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# EFFECT OF DRY LIVE YEAST INCLUSION IN FATTENING RABBIT DIETS ON PRODUCTIVE PERFORMANCE AND DIGESTIBILITY OF NUTRIENTS

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*This investigation carried out to establish the dietary dry live yeast (DY) effect on the productive performance and nutrients digestibility of weanling rabbits through growth period (6-11 wks old). A total of 60 weanling cross-bred rabbit (Californian × New Zealand)-6 wks-old, were weighed and randomly allotted into 5 groups. Rabbit groups fed basal diet (18.3% CP and 2675 Kcal DE/kg) contained DY at 0.0, 0.50, 1.00, 1.50, 2.0%, respectively.*

***Results showed that** final weights and weight gain were insignificantly improved for dietary treatments compared to the control through the period 6-11 wks. Meanwhile, treated groups recorded similar feed amount consumed except those fed 0.5%DY that consumed the less amount than the control through the period 6-11 wks. Feed conversion was improved by presence of DY in the diet compared to the control through the period of 6-11 wks. All nutrients digestion coefficients were insignificantly improved by DY in the diet, while crud fiber digestibility was significantly enhanced compared with the control.*

***In conclusion,** the presence of dry live yeast in weanling rabbit diet could trigger positive effects for growth performance and nutrients digestibility through growing period.*

**Key words**: Rabbits, probiotics, yeasts, growth, nutrients utilization.

The rabbit are considered meat producing small animal in developing countries (Anjeniwa, 2000)) due to their short intervals for generation, fast rate of growth, high productive capacity and genetic diversity. Rabbits utilize nutrients more effectively than beef, where they can metamorphose 20% from consumed protein to comestible meat in comparison to 8-12% for beef (Basavaraj *et al.*, 2011). The intensive system of raising rabbits lead to some stresses especially at weaning period. These stressors cause spreading of coccidiosis and epizootic rabbit enteropathy; therefore, animal health status, feed efficiency and growth performance are negatively affected (Pluske *et al.*, 1997). Reducing digestive disorders and growth performance improvement in animals can be reached by antibiotics incorporation in their diets (Barton, 2000)). Antibiotics used in rabbit feeding at low level over years as growth promoters and prophylactic agent of disease (Falcao-E-Cunha *et al*., 2007), but due to the argument with antibiotic resistance and their residues in the products, which might make problems for human protection (Smith *et al.*, 2002), using antibiotics as growth promoters was banned by the European Union Commission, EUC (2005) in animal production.

Therefore, new ways are used to replace the antibiotics in order to prevent and handicap of inflammation by modulating the intestines microflora, these ways like probiotics, prebiotics, and organic acids (Marounek *et al.*, 2003). Some one of these alternatives, dry live yeast which vastly used in several livestock species to control intestinal microbiota and enhance immune function.

Yeast has been known as a probiotic in feed animal (Falcao-e-Cunha *et al*., 2007). Dry live yeast addition provide some positive effects of rabbits performance and health status, especially when animals were kept under sub-optimal environmental and sanitary conditions with high stocking density and low hygiene control (Maertens and De Groote, 1992). Yeast plays a vital role in growth and digestion by supplying the digestion enzymes that increases the activity of microflora and elimination the pathological bacteria in the digestive tract (Mountzouris *et al*., 2007). Otherwise, some investigations not found any effects for yeasts on various production parameters (Kimse *et al.*, 2012). Enhancement performance and health status are depending on the dose of yeast, age and livestock conditions. Newly, supplementing dry yeast by 1 mg/kg diet resulted beneficial impacts in animal production (Onifade, 1998), but their mechanism of action remains unknown.

So, this investigation planned to evaluate the comparative efficacy of dry live yeasts as probiotic cultures on productive and nutrients digestion of rabbits.

## MATERIALS AND METHODS

Sixty weaned males of Californian x New Zealand White (CN) rabbits 6 weeks aged were selected and randomly spliced into five groups (12 animal each), having on average nearly equal live weights (1075±55.2g). Through the studied period from 6 to 11 weeks of age feed and water were offered *ad-libitum*. All rabbits were healthy and free of external and internal parasites.

Rabbits were housed individually in wire cages and kept under the same managerial and hygienic conditions. Complete pelleted diets were contained 0.0, 0.5, 1.0, 1.5 and 2.0% dry live yeast inclusion (contained 51.8% proteins, 29.5% carbohydrates, 1.0% fat and 9.7% other components). They adjusted according to NRC (1977) to have the requirements of nutrients. Diets composition and chemical analysis are shown in Table 1. Dry live yeast (DY) of 10 cfu/g (RUMI YEAST-Saccharomyces cerevisiae Sc 47-Neovia- France) was used as growth promoter (Probiotic).

Body weight (BW) and feed intake (FI) were registered weekly. Weight gain (WG) and feed conversion ( g feed/ g gain ) were calculated.

### *Digestibility trials:*

During the 11$^{th}$ week, three rabbits from each group were moved and individually dwell in metabolic crates (25x35x30 cm), which permit feces and urine segregation through 5 days as a gathering period. Feed consumed was accurately specified. Quantitative collection of feces (coprophagy was not prevented) started 24 hours after offering the daily feed. Feces were dried at 60 C for 12 hours. Pooled feces per each rabbit were mixed, ground and sampled for analysis according to AOAC (2002). Apparent digestibility of DM, OM, CF, CP, EE and NFE were determined.

### *Statistical analysis:*

The obtained data were statistically analyzed by one-way complete design to study the effect of treatment at each time using SAS (2004). However, the significant differences among treatment groups were tested using Multiple Range Test according to Duncan (1955).

**Table 1:** Diets composition (%) and chemical analysis on dry matter basis

| Ingredients % | Control | Dry live yeast level, % | | | |
|---|---|---|---|---|---|
| | | **0.5** | **1.0** | **1.5** | **2.0** |
| Clover hay | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| Corn | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Wheat bran | 31.5 | 31.5 | 31.5 | 31.5 | 31.5 |
| SBM | 13.8 | 13.3 | 12.8 | 12.3 | 11.8 |
| Molasses | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Salt | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Vit.&Min. premix * | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Dry yeast | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 |
| **Total** | **100** | **100** | 100 | 100 | 100 |
| ***Calculated chemical analysis % **** | | | | | |
| DM | 86.30 | 86.32 | 86.34 | 86.36 | 86.38 |
| OM | 80.90 | 80.49 | 80.96 | 81.07 | 81.15 |
| CP | 18.33 | 18.33 | 18.33 | 18.33 | 18.33 |
| CF | 14.12 | 14.10 | 14.08 | 14.06 | 14.04 |
| EE | 2.320 | 2.318 | 2.315 | 2.313 | 2.310 |
| Ash | 5.400 | 5.398 | 5.395 | 5.393 | 5.390 |
| NFE | 46.13 | 45.742 | 46.235 | 46.367 | 46.47 |
| DE/kg DM *** | 2674.1 | 2675.1 | 2676.0 | 2676.9 | 2677.9 |

* **Mineral and vitamin premix supplied per kg of diet**: Vitamin A 10,000 IU, Vitamin D3,1,800 UI; Vitamin E, 15 mg; Vitamin K3, 4.5 mg; Vitamin B1, 0.5 mg; Vitamin B2, 4 mg; Vitamin B12, 0.001 mg; Folic acid, 0.1 mg; Pantothenic acid, 7 mg; Nicotinic acid, 20 mg; I, 1 mg; Mn, 60 mg; Cu, 5.5 mg, Zn, 75 mg; Fe, 40 mg; Co, 0.3 mg; Se, 0.08 mg; Robenidine, 52.8 mg, Antioxidant, 0.250 mg..

** NRC, 1977.

***Calculated according to Perez *et al*., 1998.

## RESULTS AND DISCUSSION

### *Growth performance:*

Rabbits live body weights (LBW) were not significantly affected among the treatment groups due to dietary dry yeast (DY) inclusion at different ages (Table 2). Rabbits fed all DY diets had ponderous LBW compared with the control at the 11 wks old. Final LBW was enhanced by 9.60, 8.11, 11.35 and 10.48% for rabbits fed 0.50, 1.00, 1.50 and 2.00% DY

**Table 2:** Effect of dry yeast on rabbits body weight ( $\bar{X} \pm SE$ )at different ages

| Age, wks | Control | Dry yeast (DY) level, % | | | |
|---|---|---|---|---|---|
| | | **0.5** | **1.0** | **1.5** | **2.0** |
| **6** | 1020.8±48.6 | 1122.5±52.7 | 1069.2±61.3 | 1081.7±59.4 | 1074.2±48.9 |
| **7** | 1204.2±50.0 | 1329.2±54.9 | 1265.0±61.8 | 1284.2±55.9 | 1300.8±51.6 |
| **8** | 1391.7±56.3 | 1527.5±52.2 | 1458.3±65.2 | 1498.3±52.7 | 1535.0±53.8 |
| **9** | 1601.0±65.1 | 1755.8±65.3 | 1669.2±60.4 | 1724.2±50.4 | 1765.8±55.8 |
| **10** | 1806.7±73.7 | 1974.2±67.7 | 1929.2±60.0 | 1956.7±59.0 | 1986.7±61.1 |
| **11** | 2004.2±79.2 | 2196.7±70.1 | 2166.7±71.0 | 2231.7±54.7 | 2214.2±62.9 |

diet, respectively compared to the control. A higher LBW in yeast rabbits groups could related to their good health status or especially gut health (Falcao-e-Cunha *et al.,* 2007), or it could prevent or ameliorate early weanling stress (Kritas *et al.,* 2008). Or, yeast have bio regulatory action, including microbial antibiosis funnel of pathogenic bacteria, stimulating animal's immune system, engagement and removal of pathogens (Perez 2007).

These findings are confirm with Chaudhary *et al.* (1995) and Kimsé *et al.* (2012) who noticed that rabbit performance not significantly affected by yeast addition to their diets. Pascual *et al.* (2008) revealed that dietary probiotic inclusion addition did not effect on rabbit growth rate compared with control diet without probiotic. Also, Onifade *et al.* (1999) and Shanmuganathan *et al*. (2004) recorded a favorable impact of yeast on body weight in fattening rabbits. However, live weight of rabbits increased by 16.7-18.0 % when yeast supplemented to control ration with 1.5 and 2.0 kg probiotic/ ton, respectively (Matusevicius *et al*., 2004).

Daily weight gain (DWG) of rabbits fed DY diets at different ages was not affected except of at the 11$^{th}$ week of age only (Table 3). Rabbits

**Table 3:** Effect of dry yeast on rabbits daily weight gain ( $\bar{X} \pm SE$ ) at different ages

| Age, wks. | Control | Dry yeast (DY) level, % | | | |
|---|---|---|---|---|---|
| | | 0.5 | 1.0 | 1.5 | 2.0 |
| 7th | 26.2±1.6 | 29.5±1.8 | 28.0±1.7 | 28.9±1.7 | 32.4±1.4 |
| 8th | 26.8±1.8 | 28.3±1.9 | 27.6±1.6 | 30.6±1.5 | 33.5±2.1 |
| 9th | 29.9±1.7 | 32.6±2.4 | 30.2±2.1 | 32.3±2.0 | 33.0±2.2 |
| 10th | 29.4±2.0 | 31.2±1.8 | 37.1±1.4 | 33.2±2.2 | 31.6±1.4 |
| 11th | 28.2±1.8$^{b}$ | 31.8±1.6$^{ab}$ | 33.9±2.1$^{ab}$ | 39.2±1.7$^{a}$ | 32.5±2.1$^{ab}$ |
| 6-11 | 28.1±1.3 | 30.7±1.4 | 31.4±1.1 | 32.9±1.2 | 32.6±0.6 |

a,b: Means in the same row within each item with different superscript are significantly different ($P \leq 0.05$ ).

fed 1.5% DY diet recoded ($P \leq 0.05$) higher BWG at the 11th wk of age than the control. Moreover, daily BWG recoded the higher value for all DY groups as compared with the control at 6-11 wks old, where 1.5 and 2.0% DY recorded higher daily BWG. Improvement in DWG may be attributed to dietary live yeast addition increases the population of total rumen bacteria and this increase in turn helps increase feed intake as well as feed stuff digestibility, therefore, more nutrients are available to growth operations (Habeeb *et al.*, 2017). Or, DY may ameliorate fiber digestibility, prohibit the growth of pathogens, output antibacterial compounds, encourage the immune system and improve gut morphological structure (Broadway *et al.*, 2015). These observations are in agreement with Onifade *et al.* (1999) and Shanmuganathan *et al.* (2004) who stated a favorable leverage of yeast on weight gain for fattening rabbits. Habeeb *et al.* (2006) found that average daily gain improved by 12.6 %, when yeast added to rabbit's diet. Also, Belhassen *et al.* (2016) found that body weight gain not significantly affected by yeast supplementation to rabbit's diet after weaning (5-11 wk). However, Ezema and Eze (2012) observed that inclusion of Bio-active yeast (120 mg /kg) significantly enhanced weight gain for rabbits. Shehata *et al.* (2012) postulated that amino-yeast (0.25, 0.50 and 0.75 %) addition significantly increased body weight gain of NZW rabbits as compared to the control by 31, 15 and 17 %, respectively.

Data in Table 4 shows daily feed intake (DFI) not affected among DY groups comparing with the control group at various ages except of the 9th wk and 6-11 wks of age. Daily feed consumed didn't change by DY compared with the control group at the entire period. These findings are in agreement with Hollister *et al.* (1990) who noted that dietary Lacto-Sacc supplementation did not affect rabbits feed consumption. Wallace *et al.* (2012) revealed that probiotic supplementation with either 1.0 or 1.5 g/kg diet of California White x New Zealand White and Chinchilla weaned cross-bred rabbits had no influence feed intake. Also, Belhassen *et al.* (2016) concluded that yeast supplementation to rabbit's diet not effect on feed intake after weaning (5-11 wk). Also, Bhatt *et al.* (2017) noted that feed intake not ($P \leq 0.05$) affected due to probiotic supplementation. However, Habeeb *et al.* (2006) found that average daily feed intake improved by 21.2%, when yeast added to rabbit's diet.

Table 5 shows feed conversion ratio (FCR) was better ($P \leq 0.05$) for rabbits fed 1.5 % DY diet comparing to the control at the 11th wk and 6-11 wks of age. These result may be due to yeasts addition, which reduction toxin production, stimulation enzyme production by the host, production some

**Table 4:** Effect of dry yeast on rabbits daily feed intake ($\bar{X} \pm SE$)at different ages

| Age, wks. | Control | Dry yeast (DY) level, % | | | |
|---|---|---|---|---|---|
| | | **0.5** | **1.0** | **1.5** | **2.0** |
| 7th | 77.2±4.5 | 64.3±4.8 | 77.8±4.3 | 77.4±8.1 | 83.3±7.7 |
| 8th | 97.0±4.7 | 84.9±4.7 | 94.7±4.7 | 100.3±6.4 | 99.1±4.4 |
| 9th | 106.4±3.4$^{ab}$ | 103.1±6.0$^{ab}$ | 103.3±6.1$^{ab}$ | 90.2±6.9$^{b}$ | 117.4±5.1$^{a}$ |
| 10th | 114.4±8.3 | 107.4±7.9 | 116.4±8.3 | 110.2±8.5 | 122.4±5.1 |
| 11th | 127.9±5.4 | 114.6±6.0 | 127.1±6.5 | 125.9±5.5 | 118.5±5.0 |
| 6-11 | 104.6±3.5$^{ab}$ | 94.9±4.4$^{b}$ | 103.8±4.5$^{ab}$ | 100.6±3.6$^{ab}$ | 108.1±3.7$^{a}$ |

a,b: Means in the same row within each item with different superscript are significantly different ($P \leq 0.05$ ).

**Table 5:** Effect of dry yeast on rabbits feed conversion ratio ($\bar{X} \pm SE$) at different ages

| Age, wks. | Control | Dry yeast (DY) level, % | | | |
|---|---|---|---|---|---|
| | | 0.5 | 1.0 | 1.5 | 2.0 |
| 7th | 2.95±0.20 | 2.18±0.22 | 2.79±0.25 | 2.68±0.30 | 2.57±0.25 |
| 8th | 3.62±0.20 | 3.00±0.10 | 3.43±0.19 | 3.28±0.27 | 2.96±0.27 |
| 9th | 3.56±0.24$^{ab}$ | 3.16±0.11$^{ab}$ | 3.45±0.22$^{b}$ | 2.80±0.27$^{a}$ | 3.56±0.18$^{b}$ |
| 10th | 3.89±0.24$^{ab}$ | 3.43±0.23$^{ab}$ | 3.15±0.17$^{a}$ | 3.32±0.23$^{ab}$ | 3.88±0.20$^{b}$ |
| 11th | 4.53±0.13$^{b}$ | 3.61±0.18$^{ab}$ | 3.75±0.21$^{ab}$ | 3.21±0.12$^{a}$ | 3.56±0.20$^{ab}$ |
| 6-11 | 3.71±0.06$^{a}$ | 3.09±.09$^{b}$ | 3.31±0.09$^{ab}$ | 3.07±0.11$^{b}$ | 3.32±0.10$^{ab}$ |

a,b: Means in the same row within each item with different superscript are significantly different ($P \leq 0.05$).

vitamins or antimicrobial substances, competition for adhesion to epithelial cells, increase resistance to colonization, stimulation immune system of the host and reduction stress in rabbits (Shehata and Tawfeek, 2010).

These observation are agreement with Kustos *et al.* (2004); Matusevičius *et al.* (2006) who noticed non-significant difference in FCR by using a commercial probiotics in rabbits diet. However, Shanmuganathan *et al.* (2004) recorded a favorable impact of yeast on feed conversion in fattening rabbits. Das and Das (2006) observed that probiotic supplementation (Biovet YC at 0.2% of feed) had significantly higher effect on feed efficiency in Chinchilla and Meghalaya rabbits. Kristas *et al.* (2008) reported that rabbits treated with probiotic (containing B. licheniformis and B. subtilis) at the age of 41 to 88 days had (P<0.05) better feed efficiency. Bhatt *et al.* (2017) found probiotics addition to rabbit's diets improved the feed efficiency.

***Nutrients digestibility coefficients:***

All nutrients digestibility not significantly affected due to dietary DY except for crud fiber (Table 6).

**Table 6:** Effect of dry yeast on nutrients digestibility coefficient ( $\bar{X} \pm SE$ )of rabbits

| Parameters | Control | Dry yeast (DY) level, % | | | |
|---|---|---|---|---|---|
| | | 0.5 | 1.0 | 1.5 | 2.0 |
| Dry matter | 70.2±2.8 | 74.1±1.2 | 71.5±0.6 | 71.0±1.4 | 72.7±3.0 |
| Organic matter | 71.3±2.8 | 74.9±1.0 | 72.6±0.6 | 72.3±1.3 | 74.1±2.9 |
| Crud protein | 62.6±4.0 | 70.9±3.7 | 61.2±1.7 | 64.5±4.5 | 70.8±39 |
| Ether extract | 81.4±1.7 | 84.1±1.6 | 80.7±0.7 | 81.9±1.8 | 81.0±0.6 |
| Crud fiber | $10.4±6.2^{b}$ | $29.2±3.1^{a}$ | $33.0±3.0^{a}$ | $29.1±0.9^{a}$ | $36.1±7.7^{a}$ |
| Nitrogen free extract | 83.4±2.1 | 84.3±1.6 | 82.3±0.5 | 82.2±1.1 | 81.9±1.9 |

a,b: Means in the same row within each item with different superscript are significantly different ($P \leq 0.05$ ).

Crud fiber (CF) digestibility was significantly enhanced by rising DY level in the diet compared with the control. Groups fed 1.0 and 2.0 % DY diets recorded the higher CF digestibility value compared with the control. The improvement in crud fiber digestibility attributed to live yeast could increase cellulolytic digesting bacteria, enhanced utilization of lactic acid by rumen bacteria, and increased propionic acid production in the rumen and more stable rumen pH, which enhanced rumen fermentations (Al Zahal *et al.*, 2014). Also, improved CF digestibility with probiotics addition could attributed to maintaining better gut health and environment (Mateos *et al.* 2010). This agrees with Yamani *et al*. (1992) who found crude fiber digestibility improved for rabbits treated by probiotics. Habeeb *et al.* (2006) observed that adding DY to rabbit’s diet ($P \leq 0.05$) enhanced CF digestibility by 26.9%, compared with the group fed basal diet. Bhatt *et al.* (2017) observed that digestibility of neutral detergent fiber (41.9 vs. 29.4%) improved with probiotics addition. Dry or organic matter digestibility (%) was elevated by adding DY compared with the control. While, CP digestibility recoded the higher value by adding 0.5 and 2.0% followed with

1.5 % DY in the diet than the control. These findings may attributed to dietary DY addition play an important role in digesting nutrients, inhibiting pathogens and interacting with each other as well as with the gut-associated immune system (Borda-Molina *et al*., 2018).

These observations are agreed with El-Hindawy *et al*. (1993) who observed nutrients digestibility improved by probiotic adding. Kamra *et al.* (1996) observed CP digestibility enhanced by live yeast addition. Habeeb *et al.* (2006) observed that adding DY to rabbits diet ($P \leq 0.05$) improved CP digestibility (79.5 vs 70.6), and TDN (73.7 vs 70.4) compared with the group fed basal diet. Bhatt *et al.* (2017) observed that DM, OM and CP digestibility improved with probiotics addition

***Conclusively,*** results indicated that the presence of dry live yeast in weanling's rabbit diet (0.50 up to 2.0%) could improve growth and nutrients digestibility coefficient through growing phase.

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# تأثير الخميرة الجافة على أداء النمو والتمثيل الغذائي للأرانب المفطومة

**نـها تاج الدين حسن تاج الدين**
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أجرى هذا البحث لتحديد تأثير الخميرة الجافة على الأداء الإنتاجي وهضم العناصر الغذائية للأرانب المفطومه خلال فترة النمو (6-11 أسبوع ). تم اختيار عدد 60 أرنبًا خليط (كاليفورنيا × نيوزيلندا) عمر6 أسابيع وتم وزنها وتقسيمها عشوائيًا إلى خمسة مجموعات متساوية وتم اسكان الأرانب فى اقفاص فردية. تم تكوين العليقة الأساسية (18.3٪ بروتين خام و 2675 كيلو كالوري طاقة ممثلة) وتمت تغذية المجموعة الأولى عليها كمجموعة للمقارنة بينما المجموعات الأخرى تغذت على العليقة الأساسية المحتوية على الخميرة الجافة بنسبة 0.50 ، 1.00 ، 1.50 ، 2.0٪ على التوالي حتى عمر 11 أسبوع.

**أظهرت النتائج أن** التحسن فى الأوزان النهائية ومعدل زيادة الوزن للأرانب لم يكن معنويًا يالمعاملات الغذائية مقارنةً بالكنترول خلال الفترة الكلية للتجربة (6-11 أسبوعً). كما لوحظ أن الأرانب التى تغذت على علائق الخميرة استهلكت كميات متماثلة من العليقة ما عدا التي تم تغذيتها على 0.5٪ خميرة حيث استهلكت كمية أقل مقارنة بالكنترول خلال الفترة 6-11 أسبوعًا. كما تحسنت كفاءة التحويل الغذائى بوجود الخميرة الجافة في العليقة مقارنة بالكنترول خلال الفترة 6-11 اسبوع. كما لوحظ تحسن جميع معاملات هضم العناصر الغذائية بدون معنويه بوجود الخميرة الجافة في العليقة بينما كان التحسن فى هضم الألياف الخام معنويا مقارنة بالكنترول.

**التوصية:** من هذه النتائج يمكن التوصية بوجود الخميرة الحية الجافة (0.5 – 2.0%) فى عليقة الأرانب النامية لتأثيرها الإيجابى على أداء النمو وهضم العناصر الغذائية خلال فترة النمو(بعد الفطام).