# Effect of Drinking Water Supplementation with Phyto-Additives (Horseradish, Dog-Rose, French Tamarisk And Grapes) on Body Mass in Young Rabbits

**Paula Iuliana Bohatâr[1], Marian Bura[1], Silvia Pătruică[1*], Sorin Voia[1], Cristina Pîrvuleţ[2]**

*[1] Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara,Calea Aradului, 119, 300645, Timisoara, Romania*
*[2]Academy of Agricultural and Forestry Sciences, Bd. Mărăşti, nr. 16, 011464 Bucureşti, România*

**Abstract**
In order to carry out the experiment, we made 5 hybrid rabbit groups (each one consisted of 5 individuals), homogenous in terms of age and body development, bred in cages of wire gauze. The control group was offered simple drinking water, and the other groups were offered drinking water supplemented with extracts of horseradish, dog-rose, French tamarisk and grape seeds. In each cage, we placed a stainless steel feeder for the administration of granulated forage and a plastic water supplier (300 ml capacity). During the experiment, we determined the granulated forage intake (150 g/individual/day) and the weekly body mass (between 35-105 days). At the end of the experiment, the biggest mean body mass was observed in the young rabbits that used to drink water with horseradish extract (3172±377 g), followed by those with French tamarisk (3046±162 g), dog-rose (2949±366 g) and finally by the rabbits that drank grape extract (2888±250 g). Along the 10 experimental weeks, the control group recorded significant differences ($p<0.05$) and distinctly significant ($p<0.01$) inferior to the experimental groups which were offered extracts of dog-rose, French tamarisk, horseradish and grapes.

**Keywords**: body mass, rabbits, young hybrids.

## 1. Introduction

The notion of forage additive defines a category of substances or products that are introduced in small amounts in animal feed, in order to recover some specific requirements and/or to influence in a useful way the production or health performances [1-4].The information provided by the specialty literature on the curative qualities of naturist products made us determine the effect exerted by the utilization of horseradish roots, dog-rose extract, French tamarisk extract and grape seed extract in feed supplementation in young hybrid rabbits.The horseradish roots have high vitamin C content (useful for the circulatory and immune system), phytoncides (with anti-bacterial action), ethereal oils (with calming effect), mineral salts (stimulative for metabolism) and others [5].

The dog-roses are rich in vitamin C, provitamin A, vitamins $B_1$, $B_2$, $B_3$, $B_5$, K, P, PP, E and nicotinic acid (anti-pelagic), and also in mineral salts, galactolipid (with anti-inflammatory effect), flavonoids (prevent from degenerative processes) and others [6].

The French tamarisk contains significant amounts of vitamins (C, $B_1$, $B_2$ etc), carotenoids, folic acid, phytosterols, unsaturated fatty acids, nicotinic acid and others. The French tamarisk infusion has positive effects in fighting against some severe vitamin deficiencies, it is a good detoxicant, diuretic, sudorific, anti-diarrheic, hemostatic and anti-pyretic [7].

* Corresponding author: Silvia Pătruică, patruica_silvia@yahoo.com

The grapes exert reminalizing, anti-oxidative, diuretic, hepatic decongestant, laxative effects and are a muscle and nervous tonic [8].
With the introduction of these extracts in the drinking water of rabbits, we attempted to determine the effects exerted by these on health and implicitly on the development of the young individuals studied.

## 2. Materials and methods

The biological material used was represented by young hybrid rabbits obtained successive to interbreedings in the Giant Chinchilla, Checkered Giant, White Giant and Californian breeds. In order to carry out the experiment, we made 5 lots of young hybrid rabbits, each one consisted of 5 individuals, homogenous in terms of age and body development, maintained in wire gauze cages. The control lot was offered simple drinking water, while the other lots (experimental) were offered drinking water with extracts of horseradish, dog-rose, French tamarisk and grape seeds. We installed, in each cage, a stainless steel feeder for the administration of granulated forage and a plastic water supplier (300 ml capacity). In order to determine the body mass of the young individuals (with ages ranging between 35 days and 105 days), we individually weighed them, at the end of each experimental week.

## 3. Results and discussions

Body mass evolution in young rabbits and the way it was influenced by the phyto-additives used in this experiment (horseradish, dog-rose, French tamarisk and grapes) was determined successive to individual weighing performed at the end of each experimental week (Table 1).
In the first seven weeks of experiment, the biggest mean body mass value was achieved in the rabbits offered water with grape seed extract (2898±172.84 g), and the most reduced value was obtained in the rabbit control lot (1330±377.12 g).
In the eighth and ninth weeks of the experiment, the biggest mean body mass value was obtained in the rabbits offered drinking water with French tamarisk (3036.20±180.65 g), while the smallest one was obtained in the control group (1249.20±60 g).
In the tenth experimental week, the biggest mean body mass value was achieved in the group offered water with horseradish extract (3172±377.12 g), and the smallest value was obtained in the control group (1231.33±37.02 g).
Variability within lots was experimented with the variability coefficient (CV). In the control lot, during 8 weeks, the variability was a reduced one (CV<10%), and it was medium during 2 weeks (CV=10-20%). In the experimental lots with horseradish and dog-rose, variability was medium only in one week and big (CV>20%) during 9 weeks. The lot with French tamarisk extract recorded a medium variability for 7 weeks and a bigger variability for 3 weeks, while the lot offered grape seed extract recorded a reduced variability for 3 weeks and a medium one for 7 experimental weeks. In 11 body mass determinations (out of 50), variability was reduced (22%), in 18 it was medium (36%) and in 21 cases it was big (42%).
In the first experimental week, we compared the body mass of the control lot with that in the experimental lots (table 2), and also the body mass of the experimental lots to each other.
We observed a mean body mass of the rabbits in the control lot (1134.80±88.84g) that was inferior to the mean body mass of the rabbits offered drinking water with addition of dog-rose extract (1799.80±145.46g), French tamarisk extract (1546.20±227.97g), horseradish extract (1755.60±258.33g) and grape seed extract (1882.00±116.44).
Between the lot with dog-rose and the one with French tamarisk, we observed a mean body mass of the rabbits who drank water with dog-rose extract (1799.80±145.46) that was superior to the mean body mass of the rabbits who drank drinking water with dog-rose extract (1546.20±227.97).
Between the control lot and the lot with dog-rose, we achieved a distinctly significant difference ($p<0.01$). Between the control lot and the lots with horseradish and grape extracts, we achieved significant differences ($p<0.05$).
The researches revealed a mean body mass of the rabbits belonging to the control group (1332.40±52.30g) that was inferior to the mean body mass of the rabbits belonging to the lot offered drinking water with dog-rose extract (2626.80±360.01g), French tamarisk extract (2672.60±183.17g), horseradish extract

(2606.60±312.63g) and grape seed extract (2800.50±129.37g).

**Table 1.** Body mass evolution in young rabbits according to diet

| Weighing date | Lot | X | Sx | S | Cv | Sx% | Minimal value | Maximal value |
|---|---|---|---|---|---|---|---|---|
| | Control lot | 1134.80 | 88.84 | 199.01 | 17.54 | 7.82 | 940 | 1370 |
| | Horseradish lot | 1755.60 | 258.33 | 578.66 | 32.96 | 14.71 | 1082 | 2580 |
| 21.11.2011 | Dog-rose lot | 1799.80 | 145.46 | 325.82 | 18.10 | 8.08 | 1420 | 2250 |
| | F. tamarisk lot | 1546.20 | 227.97 | 510.66 | 33.03 | 14.74 | 765 | 1994 |
| | Grape lot | 1882.00 | 116.44 | 232.88 | 12.37 | 6.18 | 1580 | 2120 |
| | Control lot | 1384.60 | 54.87 | 122.92 | 8.88 | 3.96 | 1194 | 1493 |
| | Horseradish lot | 2217.20 | 301.04 | 674.34 | 30.41 | 13.57 | 1326 | 3098 |
| 01.12.2011 | Dog-rose lot | 2182.60 | 238.34 | 533.88 | 24.46 | 10.92 | 1459 | 2897 |
| | F. tamarisk lot | 2082.40 | 241.33 | 540.58 | 25.96 | 11.58 | 1200 | 2464 |
| | Grape lot | 2408.00 | 139.41 | 278.81 | 11.58 | 5.78 | 2088 | 2707 |
| | Control lot | 1307.20 | 56.19 | 125.87 | 9.63 | 4.29 | 1173 | 1455 |
| | Horseradish lot | 2329.20 | 301.98 | 676.45 | 29.04 | 12.96 | 1394 | 3171 |
| 08.12.2011 | Dog-rose lot | 2341.00 | 286.23 | 641.15 | 27.39 | 12.22 | 1416 | 3171 |
| | F. tamarisk lot | 2225.80 | 217.84 | 487.97 | 21.92 | 9.78 | 1427 | 2593 |
| | Grape lot | 2516.50 | 99.63 | 199.27 | 7.92 | 3.95 | 2298 | 2754 |
| | Control lot | 1309.60 | 51.69 | 115.79 | 8.84 | 3.94 | 1175 | 1437 |
| | Horseradish lot | 2381.80 | 307.37 | 688.52 | 28.91 | 12.90 | 1399 | 3182 |
| 15.12.2011 | Dog-rose lot | 2434.60 | 313.30 | 701.79 | 28.83 | 12.86 | 1396 | 3270 |
| | F. tamarisk lot | 2368.20 | 201.23 | 450.76 | 19.03 | 8.49 | 1638 | 2771 |
| | Grape lot | 2596.75 | 114.16 | 228.32 | 8.79 | 4.39 | 2365 | 2890 |
| | Control lot | 1332.40 | 52.30 | 117.16 | 8.79 | 3.92 | 1178 | 1442 |
| | Horseradish lot | 2606.60 | 312.63 | 700.30 | 26.87 | 11.99 | 1529 | 3342 |
| 22.12.2011 | Dog-rose lot | 2626.80 | 360.01 | 806.43 | 30.70 | 13.70 | 1383 | 3550 |
| | F. tamarisk lot | 2591.60 | 198.52 | 444.68 | 17.16 | 7.66 | 1891 | 3043 |
| | Grape lot | 2800.50 | 129.37 | 258.74 | 9.24 | 4.61 | 2531 | 3139 |
| | Control lot | 1332.40 | 51.01 | 114.26 | 8.58 | 3.82 | 1174 | 1460 |
| | Horseradish lot | 2705.60 | 338.71 | 758.72 | 28.04 | 12.51 | 1535 | 3497 |
| 29.12.2011 | Dog-rose lot | 2684.80 | 398.25 | 892.08 | 33.23 | 14.83 | 1386 | 3754 |
| | F. tamarisk lot | 2672.60 | 183.17 | 410.30 | 15.35 | 6.85 | 2010 | 2996 |
| | Grape lot | 2840.50 | 146.09 | 292.19 | 10.29 | 5.14 | 2511 | 3200 |
| | Control lot | 1330.40 | 56.09 | 125.63 | 9.44 | 4.21 | 1151 | 1448 |
| | Horseradish lot | 2826.20 | 349.23 | 782.28 | 27.68 | 12.35 | 1585 | 3592 |
| 05.01.2012 | Dog-rose lot | 2728.60 | 424.99 | 951.98 | 34.89 | 15.57 | 1377 | 3869 |
| | F. tamarisk lot | 2835.00 | 192.28 | 430.70 | 15.19 | 6.78 | 2159 | 3258 |
| | Grape lot | 2898.00 | 172.84 | 345.68 | 11.93 | 5.96 | 2507 | 3347 |
| | Control lot | 1258.40 | 51.78 | 115.99 | 9.22 | 4.11 | 1092 | 1387 |
| | Horseradish lot | 2763.20 | 330.86 | 741.12 | 26.82 | 11.97 | 1552 | 3320 |
| 12.01.2012 | Dog-rose lot | 2662.00 | 431.38 | 966.29 | 36.30 | 16.20 | 1349 | 3821 |
| | F. tamarisk lot | 2870.00 | 171.76 | 384.73 | 13.41 | 5.98 | 2258 | 3285 |
| | Grape lot | 2860.00 | 202.72 | 405.44 | 14.18 | 7.08 | 2489 | 3430 |
| | Control lot | 1249.20 | 60.00 | 134.40 | 10.76 | 4.80 | 1062 | 1395 |
| | Horseradish lot | 2938.40 | 353.67 | 792.21 | 26.96 | 12.03 | 1638 | 3600 |
| 19.01.2012 | Dog-rose lot | 2694.80 | 415.07 | 929.77 | 34.50 | 15.40 | 1354 | 3819 |
| | F. tamarisk lot | 3036.20 | 180.65 | 404.65 | 13.33 | 5.94 | 2425 | 3541 |
| | Grape lot | 3000.25 | 173.99 | 347.98 | 11.60 | 5.79 | 2761 | 3515 |
| | Control lot | 1231.33 | 37.02 | 64.05 | 5.20 | 3.00 | 1044 | 1330 |
| | Horseradish lot | 3172.00 | 377.12 | 531.74 | 16.76 | 11.88 | 1601 | 3548 |
| 26.01.2012 | Dog-rose lot | 2949.25 | 366.49 | 732.98 | 24.85 | 12.42 | 1343 | 3824 |
| | F. tamarisk lot | 3046.80 | 162.02 | 362.92 | 11.91 | 5.31 | 2481 | 3470 |
| | Grape lot | 2888.00 | 250.02 | 500.04 | 17.31 | 8.65 | 2317 | 3530 |

Between the lot with dog-rose and the lot with French tamarisk, we observed a mean body mass of the rabbits that drank drinking water with dog-rose extract (2626.80±360.01) that was superior to the mean body mass of the rabbits who drank drinking water with French tamarisk extract (2591.60±198.52). In the fifth experimental week, we compared the control lot with the other experimental lots, and the experimental lots to each other, in terms of body mass

The significance of differences between the control lot and the lots with dog-rose and grape extracts revealed significant differences ($p<0.05$), respectively two distinctly significant differences ($p<0.01$) between the control lot and the lots with horseradish and French tamarisk.

In the tenth experimental week, we compared the control lot with the other experimental lots, and the experimental lots to each other, in terms of body mass.

**Table 2.** Significance of differences between body mass (g) of rabbits in 21.11.2011

| Lot | Item | | Difference | | Significance |
|---|---|---|---|---|---|
| | Lot | X±Sx | Absolute values | Relative values (%) | |
| Control lot n=4 X±Sx=1134.80±88.84 | Dog-rose lot | 1799.80±145.46 | -665 | 63.05 | 0.009** ds |
| | F. tamarisk lot | 1546.20±227.97 | -411.4 | 73.39 | 0.17 ns |
| | Horseradish lot | 1755.60±258.33 | -620.8 | 64.63 | 0.04* |
| | Grape lot | 1882.00±116.44 | -747.2 | 60.29 | 0.01* |
| Dog-rose lot n=5 X±Sx=1799.80±145.46 | F. tamarisk lot | 1546.20±227.97 | 253.60 | 116.40 | 0.46 ns |
| | Horseradish lot | 1755.60±258.33 | 44.20 | 102.52 | 0.75 ns |
| | Grape lot | 1882.00±116.44 | -82.20 | 95.63 | 0.53 ns |
| F. tamarisk lot n=4 X±Sx=1546.20±227.97 | Horseradish lot | 1755.60±258.33 | -209.4 | 88.07 | 0.75 ns |
| | Grape lot | 1882.00±116.44 | -335.8 | 82.15 | 0.26 ns |
| Horseradish lot n=4 X±Sx=1755.60±258.33 | Grape lot | 1882.00±116.44 | -126.4 | 93.28 | 0.62 ns |

**Table 3.** Significance of differences between the body mass (g) of rabbits in 22.12.2011

| Lot | Item | | Difference | | Significance |
|---|---|---|---|---|---|
| | Lot | X±Sx | Absolute values | Relative values (%) | |
| Control lot n=4 X±Sx=1332.40±52.30 | Dog-rose lot | 2626.80±360.01 | -1294.4 | 50.72 | 0.02* |
| | F. tamarisk lot | 2591.60±198.52 | -1259.2 | 51.41 | 0.009** ds |
| | Horseradish lot | 2606.60±312.63 | -1274.2 | 51.11 | 0.009** ds |
| | Grape lot | 2800.50±129.37 | -1468.1 | 47.57 | 0.01* |
| Dog-rose lot n=5 X±Sx=2626.80±360.01 | F. tamarisk lot | 2591.60±198.52 | 35.2 | 101.35 | 0.91 ns |
| | Horseradish lot | 2606.60±312.63 | 20.2 | 100.77 | 0.91 ns |
| | Grape lot | 2800.50±129.37 | -173.7 | 93.79 | 1.00ns |
| F. tamarisk lot n=4 X±Sx=2591.60±198.52 | Horseradish lot | 2606.60±312.63 | -15 | 99.42 | 0.75 ns |
| | Grape lot | 2800.50±129.37 | -208.9 | 92.54 | 0.46 ns |
| Horseradish lot n=4 X±Sx=2606.60±312.63 | Grape lot | 2800.50±129.37 | -193.9 | 93.07 | 1.00 ns |

**Table 4.** Significance of differences between the body mass (g) of rabbits in 26.01.2012

| Lot | Item | | Difference | | Significance |
|---|---|---|---|---|---|
| | Lot | X±Sx | Absolute values | Relative values (%) | |
| Control lot n=4 X±Sx=1231.33±37.02 | Dog-rose lot | 2949.25±366.49 | -1717.92 | 41.75 | 0.009** ds |
| | F. tamarisk lot | 3046.80±162.02 | -1815.47 | 40.41 | 0.009** ds |
| | Horseradish lot | 3172.00±377.12 | -1940.67 | 38.81 | 0.009** ds |
| | Grape lot | 2888.00±250.02 | -1656.67 | 42.63 | 0.01* |
| Dog-rose lot n=5 X±Sx=2949.25±366.49 | F. tamarisk lot | 3046.80±162.02 | -97.55 | 96.79 | 0.46 ns |
| | Horseradish lot | 3172.00±377.12 | -222.75 | 92.97 | 0.60 ns |
| | Grape lot | 2888.00±250.02 | 61.25 | 102.12 | 0.62 ns |
| F. tamarisk lot n=4 X±Sx=3046.80±162.02 | Horseradish lot | 3172.00±377.12 | -125.2 | 96.05 | 0.75 ns |
| | Grape lot | 2888.00±250.02 | 158.8 | 105.49 | 0.46 ns |
| Horseradish lot n=4 X±Sx=3172.00±377.12 | Grape lot | 2888.00±250.02 | 284 | 109.83 | 0.62 ns |

Successive to the statistical processing, we observed a mean body mass of the rabbits from the control lot (1231.33±37.02g) that was inferior to the mean body mass of the rabbits that drank drinking water with addition of dog-rose extract (2949.25±366.49g), French tamarisk extract (3046.80±162.02g), horseradish extract (3172.00±377.12g) and grape seed extract (2888.00±250.02g).

The mean body mass of the rabbits who drank drinking water with addition of grape extract (2888±250 g) was inferior to that of the lot with dog-rose extract (2949.25±366.49 g), this one to that of the lot with French tamarisk extract

(3046.80±162.02 g) and then to that of the lot with horseradish extract (3172±377.12 g). The biggest body mass (3172±377.12 g) was achieved in the lot with horseradish extract, and this was superior with 125.2 g than that of the lot with French tamarisk, with 222.75 g than that of the lot with dog-rose and with 284 g than that of the lot with grape seed extract.

By comparing the control lot with the lots with extracts of dog-rose, French tamarisk and horseradish, we achieved distinctly significant ($p<0.01$) differences, respectively a significant difference ($p<0.05$) between the control lot and the lot with grape seed extract.

## 4. Conclusions

1. In each of the ten experimental weeks, we compared the body mass of the control lot with the body mass of the experimental lots, who drank drinking water with supplementation of Dog-rose, French tamarisk, Horseradish and Grape extracts, and also the body mass of the experimental lots to each other (Dog rose-French tamarisk, Dog rose-Horseradish, Dog rose-Grape, French tamarisk-Horseradish, French tamarisk-Grape, Horseradish-Grape).

2. In the first week we achieved an insignificant difference ($p>0.05$) regarding the mean body mass of the Control lot and the experimental lot with French tamarisk, and in the second week we achieved two insignificant differences ($p>0.05$) between the Control lot and the experimental lots with French tamarisk and Horseradish.

3. The statistical body mass analysis of the rabbit lots reveals that during the ten experimental weeks there were distinctly significant differences ($p<0.01$) between the Control lot and the experimental lots with Dog-rose, French tamarisk, Horseradish and Grape.

4. By comparing the experimental lots to each other (Dog rose-French tamarisk, Dog rose-Horseradish, Dog rose-Grape, French tamarisk-Horseradish, French tamarisk-Grape, Horseradish-Grape), we achieved insignificant differences ($p>0.05$) along the entire experimental period.

## 5. References

1. Pop, I.M. Biotehnologii în nutriţia animalelor, Lito U.S.A.M.V. Iaşi, 1997.

2. Corcionivoschi, N., Drinceanu, D. Probioticele la timpul present, Ed. Mirton Timişoara, 2009.

3. Silion, (Neo) Simina Ileana, Utilizarea aditivilor furajeri în alimentaţia tineretului cunicul, Teză de doctorat, U.S.A.M.V.B. Timişoara, 2007.

4. Bura, M., Luca, I., Drinceanu, D., Ştef, Lavinia, Grozea, A., ICCF type protease influence on ration digestibility for rabbit, Buletin U.S.A.M.V. Cluj-Napoca, Vol. 55-56, Seria Zoot. şi Biot., 2001, pag. 12-16.

5. Basarab, A. Hreanul şi forţa lui vindecătoare, 2013, http://anatolbasarab.ro.

6. Racolţa, N. Măceşul şi beneficiile asupra sănătăţii, 2012, http://www.buzznews.ro.
http://sfatulmedicului.ro/medicinanaturistă.

7. XXX, Cătina, cel mai puternic antioxidant al organismului, 2012, http://www.apropo. ro./news/util/5118085.

8. Dăscălescu, Cristina Anca. Cura cu struguri, 2012.