Proceedings 5th World Rabbit Congress, 25-30 July 1992, Corvallis – USA, 1087-1100.

EFFECTS OF A PELLETED DIET SUPPLEMENTED WITH PROBIOTIC (LACTO-SACC) AND WATER SUPPLEMENTED WITH A COMBINATION OF PROBIOTIC AND ACIDIFIER (ACID-PAK 4-WAY) ON DIGESTIBILITY, GROWTH, CARCASS AND PHYSIOLOGICAL ASPECTS OF WEANLING NEW ZEALAND WHITE RABBITS

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SUMMARY

Three trials were conducted using one hundred and thirty-five New Zealand White (NZW) growing rabbits to evaluate the effects of inclusion of LACTO-SACC and two levels of ACID-PAK 4-WAY in the diet on performance of weanling rabbits.

The supplementation of LACTO-SACC (1 g/kg feed) significantly improved crude fiber (CF) digestibility, body weight, weight gain and physiological parameters (respiration rate and rectal temperature) ($P<.01,.05$). Similarly, inclusion of LACTO-SACC reduced feed intake and improved feed conversion compared with the control group.

ACID-PAK 4-WAY as an organic acidifier supplemented in the drinking water at the rate of 0.5 g/l significantly improved CF digestibility, respiration rate (RR) and plasma total protein of rabbits aged seven and four weeks up to market age ($P<.01,.05$). However, nonsignificant improvements were observed in the digestibility of various nutrients and the other parameters studied. While a higher level of the same product (2.0 g/l) showed unfavorable effects on body weight and weight gain, it showed favorable results with respect to digestibility of dry matter (DM), organic matter (OM), crude protein (CP) and ether extract (EE).

Carcass traits were unaffected by addition of either product except in treating drinking water with the low level (0.5 g/l) of ACID-PAK 4-WAY for rabbits from 4-13 weeks of age which showed higher percentages of dressed weight and hind limb weight and lower alimentary tract weight than the control group.

Presented at the 5th Congress of the World Rabbit Science Association, July 25-30, 1992. Oregon State University, Corvallis, Oregon, U.S.A.

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INTRODUCTION

Faster daily weight gain will result in marketing age being lower than the common meat breeds in Egypt (1.75 kg liveweight). If the desired slaughter weight is reached one week earlier, the requirements for housing and nutrients will be lower, assuming a fattening period of eight weeks post-weaning. Growth characteristics recorded for NZW rabbits fed a pelleted ration for approximately eight weeks post-weaning are given in Table 1.

TABLE 1. GROWTH CHARACTERISTICS FOR NZW RABBITS FED A PELLETED RATION FOR APPROXIMATELY EIGHT WEEKS POST-WEANING

Authors	Year	Daily weight gain (g)	Feed conversion ratio
Lebas	1973	36.0	2.62
King	1974	22.9	3.70
Machin et al.	1980	33.1	3.30
Soliman	1990	20.2	5.65

The quality of foodstuffs has been improved using feed additives such as nitrovin (Lazca et al.; 1988), growth hormone (Etherton et al., 1987), natural yeast culture and organic acidifiers (Cheeke et al., 1990) which have all been shown to increase growth performance.

Information obtained from Alltech Biotechnology Center (personal communication) indicated that: a) LACTO-SACC is a biological feed additive that provides live yeast culture with lactic acid-producing microencapsulated bacteria (Lactobacillus acidophilus and Streptococcus faecium) and digestive enzymes (protease, cellulase and amylase), and b) ACID-PAK 4-WAY is an organic acidifier which also contains electrolytes, enzymes and lactic acid-producing bacteria for addition to the drinking water of rabbits. Acidifiers in ACID-PAK 4-WAY reduce water pH to complement the action of the lactic acid bacteria in controlling gut pH.

The present work was carried out in order to study the effects of inclusion of both LACTO-SACC and ACID-PAK 4-WAY on digestibility, growth performance, carcass traits and some physiological aspects of weanling NZW rabbits.

MATERIALS AND METHODS

The work was conducted at a rabbit farm located east of the Nile Delta, Zagazig, Egypt. Three experiments were conducted to evaluate the inclusion of LACTO-SACC and ACID-PAK 4-WAY in the diet or in drinking water of NZW rabbits.

In the first experiment the diet was supplemented with 1 g of LACTO-SACC/kg food. In the second trial, two levels of ACID-PAK 4-WAY (0.5 and 2.0 g) were added/litre of drinking water of seven week old rabbits. In the third experiment drinking water of weanling rabbits (4 weeks) was supplemented with ACID-PAK 4-WAY at 0.5 g/l, a level which had shown favorable effects in the second experiment.

One hundred and thirty-five NZW growing rabbits were used during the three experiments. There were 48 in the first experiment, 57 in the second and 30 rabbits in the third. Rabbits in each experiment were randomly assigned to equal groups based on body weight at the beginning of each experiment. The trials lasted to 12 or 13 weeks of age. Commercial pelleted diets were purchased locally. Pellets were 1.2 cm long and 4 mm in diameter. Analysis of the diet indicated 18.57% crude protein, 16.71% crude fiber, 2.98% fat and 2600 kcal digestible energy/kg diet on a dry matter basis. The composition was 32% barley, 21% wheat bran, 10% soybean meal (44% crude protein), 28% barley hay, 3% decorticated cottonseed meal, 3% molasses, 1.35% meat meal (60% crude protein), 1% limestone, 0.34% salt, 0.3% vitamin and mineral premix and 0.06% DL-methionine.

Tap water was provided through an automatic nipple system and was mixed with ACID-PAK 4-WAY at the defined levels in experiments 2 and 3. The rabbits in all groups were kept under the same managerial and hygienic conditions and were housed in wire batteries of consistent dimensions in a windowed rabbitry with natural ventilation.

Eleven metabolism trials for digestibility and N balance were carried out during the growing period using four male rabbits in each trial. The chemical composition of diet, feces and urine were analyzed according to A.O.A.C (1980).

In order to estimate growth performance, rabbits were weighed weekly and feed consumption and consequently feed conversion were recorded. Mortality rate was calculated. By the end of the experiments four rabbits from each group were randomly taken for slaughter after being fasted for 12 hours. After complete bleeding and after pelt, viscera and tail were removed; the dressed carcass, heart, liver and kidneys were weighed. Results were tabulated for growth traits at 10, 11, 12 or 13 weeks of age to detect a suitable, economic marketing age at popular marketing weights for the Egyptian consumer (1.75 kg).

Respiration rate (RR) and rectal temperature (RT) were measured weekly during the experimental periods. In order to compare the effect of ACID-PAK 4-WAY at two levels on some blood constituents, blood samples were taken from the ear vein using clinical syringe in the morning before feeding . The plasma was separated within 1 hour by centrifugation and stored at-20°C until assayed for total protein, total lipids and alkaline phosphatase using reagent colorimetric methods. Urea-N and albumin were determined using commercial kits from Bio-Merieux (Laboratory Reagent and Products) France.

Ambient temperature and relative humidity were recorded daily using a thermohydrograph. The average minimum and maximum ambient temperature at 06.00 and 15.00 were 23° and 36°C, respectively. The corresponding values for relative humidity (RH) were 85 and 42%, respectively in experiments 1 and 2. During Experiment 3 temperature ranges were 21° and 32°C with 80 and 49% relative humidity.

Data were tabulated and subjected to statistical analysis according to Snedecor and Cochran (1982).

RESULTS AND DISCUSSION

Digestibility and Nutritive Value

Effects of LACTO-SACC. LACTO-SACC increased crude fiber digestibility of the pelleted diet ($P<.05$, Table 2). Non-significant improvements in other nutrient digestibilities were note at eight and 12 weeks of age. These changes resulted in higher total digestible nutrients (TDN), digestible crude protein (DCP) and nitrogen (N) balance (Table 2a).

These results are in agreement with those obtained by Hollister et al. (1989) who found that dry matter digestibility (DMD) and crude protein digestibility (CPD) of alfalfa, corn and barley-based diets were improved with LACTO-SACC inclusion. Values were 64.43 and 75.12%; 70.51 and 76.16% and 70.50 and 77.53% from 4-6 weeks of age but 66.16 and 74.91%; 73.77 and 72.92% and 75.55 and 78.28% respectively from 6-8 weeks of age.

TABLE 2. Effect of LACTO-SACC on digestibility of a pelleted complete diet fed NZW growing rabbits (Experiment 1)

	Week 8		Week 12	
	CONTROL	LACTO-SACC	CONTROL	LACTO-SACC
	- - - - - - - - - - - - % Digestibility (±SE) - - - - - - - - - - -			
DM	67.88(±.89)	69.08(±0.51)	69.45(±1.22)	70.69(±1.44)
OM	68.21(±.35)	69.38(±0.65)	69.90(±1.03)	70.81(±0.85)
CP	71.83(±.88)	73.96(±1.14)	74.05(±0.61)	76.57(±0.78)
CF	24.35^{A}(±.84)	28.76^{B}(±1.42)	31.47^{A}(±0.59)	35.56^{B}(±1.36)
EE	78.91(±.99)	80.21(±0.76)	78.71(±1.04)	80.40(±1.79)
NFE	80.45(±.89)	80.24(±0.54)	80.30(±0.56)	79.58(±1.15)

A,B means in same row with different superscripts differ significantly (P<.05).

TABLE 2a. EFFECT OF LACTO-SACC ON NUTRITIVE VALUE AND N BALANCE OF A PELLETED DIET FED NEW ZEALAND WHITE RABBITS

	Week 8		Week 12	
	CONTROL	LACTO-SACC	CONTROL	LACTO-SACC
TDN	64.36(±.29)	65.47(±.33)	65.86(±.90)	66.77(±.83)
DCP	13.34(±.20)	13.73(±.42)	13.75(±.82)	14.22(±.32)
N balance				
N intake (g)	2.74(±0.17)	2.87(±0.04)	3.56(±0.07)	3.46(±0.08)
Fecal N (g)	0.77(±0.06)	0.75(±0.03	0.92(±0.03)	0.81(±0.05)
Urinary N (g)	0.79(±0.07)	0.88(±0.03)	1.66(±0.01)	1.55(±0.07)
g/head/day	1.18(±0.04)	1.24(±0.02)	8.98^{A}(±0.03)	1.10^{B}(±0.10)
% of N intake	43.06(±1.26)	43.20(±1.41)	27.53(±0.44)	31.79(±2.10)

A,B means in same row with different superscripts differ significantly (P<.05).

Effects of ACID-PAK 4-WAY. ACID-PAK 4-WAY (AP4W) at 0.5 g/l improved digestibility of CP and CF significantly compared with the control (P<.05, Table 3). N balance was improved significantly (P<.05) for rabbits fed pellets with the low level at eight weeks of age. CP digestibility improved significantly when AP4W was used at 2.0 g/l (P<.05). When the two levels were compared, the .05g/l level improved digestibilities of DM, OM, CP, CF and EE compared with the 2.0g/l level. The improvement was significant for CF digestibility and N balance (Table 3a). Effects on digestibility and feed nutritive value are in agreement with Hollister et al. (1989) who found no significant differences in DM and CP digestibility due to the added probiotics.

TABLE 3. EFFECT OF ACID-PAK 4-WAY ON DIGESTIBILITY OF A PELLETED, COMPLETE FEED FED NZW GROWING RABBITS 7 TO 13 WEEKS OF AGE (EXPERIMENT 2)

	CONTROL	ACID-PAK 4-WAY 0.5 g/l	ACID-PAK 4-WAY 2.0 g/l
	% Digestibility (±SE)		
DM	69.94(±1.11)	71.06(±.58)	70.16(±0.73)
OM	70.27(±0.67)	71.05(±.60)	70.56(±0.96)
CP	71.95^{B}(±0.95)	76.92^{A}(±.82)	75.45^{A}(±0.49)
CF	33.37^{B}(±0.56)	35.37^{A}(±.67)	32.63^{A}(±1.06)
EE	80.38(±0.85)	81.93(±.97)	80.55(±0.78)
NFE	80.98(±0.97)	79.83(±.82)	80.44(±0.89)

A,B means in same row with different superscripts differ significantly (P<.05).

TABLE 3a. EFFECT OF ACID-PAK 4-WAY ON NUTRITIVE VALUE AND N BALANCE OF A PELLETED, COMPLETE FEED FED NZW GROWING RABBITS 7 TO 13 WEEKS OF AGE

	CONTROL	ACID-PAK 4-WAY 0.5 g/l	ACID-PAK 4-WAY 2.0 g/l
TDN	66.26(±.25)	66.92(±.53)	66.52(±0.30)
DCP	13.36(±.21)	14.28(±.16)	14.81(±0.79)
N balance			
N intake (g)	3.15(±0.09)	3.20(±.11)	3.28(±.05)
Fecal N (g)	0.88(±0.07)	0.74(±.04)	0.81(±.03)
Urinary N (g)	1.36(±0.07)	1.47(±.02)	1.54(±.01)
g/head/day	0.91^{B}(±0.09)	0.99^{A}(±.06)	0.93^{B}(±.03)
% of N intake	28.89(±1.96)	30.94(±.69)	28.35(±.48)

A,B means in same row with different superscripts differ significantly (P<.05).

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ACID-PAK 4-WAY at 0.5 g/l of drinking water improved CF digestibility significantly compared with the control at 8 and 12 weeks of age (P<.05, Table 4 and 4a). It can be seen that addition of ACID-PAK 4-WAY improved the digestibilities of various nutrients except NFE at 8 weeks of age, but did not improve the digestibilities of DM, OM, CP and NFE in the second period (8-12 weeks). Hollister et al. (1989) found that DMD and CPD of alfalfa, corn and barley-based diets using ACID-PAK 4-WAY was 63.62 and 75.12%; 71.60 and 74.50% and 68.61 and 78.26% from 4-6 weeks of age. It was 66.92 and 74.88%; 74.74% and 74.57% and 73.31 and 75.93% from 6-8 weeks of age.

TABLE 4. EFFECT OF ACID-PAK 4-WAY (.5 g/l) ON DIGESTIBILITY OF PELLETED, COMPLETE DIETS FED NZW GROWING RABBITS TO 13 WEEK OF AGE (EXPERIMENT 3)

	Week 8		Week 12	
	CONTROL	ACID-PAK 4-WAY	CONTROL	ACID-PAK 4-WAY
	- - - - - - - - - - % Digestibility (±SE) - - - - - - - - - -			
DM	67.45(±1.30)	69.88(±.76)	69.36(±0.80	69.26(±0.55)
OM	67.85(±0.95)	69.66(±.77)	70.10(±0.92	69.76(±1.07)
CP	73.44(±1.18)	75.68(±.53)	75.94(±1.12	75.31(±1.27)
CF	22.01^{A}(±0.99)	34.51^{B}(±.40)	30.36^{C}(±0.27)	36.31^{B}(±0.81)
EE	79.51(±1.85)	81.25(±.49)	80.24(±0.76)	80.94(±1.80)
NFE	79.96(±2.34)	78.18(±.59)	80.27(±0.80)	77.81(±0.93)

A,B,C means in same row with different superscripts differ significantly (P<.05).

TABLE 4a. EFFECT OF ACID-PAK 4-WAY (.5g/l) ON NUTRITIVE VALUE AND N BALANCE OF PELLETED, COMPLETE DIETS FED NZW GROWING RABBITS TO 13 WEEK OF AGE

	Week 8		Week 12	
	CONTROL	ACID-PAK 4-WAY	CONTROL	ACID-PAK 4-WAY
	- - - - - - - - - - % Digestibility (±SE) - - - - - - - - - -			
TDN	64.06(±0.55)	65.75(±.37)	63.13(±.87)	65.77(±.50)
DCP	13.64(±0.48)	14.05(±.17)	14.10(±.13)	13.98(±.36)
N balance				
N intake, g	2.82(±.07)	2.71(±.02)	3.28(±.09)	2.98(±.06)
Fecal N, g	0.75(±.02)	0.75(±.01)	0.79(±.10)	0.73(±.04)
Urinary N, g	0.80(±.04)	0.64(±.01)	1.54(±.05)	1.29(±.04)
g/head/day	1.27(±.01)	1.32(±.10)	0.95(±.04)	1.05(±.86)
% of N intake	45.03(±.70)	48.71(±.10)	28.96(±.81)	35.23(±.75)

A,B,C means in same row with different superscripts differ significantly (P<.05)

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Growth Performance

Effects of LACTO-SACC. LACTO-SACC (1 g/kg growing NZW rabbit food) had a favorable effect on live body weight compared with the control group, especially by the end of growing period (2039 vs. 1889 g; P<.05). Weight gain increased significantly (P<.05) with the treated group 12% heavier than the control group while feed conversion was improved by 13.3% (Tables 5a, 5b and 5c).

TABLE 5a. EFFECT OF DIETARY LACTO-SACC ON MORTALITY, RESPIRATION RATE AND RECTAL TEMPERATURE OF GROWING NZW RABBITS (EXPERIMENT 1)

	CONTROL	LACTO-SACC	% CHANGE
Initial number of rabbits	24	24	
Final number	24	23	
Mortality, %	---	4	
Respir. rate (rpm)	96.8 (±2.6)	87.7 (±2.1)	-9.31**
Rectal temperature (C)	39.4 (±0.1)	39.0 (±0.4)	-1.01*

*(P<.05)
**(P<.01)

TABLE 5b. EFFECT OF DIETARY LACTO-SACC ON LIVEWEIGHT GAIN OF NEW ZEALAND WHITE WEANLING RABBITS

	CONTROL	LACTO-SACC	% CHANGE
	----- g -----		
4 TO 8 WEEKS			
Start weight	581 (±33)	578 (±25)	
End weight	1304 (±50)	1421 (±37)	+9.8
Total gain	724 (±25)	880 (±27)	+21.5*
Daily gain	25.9	31.4	
4 TO 10 WEEKS			
End weight	1661 (±57)	1788 (±37)	+7.6
Total gain	1080 (±37)	1214 (±31)	+12.4*
Daily gain	25.7	28.9	
4 to 12 Weeks			
End weight	1889 (±59)	2039 (±42)	+7.9**
Total gain	1308 (±46)	1464 (±39)	+11.9**
Daily gain	23.4	26.2	

*(P<.05)
**(P<.01)

TABLE 5c. EFFECT OF LACTO-SACC ON EFFICIENCY OF WEANLING NEW ZEALAND WHITE RABBITS (EXPERIMENT)

	CONTROL	LACTO-SACC	% CHANGE
4-8 weeks	3.46	2.83	-18.2
4-10	3.62	3.15	-12.7
10-11	6.77	5.93	-12.4
11-12	8.26	6.90	-16.5
4-11	3.94	3.44	-12.7
4-12	4.28	3.71	-13.3

The results obtained with LACTO-SACC may indicate that lactic acid as an end product of lactic acid bacteria modified the pH of rabbit digestive tract to prompt the useful bacteria to increase and inhibit the harmful bacteria. This resulted in an increase in growth rate and a decrease in feed consumed with an improvement in nutrient digestibilities and consequently feed conversion ratio.

Effects of ACID-PAK 4-WAY. ACID-PAK 4-WAY in drinking water at 0.5 g/l significantly increased body weight and weight gain compared with either the control or the higher rate of use (Tables 6a and 6b). ACID-PAK 4-WAY given to NZW rabbits directly after weaning at .5 g/l increased both body weight and rate of gain but not significantly (Tables 7a and 7b). Also, little improvement in feed/gain ratio was found by using the organic acidifier at the low level.

The results obtained in Experiment 2 (Table 6), perhaps reflected a cumulative effect on the digestive tract of the high level of supplement in the drinking water (2.0 g/l ACID-PAK 4-WAY). This was evidenced by the reduction of most nutrient digestibilities (see Table 3), the higher food consumed during the period 12-13 weeks of age, and the lower weight gain during the same period.

The present study showed an improvement in feed conversion of treated diets over control in the three trials conducted. Major effects on growth rate noted were significantly higher average daily gain in response to LACTO-SACC and the low level (0.5 g/l) of ACID-PAK 4-WAY compared with other treatments. Comparing the growth performance results obtained in the present study under an Egyptian environment with those found by Cheeke (1990) at Oregon State University in the northwestern USA; the latter found improvement in feed/gain ratio over the control in six of seven trials using ACID-PAK 4-WAY and in three of seven trials when LACTO-SACC was used. He noted no major effects on growth rate except in one trial in which average daily gain was significantly higher with ACID-PAK 4-WAY than with other treatments.

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TABLE 6a. EFFECT OF ACID-PAK 4-WAY ON GROWTH OF NEW ZEALAND WHITE RABBITS AGED 7 TO 13 WEEKS (EXPERIMENT 2)

	Control	ACID-PAK 4-WAY .5g/l	ACID-PAK 4-WAY 2.0g/l	% Change
Initial number	19	19	19	
Final number	15	19	16	
Respiration rate (RPM)	$182.2^{B}(\pm 3.0)$	$86.9^{A}(\pm 1.1)$	$93.2^{A}(\pm .1)$	-8.8**
Rectal temperature, °C	39.0(±.1)	38.8(±.1)	38.8(±.1)	-.5
7 TO 10 WEEKS				
Start weight	928(±10.6)	929(±8.4)	930(±11)	
End weight	1439(±22.9)	$1579^{A}(\pm 19.9)$	$1498^{B}(\pm 18.4)$	+9.7*
Total gain	$511^{A}(\pm 18.4)$	$658^{B}(\pm 17.8)$	$571^{C}(18.8)$	+28.8*
Daily gain	24.3	31	27.2	
7 TO 13 WEEKS				
End weight	$1931^{B}(\pm 27.8)$	$2028^{A}(\pm 27.8)$	$1923^{B}(\pm 32.4)$	+5.0**
Total gain	$1003^{B}(\pm 26.6)$	$1099^{A}(\pm 24.6)$	$996^{B}(35.0)$	+9.6**
Daily gain	23.9	26.2	23.7	

*P<.05, **P<.01. Indicates difference between .5 g/l and CONTROL
^{A,B,C}Means in a row with different superscripts differ, P<.05.

TABLE 6b. EFFECT OF ACID-PAK 4-WAY IN DRINKING WATER ON FEED EFFICIENCY ON NZW RABBITS (EXPERIMENT 2)

	Control	ACID-PAK 4-WAY .5g/l	ACID-PAK 4-WAY 2.0g/l
7–10 weeks	3.79	3.04	3.80
10–12	5.72	4.80	5.70
12–13	6.28	5.48	8.41
7–12	4.56	4.12	3.96
7–13	4.82	4.33	4.43

TABLE 7a. EFFECT OF ACID-PAK 4-WAY (0.5 g/l DRINKING WATER) ON GROWTH, RESPIRATION RATE AND RECTAL TEMPERATURE OF WEANLING RABBITS (EXPERIMENT 3)

	CONTROL	AP4W	
Initial number	15	15	
Final number	15	15	
Liveweight, g			
4 weeks	449 (±16.0)	448 (±22.5)	
8	1153 (±30.2)	1197 (±39.0)	
11	1590 (±35.9)	1650 (±50.1)	
11	1786 (±57)	1923 (±39)	
12	1784 (±33.3)	1766 (±48.5)	
13	1814 (±32.0	1885 (±48.5	
	- - - - - - g - - - - - - - -		
4-8 WEEKS			
Start weight	449 (±16)	448 (±22.5)	
End weight	1153 (±30)	1197 (±39.0)	+3.8
Total gain	704 (±41.5)	748 (±63.1)	+6.3
Daily gain	23.3	24.5	
4-13 WEEKS			
End weight	1814 (±32.0)	1885 (±48.5)	
Total gain	1365 (±27.4)	1436 (±50.1)	+5.2
Daily gain	21.7	22.8	

*(P<.01)

TABLE 7b. EFFECTS OF ACID-PAK 4-WAY ON EFFICIENCY OF WEANLING RABBITS (EXPERIMENT 3)

	CONTROL	AP4W	% CHANGE
4-8 weeks	2.61	2.47	-5.4
4-11	3.17	3.84	-4.11
11-12	6.19	5.89	-4.8
12-13	6.45	5.78	-10.4
4-12	3.44	3.29	-4.4
4-13	3.68	3.50	-4.9

Carcass Traits

Supplementation with either LACTO-SACC in the pelleted diet or ACID-PAK 4-WAY at 0.5 g/l drinking water improved the percentage of dressed weight (Table 8). The improvement was significant only in Experiment 3 when the ACID-PAK 4-WAY was added to the drinking water (0.5 g/l) for rabbits aged 4 weeks and raised to 13 weeks of age. The improvement may have been due to the higher live body weight and the lower alimentary tract weight (%) for the treated compared with the control group.

TABLE 8. CARCASS TRAITS OF GROWING NZW RABBITS FOR THE THREE EXPERIMENTS

	EXPERIMENT-1		EXPERIMENT-2			EXPERIMENT-3	
	CONTROL	LACTO-SACC	CONTROL	AP4W .5g/l	AP4W 2g/l	CONTROL	AP4W .5g/l
Pre-slaughter wt. (g)	1869	1994	1901	1923	1923	1860	1919
Slaughter weight (g)	1821	1941	1826	1830	1843	1811	1868
%	97.4	97.3	96.1	95.2	95.8	97.4	97.3
Carcass weight (g)	1496	1604	1516	1525	1543	1486	1544
%	80.0	80.4	79.7	79.3	80.2	79.9	80.5
Dressed weight (g)[1]	1009	1112	1018	1051	1043	1015	1114
%	54.0	55.7	53.6	54.7	54.2	54.6	58.1
Giblet weight (g)	61	72	70	99	73	55	66
%	3.3	3.7	3.7	5.1	3.8	2.9	3.4
Tore limbs weight (g)	301	338	311	321	319	321	343
%	16.1	17.0	16.4	16.7	16.6	17.3	17.9
Trunk weight (g)	238	240	246	233	256	205	234
%	12.3	12.0	13.0	12.1	13.3	11.0	12.4
Hind limbs weight (g)	407	454	365	379	379	424	460
%	21.79	22.8	19.2	19.7	19.7	22.8	24.0
Alimentary canal wt(g)	371	377	374	331	384	359	313
%	19.85	18.91	19.7	17.2	20.0	19.3	16.3

[1]Dressed weight without head.

Rabbits in experiment-1 fed 4-12 week pelleted diet supplemented with 1 g LACTO-SACC/kg diet.

Rabbits in experiment-2 fed 7-13 week pelleted diet with two levels (low 0.5 g and high 2.0 g/l drinking water) of ACID-PAK 4-WAY.

Rabbits in experiment-3 fed 4-13 week pelleted with low level (0.5 g/l drinking water) of ACID-PAK 4-WAY.

Physiological Parameters

Respiration rate (RR) and rectal temperature (RT) decreased by 9.31 and 1.01%, respectively, when the diet was supplemented with LACTO-SACC ($P<.01$, $P<.05$; Table 5a). RR decreased in rabbits given AP4W at 0.5 g/l by 14.9 and 10.1% at ages seven and four weeks, respectively; and by 8.8% with the high level (2.0 g/l) for rabbits aged seven weeks (Tables 6 and 7). The corresponding values for RT decreased nonsignificantly. These results may indicate that supplementation with either LACTO-SACC or ACID-PAK 4-WAY succeeded in reducing RR and RT and consequently heat load on the animals in hot weather.

ACID-PAK 4-WAY increased plasma total protein by 10.5 and 9.0% using low and high levels of ACID-PAK 4-WAY respectively ($P<.05$, Table 9). The other parameters studied were unaffected. Though ACID-PAK 4-WAY at both levels improved protein metabolism as a result of improved CP digestibility (Table 3), no residual effect on kidney function was indicated by altered urea N.

In conclusion, results of the present study suggest that use of dietary LACTO-SACC and ACID-PAK 4-WAY (0.5 g/l drinking water) can be a tool for improving efficiency of feed utilization and growth performance. This may be a result of improving digestibility of various nutrients and the alleviation of the heat load of the heat stressed rabbits in commercial rabbit production.

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The author would like to acknowledge the help and support of ALLTECH Biotechnology Center, Nicholasville, Kentucky, U.S.A.; and EGYTECH (Dr. Mohy Sabry), Cairo, Egypt for the supply of sample and technical documentation.