



Impact of using some herbal plants extracts on productive and physiological performance of growing rabbits under Upper Egypt conditions

By

ZEINAB ALI AHMED MOUSA

B. Sc. of Agric. Sci. (Animal Production), Assiut University, 2009
M.Sc. in Animal Production, Faculty of Agriculture, Assiut University, 2016

Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of

Philosophy Doctor

**In Agricultural Sciences
(Animal Production / Animal Physiology)**

Department of Animal Production
Faculty of Agriculture
Assiut University
Egypt

2022

Supervised by:

Prof. Dr. Hassan A. Daghash (Main Supervisor)

Professor of Animal Physiology, Department of animal production, Assiut University.

Prof. Dr. Abou Bakr A. Azoz

Professor of Rabbit Management, Department of rabbits, turkey and waterfowl breeding, ARC.

Dr. Mohsen M. Farghaly

Assistant professor of Animal Nutrition, Department of animal production, Assiut University.

Dr. Mohamed S. M. Mousa

Lecturer of Animal Breeding, Department of animal production, Assiut University.

CONTENTS	
Title	Page
I. INTRODUCTION.....	1
II. REVIEW OF LITERATURE.....	3
1. Herbal plants as feed additives in rabbits diets.....	3
2. Characteristics and chemical composition of Rosemary.....	5
3. Characteristics and chemical composition of Chamomile.....	7
4. Effect of chamomile and rosemary on growth performance of growing rabbits.....	9
4.1. Body weight and body weight gain.....	9
4.2. Feed consumption and feed conversion ratio.....	10
4.3. Mortality rate.....	12
5. Effect of chamomile and rosemary on some blood constituents of growing rabbits.....	12
6. Effect of chamomile and rosemary on hematological parameters of growing rabbits.....	16
7. Effect of chamomile and rosemary on carcass characteristics and chemical composition of meat of growing rabbits.....	17
8. Effect of chamomile and rosemary on nutrients digestibility of growing rabbits.....	19
9. Effect of chamomile and rosemary on histopathology characteristics of growing rabbits	20
10. Effect of chamomile and rosemary on bacterial activity of growing rabbits..	22
11. Effect of chamomile and rosemary on the economic efficiency of growing rabbits.....	24
III. MATERIALS AND METHODS.....	26
1. Prepare Rosemary and Chamomile Extraction.....	26
2. Active compounds analysis of extracts.....	27
2.1. Methodology of HPLC chromatography analysis.....	27
3. The experiments.....	28
3.1. Growing trial.....	28
3.1.1. Animals, management and diets.....	28
3.2. Growth performance parameters.....	30
3.2.1. Live body weight and body weight gain.....	30

3.2.2.Feed consumption (FC).....	30
3.2.3.Feed conversion ratio (Feed, g / gain, g).....	30
3.2.4.Mortality rate.....	30
3.3. Blood samples.....	30
3.3.1.Hematological parameters.....	31
3.3.2.Blood Constituents.....	32
3.4. Carcass characteristics.....	32
3.5. Histological sectors.....	33
3.6. Bacteriological study.....	34
3.7. Digestibility trials.....	35
3.8. Economic Efficiency.....	36
4. Statistical analysis.....	37
IV. RESULTS AND DISCUSSION.....	38
1. Effect of chamomile and rosemary aqueous extract on growth performance of growing rabbits.....	38
1.1. Body weight and body weight gain	38
1.2. Feed consumption and feed conversion ratio.....	41
1.3. Mortality rate.....	42
2. Effect of chamomile and rosemary aqueous extract on blood properties of growing rabbits.....	43
2.1. Blood constituents.....	43
2.2. Hematological of white blood cells.....	49
2.3. Hematological of red blood cells.....	51
3. Effect of chamomile and rosemary aqueous extract on carcass characteristics of growing rabbits.....	55
4. Effect of chamomile and rosemary aqueous extract on chemical composition of meat of growing rabbits.....	56
5. Effect of chamomile and rosemary aqueous extract on nutrients digestibility of growing rabbits.....	57
6. Effect of chamomile and rosemary aqueous extract on the histological sectors of growing rabbits.....	60
7. Effect of chamomile and rosemary aqueous extract on the intestinal bacterial activity of growing rabbits.....	66
8. Effect of chamomile and rosemary aqueous extract on the economic efficiency of growing rabbits.....	68
V. SUMMARY AND CONCLUSION.....	71
VI. REFERENCES.....	77
VII. ARABIC SUMMARY.....	١

List of Tables

Table No.	Title of Table	Page No.
1.	HPLC analysis of flavonoids and phenolic compounds of rosemary and chamomile extracts.....	28
2.	Effect of supplementing different levels of chamomile and rosemary extract and their combination on growth performance and mortality rate of growing NZW rabbits.....	39
3.	Effect of supplementing different levels of chamomile and rosemary extract and their combination on some blood constituents of growing NZW rabbits.....	44
4.	Effect of supplementing different levels of chamomile and rosemary extract and their combination on some hematological parameters of growing NZW rabbits.....	50
5.	Effect of supplementing different levels of chamomile and rosemary extract and their combination on some hematological parameters of growing NZW rabbits.....	53
6.	Effect of supplementing different levels of chamomile and rosemary aqueous extracts supplemented on some carcass traits of growing NZW rabbits.....	55
7.	Effect of supplementing different levels of chamomile and rosemary aqueous extracts on some meat chemicals of growing NZW rabbits....	57
8.	Effect of supplementing different levels of chamomile and rosemary extracts on nutrients digestibility (%) of growing NZW rabbits.....	59
9.	Effect of supplementing different levels of chamomile and rosemary extracts on the intestinal bacterial activity of growing NZW rabbits.....	67
10.	Effect of supplementing different levels of chamomile and rosemary extracts supplemented on the economic efficiency of growing NZW rabbits.....	69

List of Figures

Figure No.	Title of Figure	Page No.
1.	Growth performance (Fig. A, B, C and D) and the mortality percentage (%) (Fig. E) of growing NZW rabbits supplemented different levels of chamomile and rosemary aqueous extract.....	40
2.	Effect of chamomile and rosemary aqueous extracts on total protein, albumin and globulin (g/dl) levels of growing NZW rabbits	45
3.	Effect of chamomile and rosemary aqueous extracts on glucose (mg/dl), total cholesterol (mg/dl) and triglycerides (mg/dl) levels of growing NZW rabbits.....	46
4.	Effect of chamomile and rosemary aqueous extracts on urea level of growing NZW rabbits.....	47
5.	Effect of chamomile and rosemary aqueous extracts on creatinine level of growing NZW rabbits.....	47
6.	Effect of chamomile and rosemary aqueous extracts on total antioxidant capacity and nitric oxide levels of growing NZW rabbits.....	49
7.	Effect of chamomile and rosemary aqueous extracts on white blood cells count (WBC's) of growing NZW rabbits.....	50
8.	Effect of chamomile and rosemary aqueous extracts on lymphocytes and neutrophils % of growing NZW rabbits	51
9.	Effect of chamomile and rosemary aqueous extracts on monocytes % of growing NZW rabbits	51
10.	Effect of chamomile and rosemary aqueous extracts on Eosinophil % of growing NZW rabbits.....	51
11.	Effect of chamomile and rosemary aqueous extracts on RBC's count (x106/ μ l) of growing NZW rabbits	53
12.	Effect of chamomile and rosemary aqueous extracts on hemoglobin (g/dl) of growing NZW rabbits.....	53
13.	Effect of chamomile and rosemary aqueous extracts on hematocrit percentage (%) of growing NZW rabbits.....	54
14.	Effect of chamomile and rosemary aqueous extracts on MCV level (μ m ³) of growing NZW rabbits.....	54
15.	Effect of chamomile and rosemary aqueous extracts on MCH value (pg) of growing NZW rabbits.....	54

16.	Effect of chamomile and rosemary aqueous extracts on MCHC value (g/dl) of growing NZW rabbits.....	54
17.	Effect of chamomile and rosemary aqueous extracts on platelets count (x103/ μ l) of growing NZW rabbits.....	54
18.	Effect of chamomile and rosemary aqueous extracts on dry matter (DM), organic matter (OM) and crude protein (CP) digestibility of growing NZW rabbits	59
19.	Effect of chamomile and rosemary aqueous extracts on crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) digestibility of growing NZW rabbits	60
20.	Effect of chamomile and rosemary aqueous extracts on histological parameters in the liver of growing NZW rabbits Bar=100 μ m. H&E stain...	61
21.	Effect of chamomile and rosemary aqueous extracts on histomorphological structures in the kidney of growing NZW rabbits Bar=100 μ m. H&E stain.	63
22.	Effect of chamomile and rosemary aqueous extracts on histomorphological structures in the duodenum of growing NZW rabbits Bar=100 μ m. H&E stain.....	64
23.	Effect of chamomile and rosemary aqueous extracts on the intestal bacterial activity of growing NZW rabbits.....	67
24.	Effect of chamomile and rosemary aqueous extracts on the economic efficiency of growing NZW rabbits.....	70

List of Abbreviations

Abbreviation	Items	Abbreviation	Items
°C	Celsius	hr.	Hour
ACTH	Adrenocorticotrophic hormone	Kg	Kilogram
Alb.	Albumin	L	Liter
Alb./Glob.	Albumin/Globulin	LDL	Low-density lipoprotein
ALP	Alkaline phosphatase	m²	Square meter
ALT	Alanine aminotransferase	MCH	Mean corpuscular hemoglobin
am.	Ante meridiem	MCHC	Mean corpuscular hemoglobin
AOAC	Association of Official Analytical Chemists	MCV	Mean corpuscular volume
AST	Aspartate aminotransferase	ME	Metabolizable energy
BW	Body weight	mg	Milligram
BWG	Body weight gain	ml	Milliliter
C	Control	mmol/L	Millimoles per liter
C/P ratio	Calorie/Protein ratio	N.R.C.	National Research Council
C1	Chamomile aqueous extract; 5ml/L	ng	Nanogram
C2	Chamomile aqueous extract; 10ml/L	NO	Nitric oxide
CF	Crude Fiber	pg	Pictogram
cm	Centimeter	pm.	Post meridiem
CP	Crude protein	PUFAs	Polyunsaturated fatty acids
CR	Chamomile and rosemary aqueous extract; 5 ml/L	R1	Rosemary aqueous extract ; 5ml/L
D	Day	R2	Rosemary aqueous extract; 10ml/L
DI	Deciliter	RBC	Red blood cells
DM	Dry matter	SEM	Standard error of the mean
E. coli	Escherichia coli	TAC	Total antioxidant capacity
EDTA	Ethylene diamine tetraacetic acid	U	International unit
EE	Ether extract	WBC	white blood cells
FC	Feed consumption	WHO	World Health Organization
FCR	Feed conversion ratio	wk	Week
g	Gram	wks	Weeks
g/dl	Grams per deciliter	µl	Microliter
Glob.	Globulin	µm	Micrometer
HDL	High density lipoprotein	µmol/L	Micromole per liter

V. SUMMARY AND CONCLUSION

The present study was carried out on a private commercial rabbit farm located in Assiut government, Upper Egypt, Egypt.

The aim of this study was to investigate and evaluate the effect of using some herbal plant extracts (Rosemary and Chamomile) on the productive performance of growing rabbits under Assiut conditions during summer season. The experiment was conducted from May to June 2021. The experiment lasted for 7 wks from 5 to 12 weeks of age.

A total of 72 weaning New Zealand White growing rabbits, 5 weeks of age, with an average initial body weight of 743.17 ± 12.4 g were obtained from a local commercial farm. Rabbits were randomly distributed into 6 treatments, each containing 12 rabbits in three replicates of four rabbits, each was (6 treatments x 3 replicates x 4 rabbits = 72) with nearly similar means of live body weight, as follows:

- 1- (Control): Rabbits received daily water without supplements.
- 2- (C1): Rabbits received daily water with supplements of chamomile aqueous extract a dose 5 ml /L.
- 3- (C2): Rabbits received daily water with supplements of chamomile aqueous extract a dose 10 ml /L.
- 4- (R1): Rabbits received daily water with supplements of rosemary aqueous extract a dose 5 ml /L.
- 5- (R2): Rabbits received daily water with supplements of rosemary aqueous extract a dose 10 ml /L.
- 6- (CR): Rabbits received daily water with supplements a mixture of rosemary and chamomile aqueous extract a dose 5 ml/L of each.

The obtained results can be summarized as follows:

Total body weight and daily weight gain:

- The addition of combination with chamomile and rosemary (CR) aqueous extracts (5 ml /L) to the drinking water of growing rabbits increased ($P < 0.05$) average body weight gain and daily weight gain as compared to the C1, R1 and R2 groups. The body weight gain of rabbits in rosemary groups was lower ($P < 0.05$) than those in the control and other treatment groups.

Feed consumption and feed conversion ratio:

- There are no significant effects on feed consumption between the treated groups and the control ones. However, the feed conversion ratio (FCR) was significantly improved ($P < 0.01$) of rabbits drinking water containing a mixture of chamomile and rosemary extracts (CR) when compared with the rosemary groups, while, no significant differences in feed conversion ratio were detected between the chamomile and rosemary groups.

Mortality rate:

- The inclusion of chamomile in the drinking water of the C1 and C2 groups or its combination with rosemary in the CR group decreased the mortality rate to 0% compared to the control and rosemary groups.

Blood constituents:

- The serum total protein (TP) and albumin of chamomile (C1-C2) and rosemary (R1) extracts, as well as their combination (CR) were significantly ($P < 0.05$) lower than those in the control group. The rabbits that received 10 ml/L of rosemary (R2) extracts was higher ($P < 0.05$) total protein and albumin than other treatment groups.
- The serum glucose, total cholesterol and triglyceride concentrations were significantly decreased ($P < 0.05$) in all treatments groups in comparison with the control group.

- The serum levels of urea and creatinine were lower in chamomile groups than in the control group.
- The total antioxidant capacity was significantly increased ($P<0.05$) in rabbits that received the high doses of rosemary (C2) and chamomile (R2) and a combination of them (CR) in comparison with the control ones.
- The nitric oxide in the blood plasma of rabbits that received different levels of chamomile and rosemary extracts or their combination of them was significantly ($P<0.05$) lower than that of the control group.

Hematological parameters:

- The number of WBCs was increased ($P<0.05$) when rabbits received a high dose of rosemary extract (R2) as compared with the control group (7.07 vs. 3.65×10^3 , respectively). However, no significant differences were detected between treatment groups and the control group for the percentages of lymphocytes, neutrophils, monocytes and eosinophils.
- The number of RBCs was decreased ($P<0.05$) with a high dose of chamomile extract (10ml/L) as compared with the control one (4.09 vs. $4.87 \times 10^6 /\mu\text{l}$, respectively).
- Hemoglobin and hematocrit percentage were improved ($P<0.05$) with the supplement rosemary alone in the R2 group or their combination with chamomile in the CR group in comparison to the control group and other treated groups.
- The addition of chamomile at a rate of 5ml/L (C1) was reduced ($P<0.05$) the MCV value when compared with those of the C2, R2 and CR groups.
- Supplementing chamomile extract alone (C2) or mixed with rosemary aqueous extracts (CR) markedly increased ($P<0.05$) the platelets count when compared to other groups.

Carcass characteristics and chemical composition of meat:

- No significant ($P \geq 0.05$) differences in slaughter weight, hot carcass weight, dressing percentage, and internal organs were observed between control and treated groups or among treated groups.
- The chemical composition of meat was not influenced by the different supplements from chamomile or rosemary and their combination.

Nutrient digestion coefficients:

- Statistical analysis revealed that there were no significant differences ($P > 0.05$) of nutrient digestibility among treatments and the control groups.
- Most nutrient digestibility of chamomile groups tended to be higher than the control and other treatment groups.
- The CF digestibility was numerically increased by about 14.9% in chamomile groups and rosemary groups (R2) as compared with the control group.

Histological sectors:

- A high dose of chamomile (C2) showed normal hepatic architecture. However, with a low level of chamomile (5m/L) treatment showed mild fatty degeneration of hepatocytes.
- The liver from rabbits that received extracts rosemary (5m/L) treatment showed granular degeneration of hepatocytes. However, liver from rabbits that received extracts rosemary (10m/L) treatment showed very mild granular degeneration of hepatocytes. In addition, chamomile and rosemary combination (CR) treatments showed a normal histological appearance of the hepatic lobule.
- The chamomile and rosemary treatments revealed apparently normal histomorphological structures in the kidney. The kidney from rabbits in chamomile (5 and 10 m/L) and a combination of chamomile and rosemary combination (5m/L) treatments showed normal glomeruli and a slight

amount of cellular debris inside the lumen of renal tubules. Also, rosemary (5 and 10 m/L) treatments showed normal glomeruli and mild sloughing of renal tubular epithelium in a few tubules.

- Intestine from rabbits that received extracts of chamomile (5m/L) and rosemary (10 m/L) showing sloughed of the intestinal epithelium. The intestine from rabbits that received extract chamomile and rosemary combination (5m/L) showed continuous and intact intestinal epithelium with the normal histological architecture of the intestinal mucosa.

Intestinal bacterial activity:

- The Escherichia coli count, total anaerobic bacteria and total bacteria count were decreased ($P < 0.05$) in all treatment groups as compared with the control group.
- The lowest value of total bacterial count was observed in the group of rabbits that received the combination of chamomile and rosemary (CR) when compared with other groups.

Economic efficiency:

- The all treatments groups were tended to be lower of the total cost of feed consumption during the experiment as comparing with the control diet
- Net revenue was markedly improved when rabbits received a combination of chamomile and rosemary aqueous extract group compared with other treatment groups and the control group.
- The economic efficiency was improved in chamomile groups as well as the mixture of chamomile and rosemary group in compassion with rosemary and the control groups.

Conclusion

From the previous results it could be concluded that supplements of chamomile aqueous extracts at a level of (5-10 ml/L) and the combination of chamomile and rosemary aqueous (5 ml/l each) to the drinking water of NZW growing rabbits under Upper Egypt conditions of summer has improved growth performance and economic efficiency and decreased mortality rate and bacterial intestinal activity of growing rabbits.