

## THE IMPACT OF ADDING AROMA ON CHINCILLA DECREASE FUR CHEWING

### UTJECAJ DODATKA AROME JABUKE NA SMANJENJE GRIZENJA KRZNA ČINČILA

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#### ABSTRACT

The success of chinchilla breeding largely depends on the quality and intactness of their fur. In this paper the effect of apple aroma as food additive in concentration of 0,04% on performance and reduction of fur chewing as studied. The obtained results show that the positive results of the examined aroma use include increased body mass by 1.36%, **increased daily gain by 21.18%**, **increased consumption of food by 0.48%** and 17.13% improvement of food conversion. The addition of apple aroma to the feed also had a positive impact on decreased fur chewing by chinchillas. Only 5% out of the total number of treated chinchillas in this group had chewed fur, in comparison with the control group (without aroma addition) where 30% of animals had damaged fur, which is an important statistical improvement ( $p < 0.01$ ).

Key words: chinchilla, aroma, fur, conversion, growth, fur chewing

#### INTRODUCTION

Achieving successful and profitable production of fur is directly affected by proper environmental criteria and the use of quality food. Chinchilla is a South American rodent, herbivore, originating from South America (Peru, Chile, Bolivia) bred as a pet and for fur. It belongs to the nocturnal animals that perform most of their life activities, including feeding, at night. Chinchillas are characterized by a high quality fur which consists of extremely soft and loose hair and which makes it the third most expensive animal in the world fur market. Interesting characteristics of chinchilla fur are softness of fur (50-120 fibres comes out of each hair root) and amazing lightness of the fur which weighs almost as silk. Generally, chinchillas have the thickest fur of all animals where 1 cm<sup>2</sup> has more than 20,000 hairs. It is considered one of the softest animals in the world and its fur is 30 times softer than human hair. (Bickel, 1987; Mettler, 1999; Kamler, 2002)

One of the most negative phenomena when it comes to profitability of breeding these rodents is that for various reasons they chew their fur, which happens mostly at night. Disturbances can occur in all categories of chinchillas during the entire production cycle, but typically it occurs in pregnant females. (Jimenez, 1990; Jaros et al., 2004)

Modern concepts of nutrition in intensive animal farming are based on the use of various additives in order to achieve maximum production results. Having this in mind, we studied the impact of apple aroma produced by the company Ireks Aroma from Croatia, as a food additive on production results and the possibility of eliminating fur chewing. The use of aromatic plant extract ingredients in animal feed resulted in many positive effects such as increased growth, improved conversion of nutrients, reduced mortality and improved general health of the treated animals (Kozelov et al., 2003; Živković et al., 2003). We found that aromatic botanical additives have

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**Table 1. Chemical composition of complete pelleted mixtures for feeding chinchillas**

**Tablica 1. Kemijski sastav peletiranih potpunih smjesa za hranidbu činčila**

Components - Sastojci (%)	A-control group - A-kontrolna grupa	B- experimental group - B-pokusna skupina
Oats - Zob	21	21
Barley - Ječam	4.7	4.7
Wheat - Pšenica, %	11.6	11.56
Soybean meal - Sojina sačma (44%)	9	9
Sunflower meal - Suncokretova sačma (33%)	11.5	11.5
Sunflower meal - Suncokretova sačma (42%)	5	5
Wheat bran - Pšenične posije	6	6
Alfalfa meal - Lucernino brašno	20	20
Yeast - Stočni kvasac	1	1
Soybean groats - Sojin griz	2.1	2.1
Sugar - Šećer	2	2
Peletin - Peletin	2	2
Chalk - Stočna kreda	1.7	1.7
Monocalcium phosphate - Monokalcijev fosfat	1.1	1.1
Iodised salt - Jodirana sol	0.3	0.3
Premix - Premiks	1	1
Apple aroma - Aroma Jabuka	-	0.04
UKUPNO	100%	100%
Chemical mixtures - Kemijski sastav smjesa		
Crude protein - Sirovi proteini, %	18.74	18.80
Crude fiber - Sirova vlaknina, %	12.35	12.40
Ash - Pepeo, %	8.17	8.13
Ca, %	1.14	1.18
P, %	0.70	0.72
Na, %	0.16	0.17
Total fat - Ukupna mast, %	3.10	3.00
OJ-OJ	0.71	0.72
Lysine - Lizin, %	0.84	0.85
Methionine+cystine - Metionin+cistin, %	0.68	0.67
Threonine - Treonin, %	0.72	0.71
Tryptophan - Triptofan, %	0.27	0.26

The composition of the used premix per kg mixture (Sastav upotrijebljenog premiksa po kg smjese): A (E 672) IU / kg 23000, D3 (E 671) IU / kg 3500, E 90 mg / kg, B1 mg / kg 3, B2 5 mg / kg, B6 2 mg / kg, B12 0.02 mg / kg, K3, 1 mg / kg, C 13 mg / kg, niacin 50 mg / kg, Ca-pantothenate 21mg/kg, Mn (E5) 30 mg / kg, Zn (E6) 50 mg / kg, Fe (E1) 30 mg / kg, Cu (E4) 4 mg / kg, B (E2) 0.7 mg / kg, Se (E8) 0.2 mg / kg, Co (E3) 0.4 mg / kg, biotin 0.1 mg / kg Choline chloride 400 mg / kg, folic acid. 0.2 mg / kg, Lysine 700 mg / kg, methionine 300 mg / kg, Rovabio AP/10 200 mg / kg Phytase 100 mg / kg, Antioxidant BHT (E321) 100 mg / kg

**Table 2. The average chemical composition of hay**

**Tablica 2. Prosječan kemijski sastav sijena**

Dry mater Suha tvar %	Crude protein Sir. proteini %	Crude fiber Sir. vlaknina %	Ca g/kg DM	P g/kg DM	Mg g/kg DM	Na g/kg DM
88.26	11.90	20.10	5.10	0.98	1.00	0.42

anti-microbiological, anti-viral, anti-fungal, and anti-helminthical immune stimulating properties (Middleton et al., 1992; Dorman et al., 2000; Wenk et al., 2002; Azaz et al., 2004)

However, there is not much bibliographic data on experimental research in the field of application of aroma as a food additive for chinchillas and its impact on production features. The aim of this paper is to determine the impact of adding apple aroma on prevention of fur chewing, and production parameters such as growth, consumption, food conversion and mortality.

#### MATERIAL AND METHODS

The examination was performed on 8 families of standard chinchillas and it lasted for 30 days and included 4 females and 1 male, more precisely 40 adult animals aged 1+ years which were divided into two equal groups of 20 individuals. In both experimental groups there were 9 pregnant females and all individuals were kept in cages made of galvanized wire whose dimensions were 60 x 55 x 65 cm.

The control group (A) was fed pellets without the addition of aroma and the other experimental group (B) had aroma added ("Ireks Aroma" from Croatia) in the same food mixture in the concentration of 0.04 %. Besides pellets, both groups were fed dry and high-quality hay with no mold, and supplied with fresh water during the experiment. Daily portions included 30g of briquettes and 20g of hay given every other day per animal, while pregnant females received 20g of hay in two days and 35g of briquettes daily. The tested animals had ad libitum access to food and water. During the experiment the conversion of food and nutrients was determined based on data measurements on food consumption, and consumption of food and degree of chewed fur were monitored daily.

In the cage, dry lime sawdust (chips) was used as a bedding and animals were provided with daily

bathing in special volcanic sand for scouring and care of fur in the following proportion: sand - aroma 99: 1. Volcanic sand from the vessel was changed once a week.

The used food was sampled and chemically analyzed using standard methods of testing (AOAC, 1990). Mycotoxicological safety of food pellets was analyzed by the method of thin layer chromatography (Balzer et al., 1978). Basic physical, chemical and bacteriological analysis of the measured water parameters was performed using standard methods (Methods for testing hygienic safety of drinking water, 1990).

When it comes to microclimatic factors, the temperature, humidity and air velocity were monitored. Air temperature was measured with a thermometer, relative humidity with a hygrometer and air velocity using a katathermometrical method according to Hill. Behavior and lack of fur were monitored by a visual method of observation. Swabs were taken from the places where fur was lacking in order to determine the presence of the most common causes of fungal infections, such as the following: trichophyton mentagrophytes, microsporum canis and microsporum gypseum.

The results were grouped into appropriate series and statistically processed in a computer using common mathematical and statistical procedures that involve the analysis of variance and evaluating the significance of the results (differences) by using the "t" test.

#### RESULTS AND DISCUSSION

The data listed in Table 1 show chemical composition of used food for chinchillas in detail. Based on the shown chemical composition we can conclude that the used pellets contained all the necessary nutrients and chemical composition of complete feeds was approximately the same, completely satisfying the needs of furry animals (Soto, 1993).

**Table 3. Microbiological analysis of complete mixtures and hay**

**Tablica 3. Mikrobiološka analiza potpunih smjesa i sjena**

Type of microorganism Vrsta mikroorganizma	Determined value - Utvrđena vrijednost	
	Complete mixture - Potpune smjese	Hay - Sjeno
Salmonella spp.	0	0
Clostridium botulinum	0	0
Clostridium perfringens	0	0
Staphylococcus pyogenes	0	0
Proteus spp.	0	0
E. coli	0	0
The total number of bacteria - Ukupan broj bakterija	40000	120000
Yeasts and molds - Kvasci i plijesni	800	2500

**Table 4. The mycotoxins content in the used hay mixtures, (mg/kg)**

**Tablica 4. Sadržaj mikotoksina u upotrijebljenim smjesama i sijenu, (mg/kg)**

Mycotoxin Mikotoksin	Determined value- Utvrđena vrijednost	
	Complete mixture- Potpune smjese	Hay - Sijeno
Aflatoxin B1	-	0.001
Toxin F-2	-	-
Ochratoxin A	-	-

**Table 5. Physico-chemical and bacteriological analysis of water**

**Tablica 5. Fizikalno-kemijska i bakteriološka analiza vode**

Parameter- Parametar	Unit of Measure – Mjerna jedinica	Value - Vrijednost
Color- Boja	mg/L Pt°Co	-
Temperature - Temperatura	°C	13.5
Fuzziness - Mutnoća	°NTU	-
pH		7.40
Conductivity - Elektroprovodljivost	µS/cm	590
Ammonia - Amonijak	mg/L	-
NO <sub>3</sub>	mg/L	-
Chlorides - Kloridi	mg/L	11.8
Iron - Željezo	µg/L	9
Manganese - Mangan	µg/L	0.80
Aer.mez. bacteria - Aer.mez.bak. 22°C	n/1ml	-
Aer.mez. bacteria - Aer.mez.bak. 37°C	n/1ml	-
Total coliform - Ukupni coliformi	n/100ml	-
Escherichia coli	n/100ml	-
Enterococi	n/100ml	-

**Table 6. The average value of microclimatic parameters during the test (0-30days)**

**Tablica 6. Prosječna vrijednost mikroklimatskih parametara tijekom trajanja pokusa (0-30dana)**

Temperature, °C - Temperatura, °C	Relative humidity, % - Relativna vlažnost, %	Air velocity, m/s - Brzina strujanja zraka, m/s
18,50	58	3

The microbiological analysis of complete feeds and hay (Table 3) did not show the presence of pathogenic microorganisms. Mycotoxicological analysis of the used food indicated the presence of aflatoxin B<sub>1</sub> in hay samples in the concentration of 0.001 mg / kg. Registered values of aflatoxin B<sub>1</sub> are in accordance with the norms that regulate the allowed content of mycotoxins, according to which the maximum allowed concentration of aflatoxin B<sub>1</sub> in the hay is 0,05 mg / kg (Sl.gl. RS, br. 4/2010). The determined values of aflatoxin B<sub>1</sub> were also in accordance with the values found in the available bibliographic data (Devegowda et al, 1998; Sinovec et al. 2000).

The test results related to the basic physical, chemical and bacteriological water quality (Table

5) had balanced values, which ranged in the optimum for breeding chinchillas (Sl. list SRJ, br. 42/98 i 44/99).

The data presented in Table 6 show that the determined average values of examined microclimate factors corresponded to the optimal values reported by most authors (Kraft, 1984; Kamler, 2002; Popović, 2004). According to these researchers, the most favorable temperature for breeding chinchillas is from 16 °C to 20 °C, humidity from 50% to 60%, and air circulation from 2 to 3.5 m/s. High air temperatures above 28 °C and relative humidity above 65% not only violated the quality of fur, but they proved to be fatal for animals grown because they led to the collapse of the animals, dehydration, and ultimately death of chinchillas.

**Table 7. Chewed fur in body regions during the test**

**Tablica 7. Nagrizenost krzna po tjelesnim regijama tijekom trajanja pokusa**

Category - Kategorija	Total No. - Ukupan broj	Number chewed - Broj nagrizenih	A-control group - A-kontrolna skupina				
			Flanks - bokovi	Neck - vrat	Back - leđa	Legs - noge	Tail - rep
Males - Mužjaci	4	1	+	-	-	-	-
Females - Ženke	7	2	++	-	-	+	-
F. pregnant - Ženke gravidne	9	3	++	-	-	++	-
TOTAL -UKUPNO:	20	6	8 points - 8 bodova				
			B- experimental group B-pokusna skupina				
			Flanks - bokovi	Neck - vrat	Back - leđa	Legs - noge	Tail - rep
Males- Mužjaci	4		-	-	-	-	-
Females - Ženke	7		-	-	-	-	-
F. pregnant - Ženke gravidne	9	1	+	-	-	+	-
TOTAL - UKUPNO:	20	1	2 points - 2 boda				

Degree of chewing fur: - no chewing (0 points) + low (1 point), ++ pronounced (2 points), +++ very pronounced (3 points)

Stupanj grizenja krzna po intezitetu: - nema grizenja (0 bodova), + nizak (1 bod), ++ izražen (2 boda), +++ veoma izražen (3 boda)

**Table 8. Production results in the experiment**

**Tablica 8. Proizvodni rezultati u pokusu**

Period Days - Period dana	Categories - Kategorije	GROUP - SKUPINA	
		A-control group - A-kontrolna skupina	B- experimental group - B-pokusna skupina
Prosječna tjelesna masa činčila (g) - The average body mass of chinchillas (g)			
Start of experiment - Početak pokusa	Males - Mužjaci	555.80	560.30
	Females - Ženke	580.10	580.50
	Females pregnant - Ženke gravidne	600.90	608.30
	AVERAGE - PROSJEK	577.27	583.03
	Index - Index (%)	100	100.1
	Difference - Razlika (%)		+0.10
p>0.05			
30 <sup>th</sup> days 30. dana	Males - Mužjaci	562.80	570.50
	Females - Ženke	585.00	590.80
	Females pregnant - Ženke gravidne	615.30	625.70
	AVERAGE- PROSJEK	587.70	595.67
	Index - Index (%)	100	101.36
	Difference - Razlika (%)		+1.36
p>0.05			
Average daily gain of body weight (g) - Prosječan dnevni prirast tjelesne mase (g)			
0-30 days 0-30 dana	Males - Mužjaci	7	10.20
	Females - Ženke	4.9	10.30
	Females pregnant - Ženke gravidne	14.40	17.40
	AVERAGE - PROSJEK	10.43	12.64
	Index -Index (%)	100	121.18
	Difference - Razlika (%)		+21.18
*p<0.05			
Consumption and conversion of food pellets + hay (g) - Konzumacija i konverzija hrane pelete + sijeno (g)			
0-30 days 0-30 dana	Males - Mužjaci (g)	4510	4530
	Females - Ženke (g)	8190	8220
	Females pregnant - Ženke gravidne (g)	12120	12190
	Total - Ukupna (g)	24820	24940
	Daily - Dnevna (g)	41.37	41.57
	CONVERSION - KONVERZIJA	3.97	3.29
	Index - Index (%)	100	82.87
	Difference - Razlika (%)		+17.13

Based on the obtained results of chewed and damaged fur (Table 7) we can conclude that the presence of apple aroma in the mixture of experimental

group B contributed to a significant reduction in fur chewing (5% out of the total number) compared to animals in control group A where the total damage

of fur was found is 30% of animals. Fur chewing in the control group A was most common on hips and legs with the intensity of 8 points, which is 25% more points compared to the furry animals that were fed diet with apple aroma, which suggests the existence of highly significant differences ( $p < 0.01$ ). In places where fur was lacking, dermatological analysis did not register the presence of trichophyton mentagrophytes, microsporum canis and microsporum gypseum.

Bibliographic data (Kraft, 1984; Kamler, 2002; Mettler, 1999) suggest different factors that could cause fur chewing. Some of the most significant are inadequate nutrition, inadequate housing and zoo hygienic conditions, dirty fur, hormonal and metabolic disorders and genetic factors. Also, fungal diseases can be one of the causes of pathological skin changes that occur due to inflammation of skin, appearance of the cross, peeling, itching and hair fall out. The disorder is easily visible because the areas without hairs are very noticeable. Such animals are anxious, they lose weight, and their feces contains large amounts of hair.

According to Jaros et al. (2004) deficiency in vitamin B complex is an important factor for occurrence of the phenomenon of fur chewing, due to the lack of concentration or preventing their absorption in the presence of antivitamin. The author also states that overuse of antibiotics and sulfonamides in the treatment of diseases causes disturbances in the form of hair falling. Unfavorable ambient conditions such as high temperature, poor lighting and excessive humidity may cause these adverse effects. Farmers experience shows that parts of chinchilla fur fall off if they are roughly and suddenly caught with hands. Another cause of fur damage can be the fact that animals bite each other.

Adding apple aroma to the mixture in Group B in the quantity of 400 g/t had a positive effect at the end of the experiment and it resulted in weight gain by 1.36% compared to the control group A, but there was no statistical significance ( $p > 0.05$ ). Compared with average daily gain of body weight in the A-group, it can be concluded that the experimental B-group achieved higher daily weight gain by 21.18% which indicates the existence of significant differences ( $p < 0.05$ ). During the test, the added apple aroma in the experimental group improved the average daily intake of food by 0.48% compared to

the control group of chinchillas. The addition of aromatic additives in food resulted in an improved feed conversion in trial B-group amounting to 17.13% compared to the control A-group of chinchillas, with no additives in the mixtures.

The results are in agreement with other authors (Surdjiska et al., 2005), who found that adding a mixture of plant extracts to feed for rabbits stimulated the increase of growth and yield ranging from 3.3% to 5.5% and feed conversion improved by 9%. Aromatic plant extracts have a favourable effect on improving digestion and absorption of nutrients, because they encourage the activity of pancreatic and bile secretion (Mellor, 2001; Soliman, 2002).

Eiben et al. (2004) concluded that the use of fenugreek seeds and anise in the amount of 6 g / kg, led to improved consumption and feed conversion in rabbits with statistical relevance of ( $p < 0.01$ ). Aromatic plants extracts have antibacterial, antifungal and anti-inflammatory properties (Soliman, 2002; Sagdic, 2003), and in addition to the efficiency of digestion, they increase lactation of mammals (Albert-Buel, 1980). The application of yucca aroma in pelleted food for rabbits in a concentration of 250 mg/kg, contributed to the increase in feed consumption by 9.6%, feed conversion by 3.62%, and retention of nitrogen by 24.3% compared to rabbits fed without this stimulus (Amber et al., 2004).

In general, the obtained results showed that the addition of apple aroma had positive effects both in nutrition and prevention of fur chewing.

## CONCLUSION

The impact of apple flavor as food additive, used in the concentration of 0.04% in the pelleted food for chinchillas in this experiment had a positive effect on all analyzed parameters of production. The positive effects were seen in the following:

- increase in body weight by 1.36% ( $p > 0.05$ );
- increased daily gain by 21.18% ( $p < 0.05$ );
- increased consumption of food by 0.48%;
- improvement of feed conversion ratio by 17.13%.

The addition of the tested flavors contributed to a significant reduction in fur chewing ( $p < 0.01$ ). The treated chinchillas had only 5% of chewed fur compared to the control group (without aroma addition) where 30% of animals had damaged fur.

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## SAŽETAK

O kvaliteti i neoštećenosti krzna, u velikoj mjeri ovisi uspjeh u uzgoju činčila. U ovom radu je s aspekta utjecaja hranidbe istraživano djelovanje arome jabuke kao dodatka hrane primijenjenog u koncentraciji od 0.04% na proizvodne parametre i smanjenje grizenja krzna. Dobiveni rezultati su pokazali da se pozitivni efekti korištenja ispitivane arome ogledaju u povećanju tjelesne mase za 1.36%, povećanom dnevnom prirastu za 21.18%, povećanoj konzumaciji hrane za 0.48% i poboljšanjem konverzije hrane za 17.13%. Dodavanje arome jabuke u smjesu za hranidbu činčila je također imalo pozitivan utjecaj na smanjenje grizenja krzna činčila. Tretirane činčile imale su 5% grizenja krzna od ukupnog broja jedinki u skupini, u odnosu na kontrolnu skupinu (bez dodatka arome) kod koje je zabilježeno oštećenje krzna u 30% jedinki, što je značajno statističko poboljšanje ( $p < 0.01$ ).

Ključne riječi: činčila, aroma, krzno, konverzija, prirast, grizenje krzna