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# EFFECT OF TREATED BIOLOGICALLY JOJOBA MEAL ON POULTRY PRODUCTION: A- BROILER PERFORMANCE

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## SUMMARY

This study was aimed to investigate the effect of replacing soybean meal (SBM) by jojoba meal treated with Lactobacillus Acidophilus and Tricoderma Ressie on broiler performance. One-day old 360 unsexed Ross 308 broiler chicks were distributed into eight equal experimental treatments. The chicks in the first experimental treatment was fed control diet (T1), whereas, those in treatment 2 (T2), 3 (T3) and 4 (T4) fed diets containing jojoba meal treated by Lactobacillus Acidophilus at the level of 5, 10 and 15%, while birds in treatment 5 (T5), 6 (T6) and 7 (T7) fed diets containing jojoba meal treated by Tricoderma Ressie at the level of 5, 10 and 15%, with replacing of soya bean protein in the diets. The birds in treatment 8 (T8) fed diet containing untreated jojoba meal. Experimental period lasted for 6 weeks. Body weight, feed consumption, feed conversion ratio and carcass traits were measured during the experiment period. The highest feed consumption was noticed in T4, while the lowest one was recorded in T8. During the experimental period (0-6 weeks), control, T7 and T2 gave better feed conversion ratio.

Conclusively, it can be concluded that replacing soybean meal with treated jojoba meal biologically up to 5% could be useful for performance of broiler chicks.

***Key Words: jojoba meal, Lactobacillus, Tricoderma , performance , broiler***

## INTRODUCTION

Feed cost represents almost over 60% to 70% of the production cost in broiler diets. Soybean meal is a plant protein, which could substitute broiler diet, but it is now expensive and its price is rising due to the high demand on this ingredient. Therefore, it is important to search for other non-traditional available protein sources, which could be incorporated in broiler diets without adverse effects on broiler growth or efficiency of diet utilization. Jojoba (Simmondsia chinensis) is a native oil seed shrub being grown in the deserts or new lands, is being advocated and developed as a potential cultivated crop for warm, arid regions of the world (Hogan 1979). It produces highly marketable oil radically different chemical structure from any other known vegetable lipid which is a unique mixture of unsaturated liquid wax esters (Spencer *et al* 1984) According to (Wisniak1987), the liquid wax (about 50% by weight) composed of mono-unsaturated straight-chain acids and alcohols; each with 20 to 24 carbon atoms has characteristics similar to sperm whale oil (Sabien *et al* 1997). Also, jojoba oil has applications in cosmetics, pharmaceuticals, and numerous other products. The residue (meal) that remains after extraction of oil from the seeds contains from 26 to 33% crude protein (Verbiscar *et al* 1980 and Nasser *et al* 2007) and would increase the economic value of this crop if it could be used as a feed ingredient. Compounds other than simmondsin including poly phenolics, phytic acid and trypsin inhibitors, may be contributing to impaired feed intake and body weight gain of animals fed diets contain Jojoba seeds meal (Cokelaere *et al* 1992 and Abbott *et al* 2004). Some authors consider simmondsins to be toxic, probably after metabolism by gut microorganisms (Booth *et al* 1974). In contrast, the USA Food and Drug Administration approved simmondin as safe for human use and animal feed (Oksman *et al* 2004). From the bright side, Bellirou *et al* (2005) reported that elimination of anti-nutritional factors in jojoba seed meal could be done by different methods, including solvent extraction, heat, chemical treatment and microbial fermentation. Jojoba meal, as a by-product of jojoba seeds, is a promising feedstuff after being detoxified (Motawe *et al* 2006). Jojoba meal contained 31.89 % crude protein, simmondsin 3.33%, and total phenolic compounds 2.67%. Phytate content was found to be 2.3% in the defatted meal. Glutamic and aspartic acids were the

most abundant amino acids. The total essential amino acids content was 37.1% according to (Abd El-Rahman *et al* 2006). Biological treatment of jojoba meal by Lactobacillus Acidophilus and Tricoderma Ressie may be eliminate its anti-nutritional factors.

The aim of this experiment was to investigate the effect of biological treated jojoba meal instead of soy bean meal at different levels on broiler performance.

## MATERIALS AND METHODS

***Biological Treatment:***

This experiment designed and aimed to apply treatments on the raw jojoba meal (JM) by autoclaving it for 20 minutes at 125°c at pressure of 1.05 kg/cm$^2$ and then infecting with a pure strain of Trichoderma Ressie fungis for 21 days as a period for fungus growth to reduce or eliminate the contents of some anti-nutritional factors and reduce simmondessine of JM. While the other experiment, jojoba meal was treated by Lactobacillus Acidophilus for 21 days in anaerobic condition to reduce simmondsins of JM. Jojoba seed meal (produced by pressure and heating) were purchase from the Egyptian Natural oil Company. The pure strain of Trichoderma Ressie (ATCC 28217) fungus and Lactobacillus Acidophilus were obtained from Microbiology Research Center (MIRCEN), Faculty of Agriculture, Ain Shams University. Proximate analysis of raw and treated jojoba meals were determined according to method of A.O.A.C. (1994). Moisture, Ash, crude protein, ether extract and Crude fiber were determinate. Determination of simmondsins in raw and treated jojoba meals were analyzed. It was extracted twice with hexane (solvent meal ratio of 3: 1 (v/w) to eliminate any remaining residues of oil. The loose oil meal was desolventized in air, then dried to constant weight in an oven at 60 – 70 $^o$C prior to analysis (Verbiscar *et al*., 1980). Simmondsin was used as standard, obtained from Prof. M. Van Boven (Laboratory of Toxicology, Katholieke Universiteit Leuven, Belgium). Standard was prepared by dissolving 2 mg of simmondsin in 1 ml of methanol in a measuring flask. The solutions were kept in a refrigerator at 4$^o$C (Lein *et al*., 2002).

***Experimental Diets:***

Dietary treatments were consisted of treatment (1) (control diet) in which corn and soybean meal was the major ingredients while at treatments 2,3 and 4 the soybean meal protein was replaced by 5,10 and 15% protein of treated jojoba meal by Lactobacillus Acidophilus , respectively. Treatments 5,6 and 7 the soybean meal protein was replaced by 5,10 and 15% protein of treated jojoba meal by Tricoderma Ressie fungus, respectively, while in treatment 8 the soybean meal protein was replaced by 5% protein of untreated jojoba meal. Tables 1 and 2 showed the experimental diets.

**Table (1): The composition and calculated analysis of experimental starter diets**

| Ingredient | Control | Treated jojoba meal by lactobacillus | | | Treated jojoba meal by Tricoderma | | | Jojoba untreated |
|---|---|---|---|---|---|---|---|---|
| | | T2 (5%) | T3 (10%) | T4 (15%) | T5 (5%) | T6 (10%) | T7 (15%) | T8 (5%) |
| Yellow corn | 56 | 56 | 56 | 55.5 | 56 | 56 | 55.5 | 56 |
| Soya been meal | 30.16 | 28.653 | 27.16 | 25.66 | 28.653 | 27.16 | 25.66 | 28.653 |
| Jojoba meal | ------ | 2.39 | 4.8 | 7.2 | 2.06 | 4.1 | 6.2 | 2.39 |
| Gluten | 6.84 | 6.94 | 7.04 | 7.34 | 6.94 | 7.04 | 7.34 | 6.94 |
| Wheat | 2.98 | 1.98 | 0.98 | 0.26 | 1.98 | 0.98 | 0.26 | 1.98 |
| Oil | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dicalcim | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Limestone | 1.8 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| Primex* | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Salts | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Dl-methionine | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

A mash starter and grower diets contained adequate levels of nutrients for growing broilers diet were formulated as recommended by NRC (1994). Starter and grower diets were fed during 1-3 and 4-6 weeks of age, respectively.

***Birds and management***:

360 one-day-old unsexed Ross x Ross broilers chicks were used in this experiment. Birds were randomly distributed into eight equal experimental treatments with three replicates of 15 chicks each. Chicks were grown in floor pens and subjected to 23 hrs lighting at intensity of 3 watt/$m^2$ along the experimental period which extended to 6 weeks of age. The house temperature was kept at about 35ºC during the first 3 days, 32ºC during next 4 days and thereafter, gradually decreased by 2ºC weekly down to 24ºC.

**Table (2): The composition and calculated analysis of experimental grower diets:-**

| Ingredient | Control | Treated jojoba meal by lactobacillus | | | Treated jojoba meal by Tricoderma | | | Jojoba untreated |
|---|---|---|---|---|---|---|---|---|
| | | T2 (5%) | T3 (10%) | T4 (15%) | T5 (5%) | T6 (10%) | T7 (15%) | T8 (5%) |
| Yellow corn | 60 | 60 | 60 | 59.5 | 60 | 60 | 60 | 60 |
| Soya been meal | 30.16 | 28.65 | 27.16 | 25.66 | 28.65 | 27.16 | 25.66 | 28.65 |
| Jojoba meal | ------- | 2.39 | 4.8 | 7.2 | 2.06 | 4.1 | 6.2 | 2.39 |
| Gluten | 2 | 2.1 | 2.2 | 2.5 | 2 | 2 | 2.3 | 2.1 |
| Wheat | 3.82 | 2.82 | 1.82 | 1.2 | 3.25 | 2.7 | 1.82 | 2.82 |
| Oil | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Dicalcim | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Limestone | 1.8 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 |
| Primex* | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Salts | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Dl-methionine | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

* *Each 1kg of premix contained: Vit. A 12000IU, Vit. D 2200IU, Vit. E 10mg, Vit. K3 2000mg, Vit. B1 1000mg, Vit. B2 5000mg, Vit. B6 1500mg, Vit. B12 10mg, Pantothenic acid 10mg, Niacin 30mg, Folic acid 1000mg, Biotin 50mg, Choline chloride 300mg, Manganese 60mg, Zinc 50mg, Copper 10mg, Iron 30mg, Iodine 1000mg, Selenium 100mg, Cobalt 100mg and CaCo3 to 3g.*

Body weight, body weight gain and average daily weight gain were calculated weekly to the nearest 0.1g throughout the experimental period (1 - 6 weeks of age). Feed consumption and feed conversion ratio were calculated. Mortality and the clinical health status of all birds were monitored daily and mortality percentage for each replicate per period was calculated. Six birds from each group were randomly selected for slaughter test, fasted for twelve hrs., weighed, slaughtered by slitting the jugular vein of the birds in the morning , complete bleeding scalded and defeathered. Carcasses were eviscerated manually and weighed. Liver, gizzard were weighted. Carcass characteristics were evaluated as described by Blasco *et al*., (1993).

## RESULT AND DISCUSSION

The chemical composition of raw jojoba meal was showed in Table (3). The content of moisture, crude protein, ether extract, crude fiber and ash were 4.1, 25.5, 11.6, 13.40 and 3.51%, respectively. While the same measurements in jojoba meal treated by lactobacillus acidophilus were 3.9, 27.75, 11.5, 11.65 and 2.7, and jojoba meal treated by tricoderma ressie had 4.2, 32.2, 11.5, 11.76 and 2.8 respectively.

The results indicated that crude protein value in jojoba meal was nearly similar to that obtained by El-Shennawy (2003), Ham *et al*. (2000), Verbiscar *et al*., (1980), Swingle *et al*., (1985) and Shrestha *et al*., (2002). On the other hand, Ngoupayou *et al*. (1982) and Abbott *et al*. (1996) showed that jojoba meal had higher crude protein percentages (29.06 and 27.40%, respectively) compared with the current results.

Results of detoxification of treated jojoba meal showed that treating raw of jojoba meal with tricoderma ressie and lactobacillus acidophilus decreased the simmondesine contents from 3.6% in raw meal to 0.036 and 0.037 respectavily. This results agreements with Swingle *et al*. (1985) who reported that simmondsin levels in raw JM decreased from 4.2% to 0.12% after treating the raw meal with Lactobacillus acidophilus 629. Also, Khayyal *et al*. (2009) reported that simmondsin level in raw jojoba meal decreased from 4.82% to 0.12% after treating the raw meal with the same fungus (Trichoderma reesei) used in the present study.

**Table (3): Chemical composition of raw and treated jojoba meal**

| Item | Jojoba meal | | |
|---|---|---|---|
| | Raw | Treated by Lactobacillus | Treated by Ttrichoderma |
| Moisture % | 4.1 | 3.9 | 4.2 |
| Crude protein % | 25.5 | 27.75 | 32.2 |
| Ether extract % | 11.6 | 11.5 | 11.5 |
| Crude fiber % | 13.9 | 11.65 | 11.76 |
| Ash % | 2.6 | 2.7 | 2.8 |

The effect of different levels of jojoba meal treated by lactobacillus acidophilus and trichoderma ressie on final body weight, body weight gain, average daily weight gain, total feed consumption, total feed conversion ratio and total mortality showed in table(4). The results indicated that there are no significant effects of dietary jojoba meal treated by Lactobacillus Acidophilus when replacing with soybean meal in treatment 2 (replacing 5%) and treatment 6 which treated by Trichoderma Ressie on final body weight compare with control group which record 2014.5g. The lowest body weight gain value was observed in birds fed 10, 15% jojoba meal protein treated by lactobacillus, and birds fed 5, 15% jojoba meal protein treated by tricoderma, and birds fed 5% jojoba meal protein untreated (T8). These results agreement with the findings of Khayal *et al*. (2009) who reported that a diet containing 10% treated JM with Trichoderma reesei recorded increasing in body weight compared to the control diet in growing rabbit. Ngoupayou *et al*. (1982) found that the 5% level of L. acidophilus 609 treated JM caused a significant decrease in body weight of broiler chicks at 4 weeks of age from 748 to 689 g. Pure simmondesine does have an anorexic effect in chickens (Vermaut *et al*., 1996).

**Table(4): Effect of different levels of jojoba meal treated by Lactobacillus Acidophilus and Trichoderma Ressie on body weight, body weight gain, average daily weight gain, feed consumption, feed conversion ratio and total mortality**

| Treatment | Parameters | | | | | | |
|---|---|---|---|---|---|---|---|
| | BW0 (g) | BW6 (g) | BWG 1-6 weeks (g) | ADG (g) | Total feed intake 1-6 weeks(g) | Total feed conversion 1-6 weeks | total Mortality |
| Control | $43.59^{a}$ | $2014.5^{a}$ | $1970.98^{a}$ | $46.92^{a}$ | $3630.87^{ab}$ | $1.80^{h}$ | $2^{ab}$ |
| (T2) | $42.80^{a}$ | $1935.4^{ab}$ | $1892.61^{ab}$ | $45.06^{ab}$ | $3573.47^{cd}$ | $1.80^{h}$ | $1^{b}$ |
| (T3) | $43.21^{a}$ | $1805.0^{d}$ | $1761.79^{d}$ | $41.94^{d}$ | $3526.13^{c}$ | $2.00^{b}$ | $3^{bc}$ |
| (T4) | $43.00^{a}$ | $1831.6^{cd}$ | $1788.66^{cd}$ | $42.58^{cd}$ | $3702.92^{a}$ | $2.07^{a}$ | $2^{ab}$ |
| (T5) | $42.70^{a}$ | $1915.8^{bc}$ | $1873.18^{bc}$ | $44.59^{bc}$ | $3646.69^{ab}$ | $1.95^{d}$ | $2^{ab}$ |
| (T6) | $42.59^{a}$ | $1977.6^{ab}$ | $1935.01^{ab}$ | $46.00^{a}$ | $3657.17^{ab}$ | $1.80^{h}$ | $1^{b}$ |
| (T7) | $42.70^{a}$ | $1901.9^{cd}$ | $1859.23^{cd}$ | $44.26^{bc}$ | $3588.49^{cd}$ | $1.93^{e}$ | $1^{b}$ |
| (T8) | $42.44^{a}$ | $1831.4^{cd}$ | $1789.30^{cd}$ | $42.59^{cd}$ | $3480.74^{d}$ | $1.95^{c}$ | $3^{bc}$ |
| SE | ±0.42 | ±32.8 | ±28.4 | ±0.43 | ±57.73 | ±0.01 | ±0.3 |
| Significant | N.S | ** | ** | ** | ** | ** | N.S |

*means of each column followed by the same letter are not significantly different at the 5% level according to Duncan's multiple Range test*

Former results for feeding raw jojoba meal recorded reducing of body weight and body weight gain in broiler chicks (Verbiscar *et al*., 1980 and Vermaut *et al*., 1997), rabbits (Ngoupayou *et al*.,1982), rats (Cokelaere *et al*., 1993b; York *et al*., 2000 and Cokelaere *et al*., 2001) and dogs (Ham *et al*., 2000). The present investigation showed that the decrease in body weight and weight gain of broilers may be due to an increase of jojoba meal levels in the diets which may contain more toxicant compound with these

levels. The depression in body weight could be attributed to the uncompleted detoxification by ammoniacal hydrogen peroxide. These toxicant compounds caused the harmful effect although the cyano groups of simmondsin and related cyano compounds converting by ammoniacal hydrogen peroxide to amide, assuming that the amides are less toxic than the corresponding cyano compounds (Verbicear *et al*., 1980). In this respect, Verbiscar *et al*. (1980) and Ngoupayou *et al*. (1982) found that growth rate significantly decreased with 10% jojoba meal treated with ammoniacal hydrogen peroxide.

Feed consumption of broilers fed different levels of jojoba meal protein is shown in Table (4) and. Feed consumption was statistically affected by the treatments during the whole experimental period. the results showed that had no significant effects of feed consumption between control , treatments 4, 5 and 6.but feed consumption was lowest in broilers in the treatments 2, 3, 7 and 8. feed consumption was higher in birds fed 15% jojoba meal treated by lactobacillus acidophilus then treatment 5(5% jojoba meal treated by Tricoderma Ressie. Results of feed conversion ratio in the present study are in partial agreement with the findings of Khayyal *et al*. (2009) who reported that feed intake increased and FCR improved in rabbits fed on diet contain 10% treated JM with Trichoderma reesei. Furthermore Khalel *et al*. (2008) reported that FCR was improved in lambs fed on diets containing 10% of JM treated with Trichoderma reesei. The same authors added that feed intake increased but not significant in lambs fed the diet containing TJM compared to the control. On the other hand Ngoupayou *et al*. (1985) reported that feed consumption and FCR in rabbits fed on diets containing 5, 10 or 15% JM treated with L. acidophilus were not significantly affected compared to the control diet. Results of total mortality showed that had no significant effect of dietary jojoba treated by Trichoderma Ressie or treated by lactobacillus acidophilus These results are in accordance with the findings of Verbiscar *et al*. (1980) who reported that Hubbard broiler chicks one day of age fed on diets containing 5% treated jojoba meal with ammonical hydrogen peroxide, ammonia at room temperature or boiling water for 6 weeks of age showed no mortalities due to the dietary treatments. On the other hand El-Shennawy (2003) found that accumulative mortality percentage of rats for 4 weeks, (fed diet with irradiated at 75 kgy, microwaved and heated jojoba meal) were 66.67, 83.33 and 85.71%, respectively. Also, in rats fed fermented jojoba and irradiated at 75 kgy, the mortality was 8.5% and that for rats group fed diet fermented raw jojoba meal was 0%.

**Table(5): The Effect of different levels of jojoba meal treated by Lactobacillus Acidophilus and Trichoderma Ressie on carcass traits**

| Treatment | Parameter | | | | | | |
|---|---|---|---|---|---|---|---|
| | Carcass (g) | Gizzard (g) | Liver (g) | Kidney (g) | Heart (g) | Carcass percentage % | Dressing percentage % |
| Control | 1578.3$^{a}$ | 35.86 | 39.33$^{ab}$ | 10.5$^{a}$ | 8.70$^{ab}$ | 73.07$^{a}$ | 76.95$^{a}$ |
| (T2) | 1500.0$^{ab}$ | 35.10$^{a}$ | 41.83$^{a}$ | 10.2$^{a}$ | 8.23$^{b}$ | 72.40$^{ab}$ | 76.50$^{ab}$ |
| (T3) | 1366.6$^{b}$ | 30.80$^{a}$ | 37.16$^{ab}$ | 9.6$^{a}$ | 8.13$^{b}$ | 66.88$^{b}$ | 70.60$^{b}$ |
| (T4) | 1400.0$^{ab}$ | 34.50$^{a}$ | 38.50$^{ab}$ | 9.9$^{a}$ | 5.50$^{ab}$ | 72.1$^{ab}$ | 66.30$^{bc}$ |
| (T5) | 1426.0$^{ab}$ | 30.60$^{a}$ | 38.00$^{ab}$ | 10$^{a}$ | 9.00$^{a}$ | 69.00$^{b}$ | 73.90$^{ab}$ |
| (T6) | 1565.0$^{a}$ | 31.13$^{a}$ | 40.30$^{ab}$ | 9.8$^{a}$ | 8.66$^{ab}$ | 72.00$^{a}$ | 75.60$^{a}$ |
| (T7) | 1353.0$^{b}$ | 31.00$^{a}$ | 40.33$^{ab}$ | 9.7$^{a}$ | 8.16$^{b}$ | 68.20$^{b}$ | 72.24$^{ab}$ |
| (T8) | 1103. 3$^{b}$ | 31.13$^{a}$ | 31.00$^{b}$ | 9.8$^{a}$ | 8.13$^{b}$ | 64.50$^{b}$ | 68.60$^{bc}$ |
| SE | ±57.1 | ±2.23 | ±2.50 | ±0.45 | ±0.40 | ±1.48 | ±1.58 |
| Significant | * | NS | * | NS | NS | NS | * |

Effect of jojoba meal treated by lactobacillus acidophilus and trichoderma ressie on carcass, gizzard, liver, kidney, heart, carcass percentage and dressing percentage showed in table (5).

The results indicated that there were no significant effects of dietary jojoba meal on gizzard weight, liver weight, kidney weight and heart weight for all treatments compare with control. on the other hand had a significant effects on carcass weight, carcass percentage and dressing percentage. In respect to the relative carcass weight, the highest value were control recorded 1578.33 g then the treatment 6(10% jojoba meal treated by tricoderma then T2, T5 and T4 which had not significant effects between there. The lowest carcass weight , carcass percentage and dressing percentage were in the treatments T8, T7 and T3. The current results are in contrast with those observed by Decuypere *et al*. (1996) who reported that broiler breeder pullets fed diet containing 4 % raw jojoba meal increased liver and pancreas weights. Lisk

and Brown (1985) found that liver, carcass weight and dressing percentage of lambs fed diets containing 10 % jojoba meal were not significantly affected. York *et al*. (2000) noticed that the liver and kidney of rats treated with the simmondsin were larger than the control. However, El-Shennawy (2003) observed that there were no differences for proportional kidney, spleen and heart weights of rats fed raw diet and those fed on ration containing jojoba meal treated with irradiation up to 75 kgy heat and microwave.

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# تأثير كسب الجوجوبا المعامل حيويا على انتاج الدواجن أ- اداء دجاج التسمين

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تهدف هذه الدراسة لفحص تأثير استخدام كسب الجوجوبا المعامل حيويا بالاكتوباسيلس والتريكوديما على اداء دجاج التسمين. استخدم فى هذه التجربة عدد 360 كتكوت تسمين غير مجنس من سلالة روس 308 حيث تم توزيعهم عشوائيا على 8 معاملات . غذيت كتاكيت المعاملة الأولى على عليقة المقارنة بينما تلك المغذاة على علائق المعاملات الثانة والثالثة والرابعة التى تحتوى على كسب الجوجوبا المعامل بالاكتوباسيلس بمستويات 5 و10 و 15% على التوالى. غذيت الطيور فى المعاملات الخامسة والسادسة والسابعة على علائق تحتوى على كسب الجوجوبا المعامل حيويا بالتريكوديما بمستويات 5 و10 و 15% على التوالى بينما تلك التى تم تغذيتها على المعاملة الثامنة احتوت عليقتها كسب الجوجوبا الغير معامل. استغرقت التجربة فتر ة 6 أسابيع تم خلالها تسجيل وزن الجسم وأستهلاك الغذاء ومعدل التحويل الغذائى ومقاييس الذبيحة. سجلت المعاملة الرابعة اعلى معدل فى الأستهلاك الغذائى بينما اعطت المعاملة الثامنة أقل استهلاكا. أعطت المعاملة السابعة والثانية أفضل معدل للتحويل الغذائى خلال فترة التجربة. لم يكن للمعاملات المستخدمة فى تلك التجربة تأثير معنوى على معظم مقاييس الذبيحة التى تم تسجيلها.

نستخلص من هذه التجربة انه يمكن استخدام كسب الجوجوبا المعامل حيويا حتى نسبة 5% استبدال من كسب فول الصويا بصورة مفيدة لأداء دجاج التسمين.