

## NUTRIENT DIGESTIBILITY, PRODUCTIVE PERFORMANCE AND SOME SERUM BIOCHEMICAL INDICATORS AS AFFECTED BY SUBSTITUTION OF SOYBEAN MEAL FOR INACTIVE DRY YEAST IN GROWING LAMBS DIET

E.M. Ibrahim<sup>1\*</sup> and Soad El Naggar<sup>2</sup>

<sup>1</sup>Animal Production Department, Faculty of Agriculture, Minia University, Egypt

<sup>2</sup>National Research Centre, Animal Production Department, Dokki, Giza, 12311, Giza, Egypt

\*Corresponding author Email: [emad\\_i@mu.edu.eg](mailto:emad_i@mu.edu.eg)

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### SUMMARY

A total number of 44 growing Ossimi lambs (averaged 4 months of age and  $21.59 \pm 0.77$  kg) were used to assess the effect of soybean meal substitution for inactive dry yeast (IDY) at levels 0, 15, 30 and 45 % on nutrients digestibility, productive performance and some serum biochemical indicators of growing lambs. The results showed that digestibility coefficients of DM, OM, CP, CF, NDF, NFE and nutritive values (DCP and TDN) were increased ( $P < 0.05$ ) for lambs fed IDY at levels 15 and 30 % compared to those fed 0 and 45%. The improvement in nutrients digestibility and nutritive values was higher ( $P < 0.05$ ) for lambs fed IDY at the level 30 % than those fed 15 %. However, the averages of nutrients digestibility and nutritive values for lambs fed IDY at levels 0 and 45 % were comparable. In addition, the averages of final body weight (FBW) were increased ( $P < 0.05$ ) for lambs fed IDY at the level of 30 % than those fed 0, 15 and 45 %. Also, the averages of daily gain (ADG) were increased ( $P < 0.05$ ) for lambs fed IDY at levels of 15 and 30 % in comparison to those fed 0 and 45%. Data showed no significant differences in averages of feed intakes of soybean straw (SSI), DM and TDM among the experimental treatments. However, the intakes of DCP and TDN were greater ( $P < 0.05$ ) for lambs fed IDY at the level of 30 % than those fed 0, 15 and 45 %. The averages of feed conversion (FC) of DM (FC-DM) were improved ( $P < 0.05$ ) for lambs fed IDY at the level 30 % compared with those fed 0 and 45% of IDY. The averages of FC-DCPI and FC-TDNI were better ( $P < 0.05$ ) at 15, 30 and 45 % of IDY than 0 level. The averages of serum total protein (TP) concentrations were higher ( $P < 0.05$ ) for lambs fed IDY at the level of 30 % than those fed the levels of 15 and 45 %. Also, serum albumin levels increased ( $P < 0.05$ ) for lambs fed IDY at 30 % compared with those fed levels 0, 15 and 45 %. Serum globulin concentrations were comparable among the treatments of IDY at 0, 15 and 30 %, being the lowest concentration with feeding IDY at the level of 45 %. There were significant ( $P < 0.05$ ) increase in serum glucose concentrations for lambs fed IDY at the level of 30 % than those fed the levels 15 and 45 %, while they were comparable with those fed IDY at 0 level. The results showed no significant differences in serum concentrations of cholesterol, triglycerides and aspartate transaminase (AST) enzyme activity among the experimental treatments. This study indicated that soybean meal substitution for inactive dry yeast (especially at 30 % level) was effective to improve nutrients digestibility and productive performance accompanying with favourable signs in serum biochemical indicators of Ossimi lambs.

**Keywords:** *inactivate dry yeast, soybean substitution, nutrient digestibility, productive performance, serum biochemical indicators, growing lambs*

### INTRODUCTION

Animal feeding represents a large portion of the production cost, and the sustainability of this operation depends on the feed cost and availability (Campos *et al.*, 2014). Large amounts of by-products can be used in animal feeding, providing an alternative choice to reduce production costs. The most important concentrate rations consist mainly of soybean meal as a protein source and are the most expensive products in feed concentrates. So, because the high cost of soybean meal, good alternative by-products such as dry yeast that can replace this ingredient are needed.

According to Rufino *et al.* (2013), inactive dry yeast (*Saccharomyces cerevisiae*) is mainly available in regions producing alcohol from sugarcane. World-wide alcohol plants commonly use yeast to induce

alcoholic fermentation process. After fermentation, recovered yeast is subjected to a spray dryer process which inactivates yeast and promotes an instant drying. This by-product was found to be containing 40 – 55 % crude protein (Ali *et al.* 2017). So, this by-product may be a good source of protein to replace soybean meal.

In animal nutrition, dry yeasts have been commonly used to improve productive performance *via* enhancing gut microbial balance (McAllister *et al.*, 2011). The mechanism of such enhanced balance could mediate beneficial microbial species and preventing harmful bacteria species from the gastrointestinal tract (Uyeno *et al.*, 2015). It has been stated that dry yeast is a good source of nutrients as protein, carbohydrates, minerals and vitamins as well as a large amount of nucleotides (Ahmad *et al.*, 2012). It is also considered as rich in vitamins B and D as well as lysine, threonine and methionine (da Costa *et al.*, 2015).

A recent report showed that dietary supplementation of inactive dry yeast (20 g/head/day) has an enhancing effect on growth performance and gut health without any adverse effects in crossbred steers (Ali *et al.* 2017). However, information about using inactive dried yeast in sheep nutrition and their effect on nutrient digestibility, feeding value and related physiological responses are very limited. Therefore, the present study aimed to evaluate the effect of soybean meal substitution for inactive dry yeast at levels of 0, 15, 30 and 45 % on nutrients digestibility, feeding value, productive performance and some related serum biochemical indicators in Ossimi sheep.

## **MATERIALS AND METHODS**

### ***Experimental design:***

This study used forty four of growing Ossimi lambs (averaged 4 months of age and  $21.59 \pm 0.77$  kg). The experiment was carried out at the Farm of Animal Production Department, Faculty of Agriculture, Minia University during the months from January to April, 2016.

The animals were housed inside window stables for feeding lot groups and divided into four equal groups (11 lambs / each). The animals groups were fed diets in which soybean meal (SBM) in concentrate feed mixture (CFM) substituted for inactive dry yeast (IDY) at levels 0, 15, 30 and 45 %, respectively. The animals fed on CFM to cover their nutrients requirements according to NRC (2007). The CFM contained 40 % sugar beet pulp, 25 % wheat bran, 17 % soybean meal, 15 % yellow corn, 2 % calcium carbonate and 1 % sodium chloride. In this study, soybean straw (SS) as roughage source was offered *ad libitum*.

Feed were offered twice a day at 8 am and 2 pm and drinking water were available along the experiment. Body weights of lambs were recorded at the beginning of the experiment and biweekly thereafter, while feed intakes recorded daily. Averages of daily gain and feed conversion rates (DM, DCP and TDN) of lambs were calculated. All the parameters were recorded at the morning before animals access to feed or water. Lambs were subjected to the routinely veterinary vaccination and inspection system.

### ***Dietary Sampling and laboratory analysis:***

Dietary samples were collected daily in the last week of each month along the experiment period and a composite sample was performed. A portion of the composite sample was dried at 105 °C in a forced air oven till constant weight for DM determination. The rest of composite sample was dried at 70 °C for a constant weight, ground and kept in closely tied jars for laboratory analysis. Diets were analyzed for dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash according to AOAC (2003). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined according to Goring and Van Soest (1970). Grasp fecal samples were collected before feeding at 7 am and 1 pm for each lamb at last week of each month and mixed together, dried on 70 °C till constant weight and analyzed for DM, OM, CP, CF, NDF, ADF, EE and ash. Total tract digestibility of DM, OM, CP, CF, NDF, ADF, EE and NFE were determined using acid insoluble ash as an internal marker according to Van Keulen and Young (1977). Approximate analysis of CFM, SBM, IDY and SS are presented in Table (1); while the ingredient proportion in experimental concentrate feed mixture is presented in Table (2). Moreover, the approximate analyses of experimental diets are presented in Table (3).

**Table (1): Approximate analysis of concentrate feed mixture (CFM), soybean meal (SBM), inactive dry yeast (IDY) and soybean straw (SS) fed to growing Ossimi lambs on DM basis (%).**

Item	CFM	SBM	IDY	SS
DM	89.86	87.47	87.05	90.03
OM	92.14	92.07	97.02	88.35
CP	17.20	48.33	40.82	3.93
EE	2.58	2.15	1.33	1.08
CF	14.99	7.08	1.10	40.34
NDF	46.13	15.38	3.61	64.70
ADF	22.34	11.20	2.49	49.92
NFE	57.37	34.49	53.77	43.00
Ash	7.86	7.93	2.98	11.65

**Table (2): Ingredient proportion in experimental concentrate feed mixture (CFM, %).**

Ingredient	IDY Substitution (DM %)			
	0	15	30	45
Sugar beet pulp	40	40	40	40
Wheat bran	25	25	25	25
Soybean meal (SBM)	17	14.45	11.9	9.35
Inactive dry yeast (IDY)	-	2.55	5.10	7.65
Yellow corn	15	15	15	15
Calcium carbonate	2	2	2	2
Sodium chloride	1	1	1	1

**Table (3): Approximate analysis of experimental diets fed to growing Ossimi lambs on DM basis (%).**

Item	IDY Substitution (DM %)			
	0	15	30	45
DM	89.91	89.90	89.89	89.89
OM	91.00	91.09	91.17	91.26
CP	13.22	13.09	12.96	12.82
EE	2.13	2.12	2.10	2.09
CF	22.59	22.49	22.39	22.28
NDF	51.70	51.50	51.30	51.10
ADF	30.61	30.46	30.31	30.16
NFE	53.06	53.39	53.72	54.07
Ash	9.00	8.91	8.83	8.74

**Serum biochemical indicators analysis:**

Non-heparinized blood samples were collected from the jugular vein of lambs. Samples were left to clot at room temperature for at least 4 h, then the clots were removed and sera were cleared and stored at -20 °C for later assay. Serum total protein, albumin, glucose, cholesterol, triglycerides and aspartate transaminase (AST) were determined colorimetrically using commercial kits. Serum globulin concentrations were calculated by difference between total protein and albumin concentrations.

**Statistical analysis:**

Data were analyzed by least square means analysis of variance using General Linear Models (GLM) procedure of the statistical analysis system (SAS, 2000). The model used to analyze the different treatments studied for lambs was as follows:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:  $Y_{ij}$  = Observation,  $\mu$  = Overall mean;  $T_i$  = Effect of  $i^{th}$  treatments and  $e_{ij}$  = Experimental error. Duncan's Multiple Range test was used to detect differences between means of the experimental groups (Duncan, 1955).

## RESULTS AND DISCUSSION

### *Digestibility coefficients and nutritive values:*

Data in Table (4) illustrated that, the digestibility was generally improved by the levels of inactive dry yeast (IDY) in the diet. Digestibility coefficients of DM, OM, CP, CF and NFE were increased ( $P<0.05$ ) for lambs fed diets in which soybean meal (SBM) substituted for IDY at levels 15 and 30 %. It was noticed that the improvement in digestibility coefficients of OM, CP, CF, NDF and NFE were significantly ( $P<0.05$ ) higher for lambs fed IDY at the level 30 % than those fed 15 %. However, the averages of digestibility coefficients for lambs fed IDY at levels 0 and 45 % were almost comparable. Similar trend of results were observed for the nutritive values where the averages of nutritive values (DCP and TDN) were significantly ( $P<0.05$ ) improved for lambs fed diets in which SBM substituted for IDY at levels 15 and 30 %. Also, the averages of nutritive values were significantly ( $P<0.05$ ) higher for lambs fed IDY at the level 30 % than those fed 15 %.

In the present study, the findings that digestibility coefficients of DM, OM, CP, CF, NDF and NFE were improved ( $P<0.05$ ) with feeding IDY at levels 15 and 30 % are consistent with results reported by Freitas *et al.* (2011). They observed a quadratic effect of yeast levels on the digestibility of DM, OM, total carbohydrates and NDF in goats fed different inclusion levels of dried yeast. Also, Rufino *et al.* (2013) observed a quadratic effect of substitution levels of SBM for IDY at 0, 33, 67 and 100 % in lamb diets on their digestibility coefficients of DM, OM, CP and NDF. As far as dietary supplementation of inactivated yeast are concerned, the present results are consistent with those reported by Wafaa and Mahmoud (2014) who observed a significant ( $P<0.05$ ) improvement in the digestibility of most nutrients and fibre fractions (NDF, ADF, cellulose and hemicellulose). On the other hand, Campos *et al.* (2014) observed no effect of IDY on the total and partial apparent nutrient digestibility in beef cattle fed with different soybean meal replacement levels IDY at 0, 250, 500, 750, and 1000 g/kg.

The improvement noticed in CP digestibility with feeding inactive dry yeast, in the present study, could be related to the increase in its high rumen degradable protein compared with soybean meal (990 g/kg vs. 790 g/kg of RDP) as reported by Marcondes *et al.* (2009), and also increasing proteolytic bacteria counts (Tripathi and Karim, 2011). In addition, the observed increase in digestibility of CF with feeding IDY could be ascribed to the increase in the activity of rumen cellulolytic bacteria and protozoa counts (Tripathi and Karim, 2011), and that supplemental IDY may provide rumen microflora with vitamins and other growth promoters (Chaucheyras *et al.*, 2008). The increases in nutritive values of TDN, in the present study, with feeding IDY at levels 15 and 30 % might be explained by the high digestibilities of DM, OM, CP, CF, NDF and NFE. These results are concomitant with similar findings observed by Wafaa and Mahmoud (2014) in Barki lambs fed inactivated yeast at 5 g/day, however, they found no effect on DCP due to supplemental yeast.

### *Productive performance:*

As shown in Table (5), the averages of final body weight (FBW) were increased ( $P<0.05$ ) for lambs fed IDY at the level of 30 % than those fed 0, 15 and 45 %. In addition, the averages of daily gain (ADG) were increased ( $P<0.05$ ) for lambs fed diets in which SBM substituted for IDY at levels of 15 and 30 %. However, data showed no significant differences in averages of feed intakes of SS, DM and TDM among the experimental treatments. Meanwhile, the intakes of DCP and TDN were greater ( $P<0.05$ ) for lambs fed IDY at the level of 30 % than those fed 0, 15 and 45 %. It was also noticed that the intakes of DCP and TDN were significantly ( $P<0.05$ ) lower for lambs fed IDY at the level of 45 % than those fed the levels of 0, 15 and 30 % of IDY. The present results indicated that the averages of feed conversion (FC) of DM (FC-DM) were significantly ( $P<0.05$ ) improved for lambs fed IDY at the level of 15 and 30 % compared to those fed 0 and 45% of IDY. Also, the averages of FC-DCPI and FC-TDNI were better ( $P<0.05$ ) at 15, 30 and 45 % of IDY in comparison with 0 level.

The present results clearly indicated that feeding diets in which SBM substituted for IDY at levels of 15 and 30 % were significantly ( $P<0.05$ ) able to improve FBW and ADG in lambs compared with 0 and 45 % levels. Also, feeding IDY at the level of 30 % was more effective by 13.0 % than the level of 15 % to enhance ADG of lambs. The higher improvement observed in ADG for lambs fed IDY at levels 15 and 30 % might be attributed to the significant increase ( $P<0.05$ ) in the digestibility of different nutrients and nutritive value, feed intakes (DCP and TDN) and feed conversion (DMI, DCP and TDN) which reflected on their growth performance. These results are consistent with similar improvement in total body gain and ADG in Barki lambs fed inactivated and dried yeast at 5 g /day (Wafaa and Mahmoud, 2014). In agreement with the present study, a recent study by Ali *et al.* (2017) showed a significant improvement in

total weight gain, average daily gain and feed conversion rate in crossbred steers fed inactivate dried yeast at 20 g/day/animal. The finding that feeding IDY at levels 0, 15, 30 and 45 % had no significant effect on DMI and TDMI are consistent with similar trend noticed by Rufino *et al.* (2013) on sheep fed diets with substitution levels of SBM for IDY at levels 0, 33, 67 and 100 %. However, Campos *et al.* (2014), working on crossbred beef cattle, observed that IDY addition resulted in decreases in DMI and ADG with feeding different soybean meal replacement levels IDY at 0, 250, 500, 750, and 1000 g/kg, however, the apparent digestibility of nutrients and microbial efficiency, feed conversion or carcass gain were not affected. Eventhough, Rufino *et al.* (2013) found no effect with substitution levels of SBM for IDY at levels 0, 33, 67 and 100 % on growth performance, there was a trend to improve ADG by 13.0 % at the level of 67 %. The improvement in feed conversion (FC-DMI), in the present study, was estimated to be 14.1 % for lambs fed the level 30 % of IDY compared to 0 % level. Thus the present result agree with an improvement in feed conversion rate (10.29 %) for Barki lambs fed inactivated and dried yeast at 5 g /day (Wafaa and Mahmoud, 2014). On the other hand, Titi *et al.* (2008) found no effect on feed conversion with supplemental yeast in Awassi lambs.

#### ***Serum biochemical metabolites:***

Data in Table (6) showed that the averages of serum total protein (TP) concentrations were higher ( $P<0.05$ ) for lambs fed IDY at the level of 30 % than those fed the levels 15 and 45 %. Also, serum albumin levels were increased ( $P<0.05$ ) for lambs fed IDY at 30 % compared with those fed levels 0, 15 and 45 %. However, serum globulin concentrations were comparable among the treatments of IDY at 0, 15 and 30 %, being the lowest concentration (3.47 g /dl) with feeding IDY at the level of 45 %. The significant increase in serum TP for lambs fed IDY at the level of 30 % compared with other levels might be related with the significant ( $P<0.05$ ) improvement observed in the digestibility coefficient of CP, DCPI, nutritive value of DCP and feed conversion of DCP (FC-DCPI) , reflecting the significant improvement gained in their FBW and ADG. This means that the level 30 % of IDY was more effective to improve the metabolic processes including protein synthesis and metabolism. In the same way, similar response of serum TP and CP digestibility were detected in Barki lambs fed inactivated and dried yeast at 5 g/day (Wafaa and Mahmoud, 2014). In this respect, Lima *et al.*, (2012) reported that, dietary supplementation with dry yeast from sugar cane was considered as a good alternative protein source in feeding dairy goats, maintaining their productive performance.

As shown in Table (6), there were significant ( $P<0.05$ ) increase in serum glucose concentrations for lambs fed IDY at the level of 30 % than those fed the levels 15 and 45 %., and they were comparable with those fed IDY at 0 level. Such significant increase in serum glucose concentrations for lambs fed IDY at the level of 30 % compared with other levels might be related with the significant ( $P<0.05$ ) improvement observed in their digestibility of CF and NFE as well as the increase ( $P<0.05$ ) in nutritive value of TDN. This response of elevated serum glucose levels for lambs fed IDY at the level of 30 % could be reflected the significant ( $P<0.05$ ) improvement in their productive performance (FBW and ADG). In agreement with these results, Ghoneem and Mahmoud (2014) observed a similar response of increasing serum glucose levels in Barki lambs fed inactivated and dried yeast.

The results in Table (6) showed no significant differences in serum concentrations of cholesterol and triglycerides among the experimental treatments. The results are consistent with similar observations reported by Ghoneem and Mahmoud (2014). These findings could be indicated that IDY supplementation had no adverse effect on lipid metabolism.

The data showed no significant differences in serum concentrations of AST enzyme activity in lambs fed IDY at the levels 0, 15, 30 and 45 %. This result agree with similar trend of unchanged serum AST enzyme activities detected in Barki lambs (Wafaa and Mahmoud, 2014), and in lactating buffalo fed yeast-supplemented diets (Kholif and Khorshed, 2006). So, the present study may signify a case of normal hepatic metabolism in those lambs fed the diets in which soybean meal (SBM) substituted for IDY at levels of 15, 30 and 45 %, without any adverse effects on their health.

## **CONCLUSION**

The present study showed that the improvements gained in productive performance of lambs fed soybean meal substituted for IDY especially at levels 15 and 30 % were in harmony with the results of improving their nutrients digestibility and nutritive values accompanied with favorable signs in serum biochemical indicators. In addition, in case of feeding levels 0 and 45 %, the data were almost comparable without any adverse effects on the studied parameters. These findings are pertinent where the

substitution of soybean meal, the high-cost ingredient for a by-product such as inactive dry yeast, displayed a possibility to use new ingredients in diets of small ruminants. So, using of either ingredient will be a choice depending on cost and market availability.

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**Table (4): Effect of substitution of soybean meal for inactive dry yeast on nutrient digestibility coefficients and nutritive values of experimental treatments (mean ± SEM).**

Parameters	IDY Substitution (DM %)				SEM	Sig.
	0	15	30	45		
<b>Nutrients digestibility (%)</b>						
DM	70.24 b	73.68 a	73.89 a	69.64 c	0.119	*
OM	70.71 c	73.67 b	74.56 a	69.82 d	0.240	*
CP	69.89 c	72.95 b	74.67 a	70.01 c	0.187	*
EE	72.49	72.40	72.59	72.42	0.216	NS
CF	66.10 c	66.93 b	67.99 a	65.96 c	0.213	*
NDF	65.02 b	65.60 b	66.69 a	64.66 b	0.325	*
ADF	63.64	63.89	64.10	63.47	0.293	NS

NFE	70.92 c	73.38 b	74.74 a	70.48 c	0.162	*
Nutritive value (%)						
DCP	9.24 c	9.55 b	9.68a	8.98 d	0.024	*
TDN	65.27 c	67.23 b	68.49 a	65.18 c	0.113	*

a,b,c Means within the same row having different superscripts significantly different, (\*P<0.05),NS = not significant.

**Table (5): Effect of substitution of soybean meal for inactive dry on productive performance of growing Ossimi lambs (mean ± SEM).**

Parameters	IDY Substitution (DM %)				SEM	Sig.
	0	15	30	45		
Body weight:						
Initial body weight (kg)	21.63	21.13	21.75	21.86	0.771	NS
Final body weight (kg)	38.18 b	38.67 b	41.51 a	38.23 b	0.805	*
Daily gain (g/day)	183.89c	194.89 b	219.56 a	181.89c	0.003	*
Feed intake:						
SSI	0.42	0.41	0.43	0.39	0.012	NS
DMI	0.96	0.93	0.99	0.93	0.028	NS
TDMI (kg/head/day)	1.38	1.34	1.42	1.32	0.040	NS
DCPI	0.128 b	0.128 b	0.138 a	0.119 c	0.001	*
TDNI	0.900 b	0.900 b	0.973 a	0.860 c	0.001	*
Feed conversion:						
FC-DMI/kg gain	7.50 a	6.88ab	6.47 b	7.26 a	0.243	*
FC-DCPI/gain	0.696 a	0.657 b	0.629 c	0.654 b	0.001	*
FC-TDNI/gain	4.89 a	4.62 c	4.43 d	4.73b	0.008	*

a,b,c Means within the same row having different superscripts significantly different, (\*P<0.05),NS = not significant.

**Table (6): Effect of substitution of soybean meal for inactive dry yeast on serum biochemical indicators of growing Ossimi lambs (mean ± SEM).**

Parameter	IDY Substitution (DM %)				SEM	Sig.
	0	15	30	45		
Total protein (g/dl)	7.63 ab	7.43 bc	7.87 a	7.20 c	0.119	*
Albumin (g/dl)	3.70 b	3.60 b	4.10 a	3.73 b	0.109	*
Globulin (g/dl)	3.93 a	3.83 ab	3.77 ab	3.47 b	0.123	*
Glucose (mg/dl)	86.97 ab	81.60 bc	91.50 a	78.31 c	2.00	*
Cholesterol (mg/dl)	143.46	147.34	139.15	143.48	5.59	NS
Triglycerides (mg/dl)	118.89	121.14	119.43	114.75	4.69	NS
AST (U/L)	115.67	114.17	115.00	116.00	0.70	NS

a,b,c Means within the same row having different superscripts significantly different, (\*P<0.05),NS = not significant.

معاملات الهضم، الأداء الإنتاجي وبعض مؤشرات السيرم البيوكيميائية كتأثير استبدال كسب فول الصويا بالخميرة الجافة الغير نشطه في علائق الحملان النامية

عماد الدين محمد إبراهيم<sup>1</sup> و سعاد النجار<sup>2</sup>

<sup>1</sup>تقسم الإنتاج الحيواني - كلية الزراعة - جامعة المنيا - المنيا - مصر

<sup>2</sup>تقسم الانتاج الحيواني - المركز القومي للبحوث - الدقى - الجيزة - مصر

استخدم في هذه الدراسة عدد أربعة وأربعون من الحملان الأوسيمي بمتوسط 4 شهور من العمر، ووزن  $0.77 \pm 21.59$  كجم لتقييم تأثير استبدال كسب فول الصويا بالخميره الجافة عند مستويات صفر ، 15 ، 30 و 45 % على معاملات الهضم، الأداء الإنتاجي و بعض مؤشرات السيرم البيوكيميائية للحملان النامية.

أظهرت النتائج أن معاملات هضم المادة الجافة، المادة العضوية، البروتين الخام، الألياف الخام، الألياف المستخلصه بالمحاليل المتعادله، الكربوهيدرات الذائبة وكذلك القيم الغذائية للبروتين المهضوم والمركبات الغذائية الكلية المهضومة زادت معنوياً ( $P<0.05$ ) للحملان المغذاه على الخميره الجافة عند مستويات 15 ، 30 % مقارنة بتلك المغذاه على الخميره عند مستوي صفر ، 45 % . كان التحسين في معاملات الهضم الغذائية والقيم الغذائية للبروتين المهضوم والمركبات الغذائية الكلية المهضومة أعلى معنوياً ( $P<0.05$ ) للحملان التي غذيت على الخميره عند مستوي 30 % مقارنة بتلك المغذاه على الخميره عند مستوي 15 % . بينما تساوت معاملات الهضم الغذائية والقيم الغذائية للحملان المغذاه على الخميره عند مستوي صفر ، 45 % . كما زادت ( $P<0.05$ ) متوسطات وزن الجسم النهائى للحملان المغذاه على الخميره الجافة عند مستوي 30 % مقارنة بتلك المغذاه على الخميره عند مستوي صفر ، 15 ، 45 % . ارتفع معدل الزيادة اليومية في الوزن معنوياً ( $P<0.05$ ) للحملان المغذاه على الخميره الجافة عند مستويات 15 ، 30 % مقارنة بتلك المغذاه على الخميره عند مستوي صفر ، 45 % . ولم تلاحظ أية فروق معنوية بين المعاملات في متوسطات المأكول من تبن فول الصويا ، المأكول من المادة الجافة و المأكول الكلي من المادة الجافة. زاد المأكول من البروتين المهضوم والمركبات الغذائية الكلية المهضومه معنوياً ( $P<0.05$ ) للحملان المغذاه على الخميره الجافة عند مستويات 30 % مقارنة بتلك المغذاه على الخميره عند مستوي 0 ، 15 ، 45 % . كما حدث تحسن معنوي ( $P<0.05$ ) في معدلات التحويل الغذائي للماده الجافة للحملان المغذاه على الخميره الجافة عند مستوى 30 % مقارنة بتلك المغذاه على الخميره عند مستوي صفر ، 45 % . كانت معدلات التحويل الغذائي للبروتين المهضوم والمركبات الغذائية الكلية المهضومه أفضل ( $P<0.05$ ) للحملان المغذاه على الخميره الجافة عند مستويات 15 ، 30 ، 45 % مقارنة بتلك المغذاه على الخميره عند مستوي صفر % . أظهرت النتائج ارتفاع مستويات تركيزات البروتين الكلي ( $P<0.05$ ) في السيرم للحملان المغذاه على الخميره الجافة عند مستوي 30 % مقارنة بتلك المغذاه على الخميره عند مستوي 15 ، 45 % . بينما زاد تركيز مستوى ألبومين السيرم ( $P<0.05$ ) للحملان المغذاه على الخميره الجافة عند مستوي 30 % مقارنة بتلك المغذاه على الخميره عند مستوي صفر ، 15 ، 45 % . بينما كان تركيز السيرم من الجلوبيولين متساوياً في الحملان المغذاه على الخميره عند مستوي صفر ، 15 ، 30 % وكان أقل تركيزاً عند مستوي 45 % . وقد حدث ارتفاع معنوي ( $P<0.05$ ) في تركيز السيرم من الجلوكوز للحملان المغذاه على الخميره الجافة عند مستوي 30 % مقارنة بتلك المغذاه على الخميره عند مستوي 15 ، 45 % مع عدم اختلافها عن تلك المغذاه على الخميره عند مستوي صفر % . ولم تلاحظ أية اختلافات معنوية في تركيزات سيرم الدم من الكوليستيرول، الجلوسريادات الثلاثية ونشاط انزيم (AST) بين المعاملات.

يمكن أن نستخلص من هذه الدراسة أن استبدال كسب فول الصويا بالخميره الجافة (خاصه عند مستوي 30 %) كان ذو فاعلية في تحسين معاملات الهضم الغذائية والأداء الإنتاجي مصحوباً بعلامات جيدة في مؤشرات السيرم البيوكيميائية للحملان الأوسيمي.