84 | 91.78 | 93.67 |
| Soy bean meal            | 100         | 100*      | Crude protein(%)**                        | 16.63 | 16.74 | 2.94  |
| Wheat bran               | 350         | 350       | Ether extract(%)**                        | 3.38  | 3.41  | 0.64  |
| Yellow maize             | 85          | 85        | Crude fiber(%)***                         | 16.63 | 16.74 | 38.38 |
| Urea                     | 5           | 5         | Ash(%)***                                 | 7.33  | 7.33  | 9.9   |
| Salt (NaCl)              | 5           | 5         | ME. (Kcal./kg)***                         | 2792  | 2792  | 1481  |
| Limestone(Caco3)         | 5           | 5         |                                          |       |       |       |

*treated with formaldehyde. N.T.R=Non treatment ration, T.R= treatment ration with formaldehyde.
** Determined on dry matter base according to [5].
***Calculated from chemical analysis tables for Iraqi feed stuffs [7].
Blood samples were individually collected early in the morning after fasting overnight from all calves groups; at the age of 4 months (beginning of the experiment), 6 months (middle of the experiment) and 8 months (end of the experiment) and before morning feeding, via jugular vein, by using a 10 ml plastic disposal syringe. About 10 ml of blood were obtained from each calf by using two vacuumer tubes. The first section of the blood (5 ml) was placed in plastic containers containing ethylene-diamine tetra-acetic acid (EDTA), the tubes were inverted several times to ensure adequate mixing of the blood with anticoagulant and transported to the Animal health laboratory at Technical Agricultural College, Mosul for hematological analysis, the samples were analyzed within two hours after collection, the hematological analysis included: total of erythrocyte (RBC's × 10^6 cells/ul) and leukocyte (WBC's × 10^3 cells/ul) counts, hemoglobin concentration (Hb, g/dl) and packed cell volume (PCV%); were determined by using the automatic hemocytometer analyses (American genex type). The second section of the blood (5 ml) was placed in plastic containers free of anticoagulant, to obtain the serum using the centrifuge (3000 cycles/min) for 15 minutes, and put the serum in the plastic containers sealed and kept under temperature (-20°C) until the completion of biochemical tests. Biochemical tests were evaluated by using a number of analysis performed by using commercial kits (Biolabo Merieux, France) for the measurement of total protein, albumin, cholesterol, triglycerides, glucose, urea, calcium, phosphorus, sodium and potassium in serum by using commercial kits (MBH, German) and magnesium in serum by using commercial kits (Biomaghreb company Tunisian), according to the procedure outlined by the manufacturer and by automatic spectrophotometer.

The experiment was designed by the complete randomized design (CRD). Data generated from the experiment were statically analyzed by analysis of variance was carried out on all data according to [9]. Then means were separated by Duncan’s multiple range tests (10) to determine the significant at 0.05% level of probability.

3. Results and discussion

3.1. Productive performance

The results presented in table (2) show no significant effect of formaldehyde treatment on the average daily intake of concentrated ration, wheat straw, and total intake, however, the quantities of concentrated ration, wheat straw, and total intake have been reduced arithmetically by the first main treatment groups (barley and soybean meal) non-treated by formaldehyde) as compared to the second treatment main groups (barley and soybean meal were treated with formaldehyde) during the study period, and the low intake of concentrated rations for the two experimental treatments groups resulted in a low intake of wheat straw, this may be attributed to have positive relation between daily intake of starter ration and roughage [11]. The results were consistent with the results of [12], which observed that there were no significant effect on the use of different levels of the non-digested protein in rumen in Holstein calves diets at age12-20 weeks on the daily feed intake rate, and the results were consistent also with the results of [13], which showed no significant effect of non-treated barley and treated barley by formaldehyde on daily feed intake rations and barley straw by feeding Friesian × Karadi dairy cows. The results showed that there was no significant effect of the experimental treatments on the daily and total weight gain and final weight (table 2). However, the daily and total weight gain and final weight were increased arithmetically by the treatment of barley and soybean meal treated with formaldehyde (the 2nd treatment) as compared to the treatment of barley and soybeans non-treatment with formaldehyde (the 1st treatment), which was reflected in the absence of significant differences in total weight gain and final weight. The absence of significant differences in daily and total gain between the two experimental treatments was attributed to the fact that the experimental treatments provided the necessary requirements for the growth of calves [12]. The results were consistent with the results of [14], which indicated that there was no significant effect of the soybean meal non-treated or soybean meal treated with formaldehyde on the daily gain and the final weight of dairy cows calves.
Table 2. Effect of formaldehyde treatment, sex and calf age in some productive performance

| Factors        | Studied traits | Feed consumption (kg/calf/day) | Calf weight (kg.) | Average weight Gain /calf |
|----------------|----------------|--------------------------------|------------------|--------------------------|
|                |                | Concent.*                      | Straw            | Total                    | Initial | Final | Daily(gm) | Total(kg) |
| Mean S.E.**    |                | 2.50 ±0.29                     | 0.55 ±0.08       | 3.05 ±0.29               | 50.10 ±2.70 | 106.50 ±0.29 | 400.71 ±57.98 | 56.65 ±3.11 |
| Effect of formaldehyde(1) |              | N.T.R.***                      | 2.44             | 0.52                     | 2.96             | 50.30 ±0.29 | 105.85 ±0.50 | 396.79 ±2.44 |
|                |                | T.R. ***                       | 2.56             | 0.58                     | 3.14             | 49.90 ±0.29 | 106.55 ±0.34 | 404.64 ±2.70 |
| Effect of calf sex(2) |              | Female(F.)                     | 2.40             | 0.50                     | 2.90             | 48.90 ±0.29 | 104.80 ±0.50 | 399.29 ±5.26 |
|                |                | Male(M.)                       | 2.60             | 0.60                     | 3.20             | 51.30 ±0.29 | 107.60 ±1.05 | 402.14 ±6.30 |
| Interaction between (1×2) |              | N.T.R.xF                       | 2.39             | 0.48                     | 2.87             | 49.35 ±0.29 | 104.55 ±0.50 | 394.29 ±5.20 |
|                |                | N.T.R.xM                       | 2.49             | 0.56                     | 3.05             | 51.25 ±0.29 | 107.15 ±0.50 | 399.29 ±5.26 |
|                |                | T.R.xF                        | 2.50             | 0.52                     | 3.02             | 48.45 ±0.29 | 105.05 ±0.50 | 404.29 ±5.60 |
|                |                | T.R.xM                        | 2.62             | 0.64                     | 3.26             | 51.35 ±0.29 | 108.05 ±1.05 | 405.00 ±6.70 |

*Concent.=concentration ration,** S.E=standard error .
*** N.T.R=Non treatment ration, T.R= treatment ration with formaldehyde

Also the results presented in table (2) indicate that there was no significant effect of calves sex on the average intake of concentrated rations, wheat straw and total intake, this is reflected in the absence of significant effect of calves sex on the average daily and total weight gain at the age of 4,6 and 8 months (table 2), however, the daily and total weight gain and final weight had increased arithmetically in male calves as compared to females calves. The absence of significant effect of sex in calves in the daily and total weight gain and the final weight at the age of 8 months, may be attributed to small number of observations and the absence of significant effect of treatment in the consumption of daily feed intake. The results were consistent with results of [15], who pointed out that there was no significant effect of the Bengal hybrid bovine calves sex (25% local and 75% Friesian,37.5% local and 62.5% Friesian) on the daily gain and final weight for calves at the age of 3 and 6 months respectively, and the results of [16] who pointed out that there was no significant effect of the bovine Turkish rivers calves sex in the final weight for calves at the age of 6 and 12 month respectively.

The results of the statistical analysis showed that the interaction between the effect of the formaldehyde treatment and calf sex (table 2) had a non-significant effect on feed intake, daily and total intake, daily and total weight gain and final weight of calves.

3.2. Measurements of Body Dimensions

The results presented in [3] showed that there was no significant effect of nutritional treatments (1st treatment, barley and soybean meal non-treated with formaldehyde and 2nd treatment, barley and soybean meal treated with formaldehyde) in all studied body measurements, this may be related to the absence of significant differences effect of the final body weight of calves between the two main groups fed on the 1st treatment and 2nd treatment on all body measurements, respectively. These results were consistent with the results of [17] which indicating that there was no significant effect of nutritional treatments on body length, chest and abdomen girth, front and wither height for local sharabi calves.

Also the results shown in table (3) indicate that there was no significant effect of calves sex in all measurements of body dimensions, this may be due to the absence of significant differences in the final calves weight between the sexes, this was reflected in the absence of significant differences between the males and females calves in all measurements of body dimensions. These results were consistent with the results of [18] who pointed out that there was no significant effect of the calves sex
on body length, chest girth and wither height for cross Indonesian cattle until the age of 10 months, and consistent with the results of [16], they noted no significant effect of the calves sex on the length of the body, wither height, the chest circumference and the thickness of the wither for Turkish water buffalo calves at the age of 6 and 12 months respectively.

The results in table 3 showed that the interaction between the effect of the formaldehyde treatment and calf sex had a non-significantly effect on body length, chest and abdomen girths and front and wither heights.

### Table 3. Effect of formaldehyde treatment, sex and calf age in different body measurements and dimensions (cm)

| Studied traits factors | Body length | Girth | Height |
|------------------------|-------------|-------|--------|
|                        | Mean ±S.E*  | Chest | Abdomen | Front | Wither |
| Effect of formaldehyde(1) | 141.60 ±7.80 | 130.90 ±4.35 | 133.40 ±7.35 | 101.85 ±9.6 | 109.9 ±8.4 |
| N.T.R.F** | 141.50 | 130.80 | 133.10 | 101.30 | 108.2 |
| T.R.** | 141.70 | 131.00 | 133.70 | 102.40 | 111.60 |
| Effect of calf sex(2) | 139.80 | 130.50 | 131.10 | 100.60 | 107.70 |
| Female(F.) | 143.40 | 131.30 | 135.70 | 103.10 | 112.10 |
| Male(M.) | 139.70 | 130.40 | 130.90 | 99.90 | 106.1 |
| Interaction between (1×2) | 143.30 | 131.20 | 135.30 | 102.70 | 110.3 |
| N.T.R.xF | 139.90 | 130.60 | 131.30 | 101.30 | 109.3 |
| N.T.R.xM | 143.50 | 131.40 | 136.10 | 103.50 | 113.90 |
| T.R.xF | 143.30 | 131.20 | 135.30 | 102.70 | 110.3 |
| T.R.xM | 143.50 | 131.40 | 136.10 | 103.50 | 113.90 |

*S.E=standard error. ** N.T.R=Non treatment ration, T.R= treatment ration with formaldehyde.

#### 3.3 Hematological Parameters

The results shown in the table (4) there was no significant effect on the use of barley and soybean treated and non-treated with formaldehyde in all studied hematological parameters, the total of erythrocyte count (RBC), total of leukocyte count (WBC), hemoglobin concentration (Hb) and packed cell volume (PCV). These results were consistent with the results of [19] which indicated that there was no significant effect of the nutritional treatments on the total of erythrocyte count (RBC), total of leukocyte count (WBC), hemoglobin concentration (Hb) and packed cell volume (PCV) in the local Sharabi calves.

Also The results in the table 4 indicated that there was no significant effect of sex calves in all studied hematological parameters. The results were similar in both sexes, but it was noticed that male calves were arithmetically superiority in some of the studied traits than female calves, on the other hand female calves was the arithmetically superiority in another some of the studied traits than male calves, this fluctuation in the results may be due to the small number of observations, and these results were consistent with the results of [20], who pointed to the absence of significant effect of the calves sex of Banni Indian buffalo in leukocyte count (WBC), hemoglobin concentration (Hb) and packed cell volume (PCV).

Data in table (4) clearly indicated that calves age was significantly (P≤0.05) affected the most of the studied hematological parameters. A significant (P≤0.05) increase in the total of erythrocyte count (RBC), total of leukocyte count (WBC), hemoglobin concentration (Hb) and packed cell volume (PCV) by increasing the calves age. The significant increase in the total of RBC may be due to the increasing in body weight of calves as results of the increasing calves age which requires additional numbers of red blood cells to perform metabolic processes [21]. This increase in RBC was reflected in a significant (P≤0.05) increase in the level of hemoglobin concentration (Hb), while the significant increase in the total of leukocyte count (WBC) as calves get older, this may be due that
those animal were in phase of growth and the animal need for defense system against diseases [21]. The obtained results are in accordance with those reported by [22], they found that total of erythrocyte count (RBC), total of leukocyte count (WBC) and hemoglobin concentration (Hb) were increase significantly (P≤0.05) in serum of Sharabi calves as get older (9 and 12 months).

Table 4. Effect of formaldehyde treatment, sex and calf age in some hematological parameters

| Studied traits Factors | RBC (×10^6/µl) | WBC (×10^3/µl) | Platelets (×10^3/µl) | Hb. (g/dl) | PCV (%) |
|------------------------|----------------|----------------|----------------------|------------|---------|
| Mean ±S.E*              | 8.20 ± 1.33    | 7.98 ± 1.42±   | 4.40 ± 0.28          | 9.98 ± 1.21± | 33.90   |
| 1: Effect of formaldehyde |               |                |                      |            |         |
| N.T.R.**               | 8.27 a         | 7.96 a         | 4.40 a               | 9.81 a     | 33.97 a |
| T.R.***                | 8.13 a         | 7.99 a         | 4.39 a               | 9.97 a     | 33.83 a |
| : Effect of calf sex2  |                |                |                      |            |         |
| Female                 | 8.16 a         | 7.97 a         | 4.38a                | 9.83 a     | 33.81 a |
| Male                   | 8.24 a         | 7.99 a         | 4.42 a               | 9.95a      | 33.99 a |
| 3: Effect of calves age (month) |     |                |                      |            |         |
| 4                      | 7.91 c         | 7.64 c         | 4.36 a               | 9.49 c     | 31.76 c |
| 6                      | 8.14 b         | 7.95 b         | 4.38 a               | 9.89 b     | 33.85 b |
| 8                      | 8.55 a         | 8.35 a         | 4.46 a               | 10.29 c    | 36.09 a |

*S.E=standard error. ** N.T.R=Non treatment ration, T.R= treatment ration with formaldehyde. ***Means with different letters vertical show significant difference at(P≤0.05).

The results of the statistical analysis showed that the interaction between the effect of the formaldehyde treatment, calf sex and age had significantly (P≤0.05) effect some studied hematological parameters.

3.4 Biochemical Parameters

The results of the statistical analysis presented in table (5) showed no significant effect of experimental treatments in all values of the studied biochemical parameters, total protein, albumin, globulin, cholesterol, triglyceride, glucose and blood urea. The absence of significant effect of barley and soybean meal treated or non-treated with formaldehyde on total protein, albumin and globulin may be attributed to absences of significant effect of formaldehyde treatment on the average daily intake of concentrated ration and wheat straw, and total intake. These results were consistent with the results of [4], they indicated no significant effect of feeding the soybean meal treated or not treated with formaldehyde for cross breed Friesian cows on total protein, albumin and globulin cholesterol, triglyceride, glucose and blood urea.

The results presented in the table (Table 5) also showed no significant effect of calves sex on all studied biochemical parameters. These results were consistent with the results of [23] who indicated no significant effect of the calves sex of Indian Banni buffalo calves in total protein concentrations, albumin, globulin, cholesterol and blood urea.

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Table 5: Effect of formaldehyde treatment, sex and calf age in some biochemical parameters.

| Studied traits Factors | Total protein (g/dL) | Globulin (g/dL) | Albumin (mg/dL) | Cholesterol (mg/dL) | Triglyceride (mg/dL) | Glucose (mg/dL) | Urea (mg/dL) |
|------------------------|----------------------|----------------|----------------|------------------|---------------------|----------------|--------------|
| Mean ±S.E*             | 6.46 ±0.22           | 3.28 ±0.22     | 3.18 ±0.22     | 122.31 ±0.22     | 50.03 ±0.22         | 61.53 ±0.22    | 32.68 ±0.22  |

1: Effect of formaldehyde
- N.T.R.** 6.38 a 3.23 a 3.15 a 123.34 a 50.84 a 61.64 a 32.82 a
- T.R.** 6.54 a 3.33 a 3.21 a 121.28 a 49.23 a 61.42 a 32.54 a

2: Effect of calf sex
- Female 6.39 a 3.24 a 3.15 a 121.52 a 49.87 a 61.72 a 32.87 a
- Male 6.53 a 3.32 a 3.21 a 123.00 a 50.19 a 61.34 a 32.49 a

3: Effect of calves age (month)
- 4 6.31 b 3.22 a 3.09 b 123.71 a 51.99 a 63.20 a 31.54 b
- 6 6.43 ab 3.27 a 3.16 ab 122.27 ab 49.93 ab 61.28ab 32.94 ab
- 8 6.64 a 3.35 a 3.29 a 120.95 b 48.17 b 60.11 b 33.56 a

*S.E=standard error, ** N.T.R=Non treatment ration, T.R= treatment ration with formaldehyde.
*** Means with different letters vertical show significant difference at (P≤0.05).

The results indicated in table (5) that calves ages has a significantly affect (P≤0.05) the most studied biochemical traits. The total protein, albumin and urea were increased significantly (P≤0.05) while concentrations of glucose, cholesterol and triglycerides were decreased significantly (P≤0.05) by advance of calves ages. The significant (P≤0.05) increasing in total protein may be attributed to growth in the calves bodies, which requires an increase in cell anabolism processes and reduced catabolism metabolism which reflect to increase final body weight [24]. These results were consistent with the results of [22], they found that total protein, albumin and blood urea were increased significantly (P≤0.05) by advancing the age of local calves. While the significant (P≤0.05) decreasing in serum glucose may be attributed to an increase in microorganisms activity in rumen by increasing calves ages [25]. While the significant (P≤0.05) decreasing in cholesterol, triglycerides and glucose by increasing the age of local calves.

The results of the statistical analysis showed that the interaction between the effect of the formaldehyde treatment, calf sex and age had significantly (P≤0.05) effect some studied biochemical parameters.

3.5 concentrations of some mineral elements

The results presented in table (6) showed that there were no significant effect of the nutritional treatment (barley and soybean meal treated or non-treated with formaldehyde), sex (female or male) and age(4,6 and 8 months) of calves in the concentrations of all studied mineral elements, calcium, phosphorus, potassium, sodium and magnesium in the calves serum. The results that due to the absence of significant effect of the nutritional treatments in the concentrations of mineral elements were accordance with the results of [26], who indicated that there was no significant effect of nutritional treatment in concentrations of calcium, potassium, sodium and magnesium in local calves serum. Also the results that due to the absence of significant effect of the calves sex in concentrations of calcium, potassium, sodium and magnesium are accordance with the results of [23] who indicated no significant effect of the calves sex of Indian Banni buffalo calves in concentrations of calcium, potassium, sodium and magnesium and consistent with the results of [27], they did not notice a significant effect of the Holstein-Friesian and Brown Swiss ages 8 and 12 months in the concentration of sodium and potassium.
The results of the statistical analysis showed that the interaction between the effect of the formaldehyde treatment, calf sex, and age had non-significantly effect on the concentrations of studied minerals elements.

Table 6. Effect of formaldehyde treatment, sex and calf age in some minerals concentration (ml/dl)

| Factors | Studied traits | calcium | phosphorus | potassium | sodium | magnesium |
|---------|----------------|---------|------------|-----------|--------|-----------|
|         | Mean ± S.E*     | 7.91 ± 0.41 | 3.13 ± 0.32 | 2.83 ± 0.11 | 127.83 ± 2.37 | 2.57 ± 0.28 |
|         | N.T.R.**        | 7.89 | 3.11 | 2.81 | 127.82 | 2.55 |
|         | T.R.**          | 7.93 | 3.17 | 2.85 | 127.84 | 2.59 |
|         | :Effect of calf sex2 | Female | 7.88 | 3.10 | 2.77 | 127.75 | 2.53 |
|         |                | Male   | 7.94 | 3.16 | 2.89 | 127.91 | 2.61 |
|         | :Effect of calves age (month)3 | 4 | 7.81 | 3.08 | 2.73 | 127.74 | 2.48 |
|         |                | 6     | 7.93 | 3.13 | 2.85 | 127.82 | 2.59 |
|         |                | 8     | 7.99 | 3.21 | 2.91 | 127.93 | 2.64 |

*S.E=standard error, ** N.T.R=Non treatment ration, T.R= treatment ration with formaldehyde

4. Conclusions
The study concludes that soybean and barley treated with formaldehyde can be used as part of the starter diets of the local calves until weaning due to the absence of any evidence of adverse effects on the growth characteristics and therefore on the health of the animals treated for these source.

5. Acknowledgements
Researchers thank the Ministry of Agriculture, State Board of Agricultural Research, researchers thank the Ministry of Agriculture, State Board of Agricultural Research, Department of Agricultural Research, Animal Husbandry Station, Al-Rashedia - Mosul, and the Deanship of the Agricultural Technical College, Mosul, University of Northern Technology for facilitating and accomplishment for this research mission.

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