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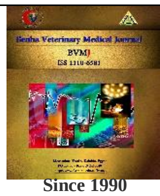

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Effect of feeding Extruded-pressed Soybean Meal on Broiler chicken Performance and Economic Efficiency.

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ABSTRACT

This study examined how extruded-pressed soybean meal (EP-SBM) affected the growth performance and economic efficiency of broiler chicks. Three groups of total 198 unsexed one-day-old Ross 308 chicks were created at random (3 replicate/22 bird/replicate). Isocaloric and Isonitrogenous diets were as follows: G1 (control) [basal diet +soybean meal (46%)], G2 [basal diet + (EP-SBM) (5, 10, and 20% for starter, grower, and finisher, respectively)] and G3 [basal diet + (10, 15, and 25% (EP-SBM) for starter, grower, and finisher, respectively)] for 42 days. Body weight significantly differed on days 7, 14, 21, and 28 (881.41, 744.3, and 774.83 g/bird, for G3, G2, and G1 on day 28, respectively). Moreover, body weight gain increased significantly on day7 and 14 for G2 and G3 than G1 (138.96, 99.49 and 92.68 g/bird on day 14 for G3, G2 and G1, respectively). Also, Feed intake differed significantly during 1st and 2nd weeks. In addition, feed conversion rate significantly increased during 1st and 2nd weeks for G1 than G2 and G3. Compared to G1, The addition of extruded-pressed SBM in G2 and G3 resulted in a lower total feed cost, total variable cost, and total cost than G1, which recorded the highest value. Regarding return parameters, they showed non-significant decrease in the cost of each kg of body weight and body weight gain from feed. It was concluded that extruded-pressed SBM improved performance and economic efficiency, so; it could be added to broiler diets.

1. INTRODUCTION

In actuality, with up to 70% of the overall cost going toward feed, chicken production was shown to be the most expensive (Mwaniki and Kiarie, 2018). More sustainable, high-quality feed sources are urgently needed in order to address nutritional difficulties and transform current animal production into a more sustainable enterprise (Sayed et al., 2019).
Producers began adding soybeans to chicken diets after the feeding of livestock with animal products as a source of protein was outlawed (Karsli et al., 2016). Soybeans have a well-balanced amino acid profile and include 18 to 22 percent high-quality oil, mostly in the form of linoleic acids (Foltyn et al., 2013). Although anti-nutritional factors limit its use and digestion, Due to its high protein content and well-balanced amino acid profile, soybean meal was the most widely utilized vegetable protein in animal feed (Alagawany et al., 2017).
Woodworth et al., (2001) mentioned that the extruder-expeller process creates a product with higher amount of fat and better digestibility of amino acids when compared to soybean meal that has been extracted using solvents. The resulting EESBM had a greater dry matter content and greater digestible amino acids than soybean meal that had undergone standard processing. Extruded SBM had higher energy that was metabolizable and digestible when compared to solvent-extracted SBM. This would hasten growth and boost feed consumption.
When birds fed a diet containing SBM that has been extracted using a solvent and high shear dry corn showed the same feed intake of birds fed a diet containing Express SBM and high shear dry except during the growing period, when birds fed a diet containing extruded-pressed SBM (ESBM) and high shear dry corn showed greater feed intake than other diets (Meyer and Bobeck, 2021). Additionally, It was found that diets using extruded-pressed SBM gained more body weight in the starting phase than diets using SBM that had been extracted using solvents, and that both diets using extruded-pressed SBM gained more weight than conventional diets during the key ending period (Meyer and Bobeck, 2021).
Jahanian and Rasouli, (2016) reported that ingredient extrusion of improved digestibility leads to higher feed intake. Also, Birds' body weight declined, and the feed conversion rate rose as the proportion of expeller cake in their diet increased. In turn, Powell et al., (2011) mentioned that the feed conversion rate wasn't significantly altered after the introduction of soybean meal that had been expeller-extruded as the only protein source. They concluded that extruded expelled (EESBM) soybeans could

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replace soybean meal without having an adverse effect on growth or mortality.
The goal of this study was to determine how different quantities of Extruded-pressed soybean meal addition to broiler chicken diets affected growth performance and economic efficiency measures.

2. MATERIAL AND METHODS

Management and Housing:
At the Center of Experimental Animal Research, Faculty of Veterinary Medicine, Benha University under the ethical number (NO BUFVTM 01-08-22), Egypt. One-day-old Ross 308 broiler chicks totaling 198 were distributed at random into 3 groups each one contained 66 birds divided into 3 equal replicates (22 bird /replicate). Experimental diets were isocaloric, isonitrogenous and lasted for 42d [Starter (from 0:11d), Grower (11:23d), and Finisher (24:42d) diets]as follows: G1 (control) (basal diet +SBM 46%), G2, basal diet + extruded-pressed soybean meal (5, 10 and 20%for starter, grower and finisher). G3, basal diet + (10, 15 and 25% Extruded-pressed soybean meal for starter, grower, and finisher). All birds were reared under the same management and environmental conditions. Extruded-pressed soybean meal was produced by Insta-Pro Express extruder/press system with trademark name Express® soybean meal. The nutritional value of the protein-rich raw ingredients utilized in the experiment to raise broiler chicks is presented in Table1.

Table 1 The chemical composition of soybean raw materials.

Items	Soybean meal (46%) (%)	Extruded-pressed SBM (%)
Moisture	12.98	9.80
Crude protein	46.30	43.28
Crude ASH	5.44	5.56
Crude fat	1.53	9.2
Crude fiber	3.72	5.6

Measurements of growth performance:
Body weight and body weight gain:
The body weight of chicks was recorded at the beginning of the experiment as well as weekly to evaluate the impact of dietary practices on changes in body weight and development patterns. Birds were weighed in the early hours of the day before feeding, using an electronic scale. The difference in body weight gain between two consecutive weeks was used to compute the live weight gain (g/broiler chick) at weekly intervals.

$$Average\ daily\ weight\ \ gain\ (ADG) = \frac{\text{Total body weight gain}}{\text{42 days}}$$

$\text{The relative growth rate } (RGR) = \frac{W_2 - W_1}{1\backslash 2(W_2 + W_1)} \times 100$ (Crampton and Lloyd, 1959).

Feed intake and feed efficiency:
The chicks were regularly supplied with experimental morning feeds, and the amount of feed consumed each day was calculated by weighing the feed that was delivered and the remainder, then dividing that amount by the number of birds that were fed each day in each group.(Wanger et al., 1983)the feed conversion ratio (FCR) was calculated by dividing the amount of feed ingested (in grams) by the weight gain (in grams) over the same week.

$FCR = \frac{\text{FI (g)}\ bird\ per\ week}{\text{BWG (g)}\ bird\ per\ week}$ Where FI (feed intake), BWG (body weight gain)

The European efficiency factor.
The European efficiency factor (EEF) was calculated using the following equation according to (Marcu et al., 2013).

$$\text{EBI} = \frac{\text{livability \%} \times \text{average daily gain (g)}\ per\ chick}{\text{FCR} \times 10}$$

Economic efficiency:
Different costs of production and return characteristics are included in economic efficiency; costs include total costs (Ngamkala et al., 2020)which are made up of total variable cost (TVC) and total fixed cost (TFC). TVC included total feed, management, and chick price costs. It was estimated per LE (1 USD ≈ 15.50 LE) during the experimental period. TFC, (depreciation cost for equipment).

$\text{Total Revenue (TR)} = \text{litter selling revenue} + \text{the bird selling revenue per gram}$

According to the methods of (Omar, 2014).

$\text{bird's selling revenue} = \text{final body weight per gram} \times \text{Market price (kg of meat} = 25\ \text{L.E).}$

$\text{Net profit per chick(NP)} = \text{TR} - \text{TC}$(Tareen et al., 2017),

$$\text{Relative economic efficiency} = \frac{\text{Economic efficiency of each experiment group}}{Economic\ efficiency\ of\ the\ control\ group)} \times 100$$

The cost of kg bird weight and body weight gain from the feed are two examples of partial economic efficiency. (Mohammed et al., 2021)

$\text{Cost of kg body weight from feed} = \text{feed cost(LE)} \div \text{bodyweight (kg)}$

$\text{Cost of kg body weight gain from feed} = \text{feed cost (LE)} \div \text{bodyweight gain (kg)}$

Statistical analysis:
The data were collected, arranged, summarized, and then analyzed statistically using the SPSS statistical software (Spss, 2007)for the following :
One-way analysis of variance (ANOVA): It was done to compare the means of variables across several treated groups for all parameters (excluding mortality). The SPSS program's Duncan's Range Test was used to determine significance. The outcomes are displayed as Mean ±SE.

3. RESULTS

Table 1 lists the nutritional value of the protein-rich raw ingredients utilized in the experiment to raise broiler chicks (Ross 308). Soybean meal (46.30%) had the highest crude protein content among the examined soybean raw materials. Extruded-pressed soybean meal had (43.28 %) crude proteins lower than solvent-extracted soybean meal (46%). In consequence, Extruded-pressed soybean meal had the highest crude fat content (9.2 %) but solvent-extracted soybean meal (46%) contains about (1.53%) crude fat content lower than extruded-pressed soybean meal, which was reflected in the gross energy level of the analyzed raw materials.

Growth performance during the experimental period:
Table 2 represented different growth parameters as body weight (BW), body weight gain (BWG), relative growth rate (RGR). Initial BW of chicks didn't show any significant difference (p> 0.05) among different treated groups. Body weight showed a significant difference on day 7, 14, 21 and 28. The highest values for Ross 308 chicks fed on diet containing extruded pressed (881.41, 744.37 and 774.83 g/bird forG3, G2andG1 on day 28, respectively, and there was no significant difference among BW changes of birds on day 35 and 42 (p> 0.05). Additionally Extruded-pressed soybean meal recorded non-significant numerical increase of EBI in groups G2 and G3 than G1 (Fig.1).

Table 2 Effect of addition of extruded-pressed SBM on body weight (BW), body weight gain (BWG) and relative growth rate (RGR) of Ross®308 broiler chickens at different weeks.

Items	Period/week	Group (1) Mean±SE	Group (2) Mean±SE	Group (3) Mean±SE	P value.
BW	initial	36.62^{a}±0.16	37.60^{a}±0.57	37.31^{a}±0.17	0.214
	Day7	116.47^{b}±6.99	117.93^{b}±3.54	149.63^{a}±1.67	0.004
	Day 14	209.15^{b}±6.84	217.42^{b}±14.65	288.59^{a}±8.52	0.003
	Day 21	423.57^{b}±28.58	401.79^{b}±34.58	527.13^{a}±19.14	0.042
	Day 28	774.83^{ab}±33.05	744.37^{b}±42.86	881.41^{a}±6.77	0.049
	Day 35	1350.70^{a}±41.10	1325.70^{a}±23.45	1444.30^{a}±45.68	0.145
	Day 42	2083.70^{a}±150.84	2089.20^{a}±43.34	2353.70^{a}±78.54	0.179
BWG	0–7 day	79.85^{b}±7.14	80.33^{b}±4.10	112.32^{a}±1.69	0.005
	7–14 day	92.68^{b}±7.37	99.49^{b}±11.23	138.96^{a}±7.17	0.02
	14–21 day	214.43^{a}±22.95	184.37^{a}±21.75	238.54^{a}±11.72	0.223
	21–28 day	351.26^{a}±13.66	342.58^{a}±13.47	354.28^{a}±14.92	0.834
	28–35 day	575.90^{a}±16.76	581.36^{a}±19.42	562.93^{a}±43.32	0.901
	35–42 day	732.93^{a}±166.43	763.43^{a}±27.41	909.33^{a}±107.21	0.547
	Cumulative BWG	2047.00^{a}±150.93	2051.60^{a}±43.68	2316.40^{a}±78.38	0.18
RGR	1st week	103.91^{b}±4.55	103.18^{b}±3.25	120.15^{a}±0.79	0.017
	2nd week	57.07^{a}±4.98	58.96^{a}±3.60	63.34^{a}±1.89	0.512
	3rd week	67.41^{a}±3.77	59.29^{a}±3.14	58.44^{a}±1.31	0.135
	4th week	58.85^{a}±3.23	60.10^{a}±2.99	50.40^{a}±2.97	0.127
	5th week	54.26^{a}±1.77	56.40^{a}±3.64	48.30^{a}±2.76	0.192
	6th week	42.12^{a}±7.95	44.70^{a}±1.12	47.81^{a}±5.28	0.777
	Cumulative RGR	193.02^{a}±0.50	192.92^{a}±0.23	193.75^{a}±0.18	0.239

Means carrying a-b-c significantly different among different groups of the same row.

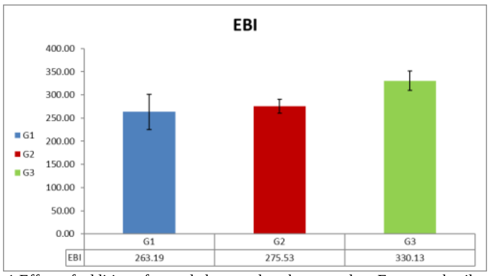

Figure 1 Effect of addition of extruded-pressed soybean meal on European broiler index.

Concerning BWG, there was a significant difference recorded on day7 and 14 ($p<0.05$), the highest values were recorded for G2 and G3 (138.96, 99.49 and 92.68 g/bird for G3, G2and G1on day 14, respectively). Cumulative BWG didn't show any significant difference ($p> 0.05$).

Relative growth rate (RGR) showed a significant increase during 1st week only for the 3rd experimental group (120.15, 103.18 and 103.91% for G3, G2 and G1, respectively). The total RGR did not reveal any appreciable variation across the groups.

Table 3 represented FI and FCR. Feed intake (FI) during 1st, 2nd week showed a significant ($p<0.05$) increase for G3 than for G2 and G1 (142.50, 122.60 and 136.01 g/bird for G3, G2, and G1 on 1st week, respectively), (353.33, 282.67, and 317.33 g/bird for G3, G2, and G1 on 2nd week, respectively).

The feed conversion ratio (FCR) and the cumulative FCR (CFCR) didn't differ significantly among the rearing period but during 1st and 2nd weeks, FCR showed a tendency to increase ($p<0.01$) for G1 than G2 and G3 (1.73, 1.54, and 1.26 for G1, G2, and G3 during 1st week, respectively), (3.45, 2.85, and 2.56 for G1, G2, and G3 during 2nd week, respectively).

Table 3 Effect of addition of extruded-pressed SBM on feed intake (FI) and feed conversion rate (FCR) of Ross®308 broiler chickens at different weeks

Items	Period/week	Group (1) Mean±SE	Group (2) Mean±SE	Group (3) Mean±SE	P value.
FI	1st week	136.01^{a}±2.47	122.60^{b}±1.80	142.50^{a}±4.11	0.008
	2nd week	317.33^{b}±11.14	282.67^{c}±4.33	353.33^{a}±6.67	0.002
	3rd week	529.22^{a}±4.60	508.90^{a}±22.45	533.06^{a}±1.66	0.436
	4th week	818.67^{a}±14.68	806.33^{a}±36.41	836.67^{a}±10.17	0.672
	5th week	965.16^{a}±4.79	933.29^{a}±24.41	948.70^{a}±2.83	0.360
	6th week	1003.40^{a}±9.78	934.38^{a}±19.69	1004.00^{a}±12.07	0.09
	Cumulative feed intake (FI)	3769.80^{a}±23.24	3588.20^{a}±62.16	3818.30^{a}±16.41	0.117
FCR	1st week	1.73^{a}±0.14	1.54^{ab}±0.10	1.27^{b}±0.06	0.051
	2nd week	3.45^{a}±0.14	2.91^{ab}±0.31	2.55^{b}±0.09	0.054
	3rd week	2.53^{a}±0.29	2.86^{a}±0.42	2.25^{a}±0.12	0.415
	4th week	2.34^{a}±0.14	2.36^{a}±0.12	2.37^{a}±0.07	0.986
	5th week	1.68^{a}±0.06	1.61^{a}±0.06	1.71^{a}±0.13	0.742
	6th week	1.50^{a}±0.29	1.23 ^{a}±0.06	1.14^{a}±0.14	0.417
	Cumulative FCR	1.86^{a}±0.13	1.75 ^{a}±0.05	1.65^{a}±0.05	0.30

Means carrying a-b-c significantly different among different groups of the same row.

Economic efficiency measures:

The results of economic efficiency measures are displayed in table 4. Concerning the different feed costs for the Starter (from 0:11d), Grower (11:23d), and Finisher (24:42d) diets. Starter feed costs differed significantly among the three different groups (LE, 1.88, 1.66, and 2.01for G1, G2, and G3, respectively). With respect to finisher feed costs, there was a significant difference between 3 experimental groups. G1 showed a significant increase for finisher feed costs than for G2 and G3 (LE, 17.3, 15.89, 16.26 for G1, G2, and G3, respectively). However, grower feed costs did not differ significantly among different groups.

Regarding total feed cost, total variable cost (TVC) and total costs (TC), they showed a significant difference between three groups; For total feed cost, G1 recorded the highest feed cost (LE, 26.68) while G2 showed the lowest value for total feed cost (LE,24.58) followed by G3 (LE,25.76). TVC and TC also differed significantly between 3 groups. G1 recorded the highest value (LE, 40.23 and 41.8 for TVC and TC, respectively). However, the lowest values recorded by G2 (LE, 38.13 and 39.7 for TVC and TC, respectively) followed by G3 (LE, 39.31and 40.88 for TVC and TC, respectively).

Return parameters, economic and relative economic efficiency did not differ significantly among three groups. The addition of Extruded-pressed SBM to a diet of Ross 308 broiler chicks caused non-significant decrease in feed cost (LE) for each kg body weight and body weight gain.

Table 4 Effect of addition of extruded-pressed SBM on economic efficiency measures of Ross®308 broiler chickens at different weeks.

Items	Group (1) Mean±SE	Group (2) Mean±SE	Group (3) Mean±SE	p value
Starter cost	1.88^{b}±0.04	1.66^{c}±0.01	2.01^{a}±0.01	0.000
Grower cost	7.5^{a}±0.02	7.03^{a}±0.26	7.49^{a}±0.02	0.113
Finisher cost	17.3^{a}±0.1	15.89^{b}±0.51	16.26^{ab}±0.09	0.039
Total feed cost	26.68^{a}±0.16	24.58^{b}±0.77	25.76^{ab}±0.11	0.048
light	0.3	0.3	0.3	
Labor	1.60	1.60	1.60	
Chick price (LE)	9	9	9	
Litter price (LE)	0.9	0.9	0.9	
TVM	1.75	1.75	1.75	
Building rent	1.5	1.5	1.5	
Equipment	0.07	0.07	0.07	
TFC/chick	1.57	1.57	1.57	
TVC	40.23^{a}±0.16	38.13^{ab}±0.77	39.31^{ab}±0.11	0.048
TC	41.8^{a}±0.16	39.7^{b}±0.77	40.88^{ab}±0.11	0.048
Bird selling price (LE)	52.09^{a}±3.77	52.23^{a}±1.08	58.84^{a}±1.96	0.179
Litter selling price (LE)	0.5	0.5	0.5	
Total return (TR)	52.59^{a}±3.77	52.73^{a}±1.08	59.34^{a}±1.96	0.179
Net return	10.79^{a}±3.65	13.03^{a}±1.31	18.46^{a}±1.86	0.160
Economic efficiency	0.26^{a}±0.09	0.33^{a}±0.04	0.45^{a}±0.04	0.151
Relative economic efficiency (%)	100.00^{a}±33.62	127.76^{a}±14.66	175.11^{a}±17.18	0.151
Feed cost (BW) (LE/Kg)	12.93^{a}±0.85	11.77^{a}±0.43	10.97^{a}±0.32	0.134
Feed cost (BWG)(LE/K)	13.16^{a}±0.89	11.99^{a}±0.44	11.14^{a}±0.33	0.137

4. DISCUSSION

From the results of the chemical composition analyses of the protein raw materials (soybean meal 46% and Extruded-pressed soybean meal) (Table1) used in this study, we found that the results within the range of values obtained by(Meyer and Bobeck, 2021). The manufacturing process, oil extraction (chemical and mechanical), and processing methods all impact the chemical makeup as well as the fat content (degree of heat treatment for inactivation of anti- nutritional factors especially trypsin inhibitors and urease activity). When soybeans are processed with the Insta-Pro Express TM extruder/press system, the resulting extruded-pressed soybean meal typically has a higher dry matter content and lower moisture content than soybean meal that has undergone conventional processing.

In this study, the addition of extruded-pressed soybean meal to feed formulations of Ross308 broiler chickens allowed a significant increase in the BW, BWG and RGR of chicken with no effect on FCR and EBI ; these results were in agreement with that reported by (Janocha and Milczarek, 2022)and by (Meyer and Bobeck, 2021) who concluded that birds provided diets containing Extruded-pressed soybean meal gained more body weight overall and during each performance period than birds fed diets containing solvent-extracted SBM (SBM 46%).Also, This was consistent with the information provided by (Zhang et al., 1993), who mentioned that the body weight gain increased due to the presence of extruded-pressed SBM in the diet.

Powell et al., (2011) did not observe any appreciable differences in the FCR. The addition of 10% or 20% soybean cake to feed regimens for Ross 308 broiler chickens did not affect BW or FCR, according to (Ganzer et al., 2017). Woodworth et al., (2001), also noted that the growth performance of pigs fed either extruded-pressed SBM or SBM extracted using solvent was similar when fed diets of the same digestible lysine and metabolizable energy, indicating that the extruding-expelling method effectively inactivated the anti- nutritional factors of uncooked SBM.

These results disagreed with those recorded by Sliwa, (2018), who discovered that birds' BW reduced while their FCR increased as the amount of soybean expeller cake in their diet increased. When the SBM was completely eradicated using the expeller cake, the final BW significantly decreased (7.7%), and the FCR increased (5.5%). Also, in contrast, Meyer and Bobeck, (2021) reported that FCR was improved in the case of an Express SBM-based diet which might be a result of increased ME.

Ross 308 broiler chicken fed Extruded-pressed-based diet presented significantly higher FI than those fed diet containing SBM46% in the 1st and 2nd weeks. These findings are in line with those of Meyer and Bobeck, (2021), who found that chicken fed diets containing extruded-pressed SBM consumed feed at a higher rate than chicken fed diets containing SBM 46%.This difference was likely caused by improved energy availability and palatability (increased sweetness, decreased starch, and increased dextrin), as well as the possibility that ingredients subjected to the extrusion process would pass more quickly through the digestive system and thus enable higher feed intake. In case of extruded ingredients, daily growth and feed efficiency improved. Also, Powell et al., (2011) reported that when fed diets based on measured amino acid values, extruded-expelled SBM and solvent extracted SBM had the same feeding value for 0 to 18 day old broilers.

The addition of extruded-pressed SBM at different levels to the diet of Ross308 broiler chicken resulted in significant differences along total feed costs, total variable cost (TVC), and total cost (TC). G1 revealed a higher total feed cost, TVC, and TC than G2 and G3, (LE,26.68, 40.23 and 41.8 for total feed cost, TVC and TC for G1, respectively), while G2 and G3 revealed the lowest total feed cost, TVC and, TC (LE, 24.58, 38.13, and 39.7 for total feed cost, TVC and TC for G2, respectively),(LE, 25.76, 39.31, and 40.88 for total feed cost, TVC and TC for G3, respectively). This is due to extruded-pressed SBM containing both highly digestible protein (amino acids) and oil (7-8%) in the same ingredient, which decreases the amount of SBM 46% and corn in the diet. Compared to conventional solvent-extracted products, extruded SBM demonstrated higher amino acid digestibility in broilers by up to 10% in digestibility coefficients. This illustrates why the extruded-pressed SBM-based diet increased the FI of Ross 308 broiler chicks, and at the same time, birds fed a diet containing extruded-pressed SBM recorded lower values for total feed cost, TVC, and TC (Jahanian and Rasouli, 2016). Also, Pacheco et al.,(2014) revealed that feeding hens mechanically pressed SBM with intermediate ANF levels boosted the feed efficiency of broilers.

The addition of extruded-pressed soybean meal resulted in non-significant increase in net return, economic and relative economic efficiency, which reached (175.11) for G3 versus (100.00) for G1. This was mainly due to the positive effect of extruded-pressed soymeal on body weight which recorded the highest value in G3 and lower feed cost than the control group. Also, these results reflected on lowering the cost of each kg BW and BWG from feed in groups containing extruded-pressed soymeal than control group.

This study demonstrated that Ross308 broiler chicken fed the extruded-pressed SBM had a higher final BW than those fed SBM 46%based diet. Also, birds fed the extruded-pressed SBM-based diet recorded a significantly higher body weight gain at 7 and 14 days than those fed a diet containing SBM 46%. Moreover, birds fed extruded-pressed SBM-based diet recorded a significantly higher feed intake at 1st and 2nd week than those fed diets containing SBM 46%. This was reflected in the different economic efficiency measures as non-significant increased return parameters in birds fed a diet containing extruded pressed than those fed SBM 46% based diet. Thus, indicated that addition of extruded pressed to diet of Ross308 broiler chicken did not have any adverse effect on growth performance and economic efficiency parameters. This is in agreement with that reported by(Janocha and Milczarek, 2022), who revealed that the best raising results were obtained when non-GM soybean expeller cake was completely substituted for GM soybean meals in broiler chicks.

5. CONCLUSION

The addition of dietary extruded-pressed soybean meal in broiler chicken feed formulations up to 10, 15 and 20% in starter, grower, and finisher broiler chicken diets, respectively, resulted in good rearing results without any bad effect on growth performance. Regarding economic efficiency measures, it was concluded that the addition of extruded-pressed soybean meal to the diet of broiler chicken produced good economic efficiency.

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