

# Chemical quality of chicken meat originated from broilers fed with the addition of zeolite clinoptilolite

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## Summary

The effect of the addition of native zeolite clinoptilolite on meat quality of broilers was researched in this paper. Zeolites are natural volcanic minerals which can absorb and bind different substances because of its crystal lattice structure. Thanks to its antiseptic and antibacterial properties these minerals are often used in the veterinary medicine nowadays. According to EU regulations, the nutraceutical zeolite clinoptilolite is recommended feed additive. In order to determine the impact of natural zeolite clinoptilolite added in standard feed of broiler chickens on the chemical quality of the meat using standard chemical methods, the broiler drumsticks and breastfillet of 15 broilers from each experimental group were used. Results of this study show a positive effect of natural zeolite klinoptilolita on broilers meat quality.

**Keywords:** broilers, zeolite clinoptilolite, meat quality

## Introduction

The fears of using antibiotic growth promoters in animal feed on human health and/or misuse of antibiotic growth promoters, led to the ban of their use in the European Union (Regulation EC No. 1831/2003), and there is an intensive search for the applicable technical and economic alternatives for antibiotic growth promoters (AGP) and among nutraceutical as feed additives to control stress factors on the health of animals. Food for animals must provide a sufficient amount of digestible nutrients, and must protect animals from oxidative stress, minimize the possibility of disease and maintain an effective immune system. Therefore, in the present time the feed is considered as a mixture of different nutrients and nutrients. Nutrients are the food components like carbohydrates, proteins, fats, vitamins and minerals, while nutrients through

different effects on the metabolism of the organism maintain its good health. Accordingly, the term nutraceutical refers to any substance as an ingredient in animal feed, which has a beneficial effect on the health of animals, both, in the prevention of and in the treatment of infectious diseases. Some of the beneficial effects of the nutraceuticals are reducing oxidative stress, prevention of the growth of microorganisms in food, modulation of the immune system, better digestion and absorption of nutrients and modifications micropopulation of the gastrointestinal tract (Valpotić et al., 2005). Specifically, in the intensive poultry production, using of non-specific immune and nutritional modulation by selected nutraceuticals (Mršić et al., 2011; Mršić et al., 2013; Petek et al., 2013) or immunomodulators of immune response (Špoljarić et al., 2013), in accordance with EU regula-

tions of ban of the addition of AGP in food for animals, were obtained scientific results about the justification for the use of an economically competitive alternative, acceptable to farmers, feed producers and consumers. Thus, Trailovic et al., 2013 note that the addition of natural zeolite clinoptilolite preparation in broilers food enhances their protection from the harmful effects of mycotoxins of food, which ultimately affects the better utilization of the food, and better production results during the fattening (Wu et al., 2013). Also, a lot of scientific investigations suggest that the addition of natural zeolite in broilers food has a beneficial effect on their immune system (Wu et al., 2013). According to EU regulation (183/2003, 744/2012, 651/2013) of zeolite clinoptilolite as a recommended feed additive for animals, the aim of this study was to evaluate the chemical quality assessment of

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Figure 1 Sample of natural zeolite clinoptilolite

meat of broilers fed with substitute of natural zeolite clinoptilolite.

### Material and methods

The research was conducted within the VIP project No.:2012-11-17. The study was carried out in 35 days on the farm „Živković“, Kvarter, Perušić on 80 broilers (breed ROSS

308, 40 male, 40 female). Broilers were divided into 2 groups, containing 40 animals each. Groups were kept apart, but in the same facility. C group of broilers during the experiment was fed with basal food intended for broilers (starter 0-14 days of age; finisher I. 14-28 days of age; finisher II. 28-38 days of age). Broilers group A during the whole experiment were fed with basal food intended for broilers with addition of powder supplement of nature zeolite clinoptilolite in concentration of 0,5%. During the whole experiment food and water were available to broilers *ad libitum*. As a supplement to the basal food for broilers, powder supplement of zeolite clinoptilolite from commercial production (VIR-

IDISFARM – AS, B. Gojak 178, 47000 Karlovac; contract about research and professional collaboration : Class : 402-08/10-441/2 , eds Number : 251 -01-01/139-10-1 ) was used. (Figure 1).

Prior to mixing in commercial food for fattening broilers at a concentration of 0.5% samples of natural zeolite clinoptilolite were analyzed by the electronic microscope SEM-u Tescan Mira3 FEG (Centre for forensic investigations, research and expertise Ivan Vučetić, Zagreb, Croatia) (Figure 2).

Also, elemental chemical analysis of the sample preparation done on the electron microscope SEM Philips XL 30 with EDX detector (EDAX), with 10mm<sup>2</sup> of active surface Centre for forensic investigations, research and expertise Ivan Vučetić, Zagreb, Croatia). At the end of the experiment, 35th day, in abattoir, broiler buttock and white meat from 15 broilers from each experimental group were taken in order to examine the effect of addition of the supplement of zeolite clinoptilolite to the basal food intended for broilers on chemical quality of broiler meat. On Department of Hygiene and Technology of Foodstuffs of Faculty of Veterinary Medicine, University of Zagreb, shares of: water (Method according to ISO 1442 standard), fat (Method according to ISO 1443 standard), proteins (Method according to ISO 937 standard) and ash (Method according to ISO 936 standard) were determined. Statistical analyses of experimental data in content of fats and protein in meat of control (untreated) group of animals (C group) and treated group (A group) of broilers, were provided using the t-test for dependent samples.

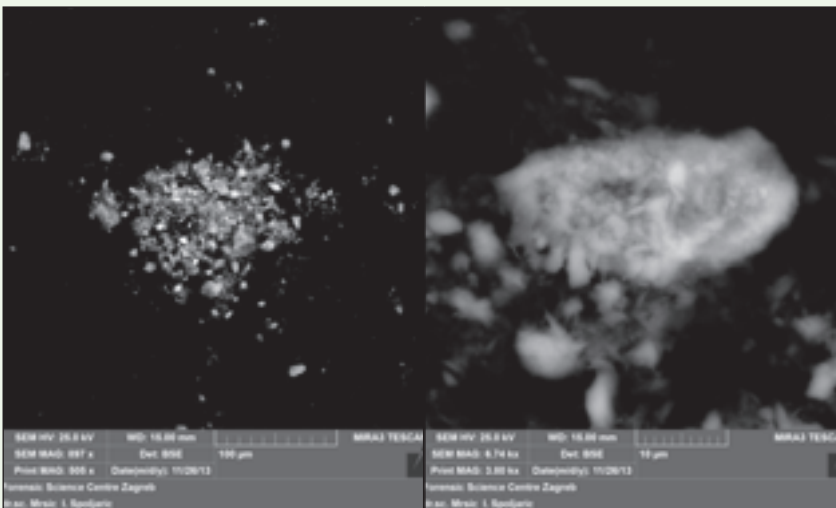


Figure 2 Visualized ultrastructure of biomass powder of nature zeolite clinoptilolite, using electronic microscope SEM-u Tescan Mira3 FEG (Centre for forensic investigation, research and expertise Ivan Vučetić, Zagreb, Croatia)

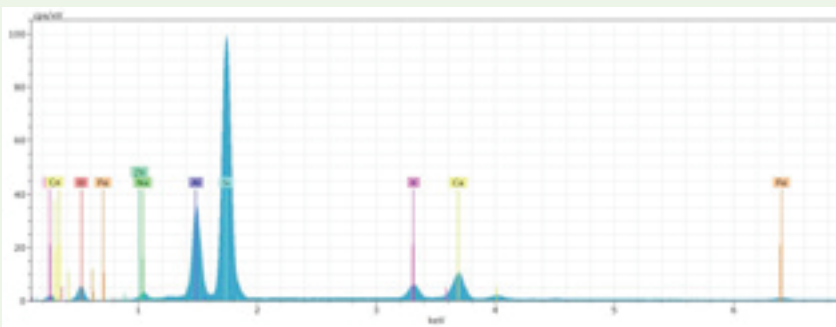


Figure 3 Elemental chemical analysis of the sample of the natural zeolite clinoptilolite, performed on electron microscope SEM Philips XL 30 with EDX detector (EDAX), with 10mm<sup>2</sup> of active surface (Centre for forensic investigations, research and expertise Ivan Vučetić, Zagreb, Croatia).

### Discussion and results

Available literature data states that zeolites are natural volcanic minerals, which because of its crystal lat-

tice structure can absorb and bind different substances and are known as ion exchangers. They are minerals with antiseptic and antibacterial activity, which are often used in veterinary medicine. The preparation of the natural zeolite clinoptilolite, used in this study, has beneficial effects on health, immune status and production parameters in broilers (unpublished results, paper under review). Also, elemental chemical analysis of the sample preparation for the presence of heavy metals and pathogens, done on the electron microscope SEM Philips XL 30 with EDX detector (EDAX), with 10mm<sup>2</sup> of active surface, in this study has not shown their presence (Figure 3).

Thus, the meat of broilers fed with the addition of natural zeolite clinoptilolite has not altered chemical composition. The buttock meat and pectoral muscle of broilers fed with the addition of natural zeolite clinoptilolite preparation had not altered chemical composition with respect to the shares of water and ash compared to 35 days old broilers fed with commercial food (Table 1, 2, 3).

## Conclusion

Unchanged chemical composition of broilers meat fed with the addition of natural zeolite clinoptilolite and established beneficial effects on health, immune status and production indicators shows the benefit of conducting further research of adding zeolite clinoptilolite in mixtures for animal consumption.

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Table 1 **Chemical composition of meat of broiler fed with the addition of 0,5% of supplement of the nature zeolite clinoptilolite during the 35 days experiment (n=15 for each group)**

Experimental group	Sliced broiler meat	Water, %	Ash, %
C	Buttock	71.25	1.05
	White meat	69.31	1.11
A	Buttock	71.63	1.01
	White meat	71.48	1.15

Table 2 **Differences in content of fat and proteins (%) in meat of broilers (n=15 per each group).**

Treatments	C		A	
	Fats	Proteins	Fats	Proteins
Mean	7.11	17.59	7.05	17.45
Stand. Error	0.061	0.060	0.055	0.061
Comparisons	C vs. A	C vs. A	-	-
Diff.	0.06 ns	0.14 ns	-	-
Stand. Dev. Diff.	0.466	0.422	-	-
t	0.694	1.774	-	-
p	0.493	0.086	-	-

ns = not significant; p>0.05

C=Control, A=treatment with 0,5% natural zeolite clinoptilolite

Table 3 **Differences in content of fats and proteins in white meat of broilers (n=15 per each group) A-fed with natural zeolite clinoptilolite during the 35 days of feeding, C-control.**

Treatments	C		A	
	Fats	Proteins	Fats	Proteins
Mean	5.66	19.82	5.84	19.78
Stand. Error	0.074	0.082	0.077	0.089
Comparisons	-	C vs. A	A vs. C	-
Diff.	-	0.04 ns	0.18 ns	-
Stand. Dev. Diff.	-	0.663	0.619	-
t	-	0.272	1.515	-
p	-	0.787	0.140	-

ns = not significant; p>0.05

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## Chemische Bewertung der Qualität des Hühnerfleisches, stammend von Masthühnern, gefüttert mit Zugabe von zeolit klinoptilolit

### Zusammenfassung

In dieser Arbeit wurde die Wirkung der Zugabe von nativem zeolit klinoptilolit auf die Fleischqualität des Hühnerfleisches, stammend von Masthühnern, erforscht. Zeolite sind natürliche Minerale vulkanischer Herkunft, die wegen ihrer Kristallgitterstruktur die Eigenschaft des Einsaugens und der Bindung verschiedener Stoffe haben. Das sind Minerale antiseptischer und antibakterieller Wirkung, die deshalb häufig im Rahmen der veterinärischen Medizin verwendet werden. Nach dem EU Regulativ ist der empfohlene Zusatz für Tiernahrung das Nutrazeutikum zeolit klinoptilolit. In der Untersuchung wurden Keulen und weißes Rückenfleisch von 15 Masthühnern aus jeder Experimentgruppe benutzt, um den Einfluss der Zugabe von nativem zeolit klinoptilolit der standarden Viehfuttermischung für Masthühner auf chemische Fleischqualität mittels standarden chemischen Methoden zu prüfen. Die Resultate dieser Untersuchung zeigen positiven Einfluss des natürlichen zeolit klinoptilolit in Bezug auf die Fleischqualität der Masthühner.

**Schlüsselwörter:** Masthühner, zeolit klinoptilolit, Fleischqualität

## Valutazione chimica della qualità della carne dei polli da allevamento il cui mangime è stato integrato con zeolite clinoptilolite

### Sommario

Questo lavoro si occupa di studiare gli effetti della zeolite clinoptilolite naturale sulla qualità della carne dei polli da allevamento. Le zeoliti sono minerali naturali di origine vulcanica i quali, grazie alla loro struttura cristallina a rete, hanno la proprietà di assorbire e connettere sostanze differenti. Grazie alle loro proprietà antisettiche e antibatteriche, oggi sono spesso usate nella medicina veterinaria. La normativa UE raccomanda l'integrazione del mangime per animali con zeolite clinoptilolite neutracetica. Nello studio sono stati utilizzati cosce e petti di pollo di 15 polli da allevamento di ogni gruppo di sperimentazione, con l'obiettivo di verificare l'influenza della zeolite clinoptilolite naturale aggiunta al mangime per polli da allevamento sulla qualità chimica della carne mediante i metodi chimici standard. I risultati di questo studio mostrano l'effetto positivo della zeolite clinoptilolite naturale sulla qualità della carne dei polli da allevamento.

**Parole chiave:** polli da allevamento, zeolite clinoptilolite, qualità della carne

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