

**INTESTINAL VISCOSITY AT BROILER CHICKENS FED WITH COMBINED FORAGES WITH DIFFERENT PROPORTIONS OF BARLEY**

**VÂSCOZITATEA DIGESTEI INTESTINALE LA BROILERI HRĂNIȚI CU FURAJE COMBINATE CU DIFERITE PROPORȚII DE ORZ**

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*Non-starch polysaccharides (NSP) are composed from chemical compounds with different physical and chemical proprieties (cellulose, arabinoxylans, beta glucans and pectic polysaccharides with manans and gallactans). The antinutritional effects on monogastrics are different and in many cases extreme. Some cereals like barley, oat, wheat, contain significant quantities of NSP. The main negative effects of NSP are related to their viscous nature, to their physiological and morphological influence on the digestive tract and their interaction with the intestinal microflora. The purpose of this experiment is to establish the correlation coefficients between the values of intestinal viscosity and the levels of NSP<sub>t</sub>, NSP<sub>i</sub> and NSP<sub>s</sub> obtained by the inclusion of different percentage of barley in the structure of combined forages. The experiment was carried out on a period of 6 weeks on 120 broiler chickens divided in four experimental groups (CL, EL1, EL2 and EL3). The broiler chickens were fed with combined forages with the same nutritive characteristics but with different percentage of barley (0-40%). It has been showed that at the age of 3 and 6 weeks the intestinal viscosity rise with up to 64.67% along with the proportion of barley from the combined forages. Between the content of forages in NSP and intestinal viscosity exist a positive correlation, the highest correlation coefficient was registered in the case of NSP<sub>s</sub>, 0.92 at 3 weeks and respectively 0.99 at 6 weeks.*

**Key words:** non-starch polysaccharides, intestinal viscosity, barley, broiler chickens

### **Introduction**

The generic name of non-starch polysaccharides (NSP) include, after Bailey (1973), cellulose, hemicelluloses, pentosans (arabinoxylans) beta glucans and pectic polysaccharides of which proportion and effect vary much function of proportion and type of forages fed to poultry and pigs.

Some cereals like barley, oat, wheat contain a large quantity of soluble non-starch polysaccharides (NSPs). The antinutritive effect of NSP draw attention of nutritionist who find out that in a combined forage based on this components the proportion of NSP can reach 12-16% of DM and can determine a rise of intestinal viscosity. It was shown that because of this viscosity the combined forages with raised content of NSP have a low digestibility which affects significant the economical and productive indices of poultry and pigs farms. The rise of intestinal viscosity slow down the diffusion rate of nutritive substances and digestive enzymes and hinder the interaction between these, leading to significant changes in the structure and function of digestive organs and nutrient digestibility (Edwards and all. 1988). Beside the direct effects of NSP on digestion and nutrient absorption, there are a number of side effects caused by microflora from small intestine. The fermentation in excess from chicken's small intestine can reduce the digestion and nutrient absorption.

### **Materials and Methods**

The purpose of this experiment is to establish the correlation coefficients between the values of intestinal viscosity and the content of NSPt, NSPs and NSPi caused by the inclusion of barley in different percentage in the structure of combined forages (0-40%).

The experiment was carried out on a period of 6 weeks on 120 broiler chickens divided in four experimental groups (CL, EL1, EL2 and EL3). The chickens were fed with combined forages with the same nutritional characteristics, but with different percentage of barley included in their structure. The content of NSP from forages was establish on tabelar values (Englyst H.,1989) and on spectrofotometric determinations. The determination of intestinal viscosity was made at 3 weeks by slaughtering the chickens and sampling the content from duodenum level, respectively at 6 weeks by sampling the content from duodenum and jejunum levels. The viscosity was determined with the Brookfield viscosimeter.

### **Results and Discussions**

Based on tabelar values and by chemical determination was establish the main content of combined forages in non-starch polysaccharides, values shown in table below.

Table 1

## The forages content of non-starch polisaccharides(NSP)(%)

Age	Specification	NSPs* (%)	Percentage	NSPi** (%)	Percentage	NSPt*** (%)	Percentage
Eclosion- 21 days	Combined forage with 0% barley	0.74	-	7.91	-	8.65	-
	Combined forage with 10% barley	1.042	0.302	8.06	0.15	9.102	0.45
	Combined forage with 20% barley	1.4	0.66	8.34	0.43	9.74	1.09
	Combined forage with 30% barley	1.76	1.02	8.67	0.76	10.43	1.78
22 days – 42 days	Combined forage with 0% barley	0.67	-	7.94	-	8.71	-
	Combined forage with 20% barley	1.4	0.73	8.56	0.62	9.96	1.25
	Combined forage with 30% barley	1.76	1.09	8.86	0.92	10.62	1.91
	Combined forage with 40% barley	2.13	1.46	9.15	1.21	11.28	2.57

\* soluble non-starch polysaccharides

\*\* insoluble non-starch polysaccharides

\*\*\* total non-starch polysaccharides

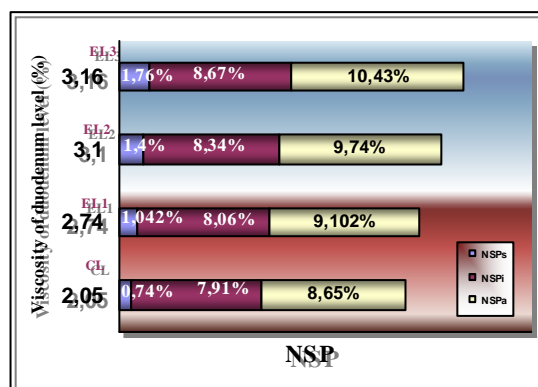
From table data it may be observed that the biggest rise in the NSP content of combined forages in the period from eclosion till 21 days is registered in the case of soluble NSP and is with 1.02% bigger at EL3 where the inclusion percentage of barley is 30%, comparative with the control group. In the second period of growth from 22 days to slaughtering, the NSPs content at EL3 was with 1.46% bigger comparative with the control group.

At 3 weeks the chickens were slaughtered to establish the viscosity at duodenum level, as is shown in table 2 and figure 1.

Table 2

## The evolution of intestinal viscosity at duodenum level at the age of 3 weeks at broiler chickens

Crt. nb.	The experimental group	The barley inclusion level (%)	Viscosity cP Duodenum	Percentage evolution
1	CL	0	2.05	100
2	EL1	10	2.74	133.65
3	EL2	20	3.10	151.21
4	EL3	30	3.16	154.14



**Figure nr. 1.** The viscosity at duodenum level at 3 weeks at broiler chickens

From table data it may be seen that the viscosity rise once with the rising of barley inclusion percentage from the combined forage, being with 33.65% greater at the experimental group with 10% barley and with 54.14% greater at experimental group with 30% barley.

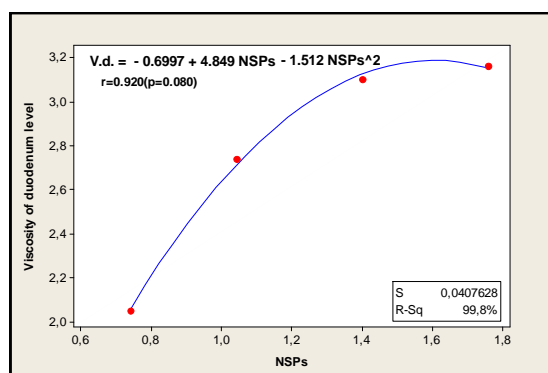
To establish the connection between the two variables respectively the content of NSP from combined forages and the viscosity at intestinal level were establish the coefficients of simple correlation showed in table 3. It may be seen that all correlation coefficients are positive and the greatest is registered in the case of NSPs, which indicate that the intestinal viscosity is influenced in larger measure by NSPs.

Table 3

The coefficients of simple correlation at 3 weeks

Specification	Viscosity
NSPs	0.920 (p=0.080)
NSPi	0.867 (p=0.133)
NSPt	0.899 (p=0.101)

In figure 2 are presented the polynomial regressions and graphic representation of NSP categories.



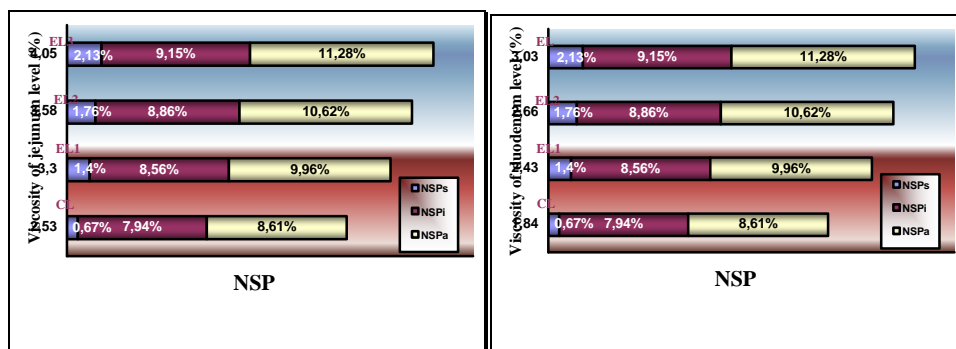
**Figure 2:** Polynomial regression of two degree function of total NSPs (at 3 weeks)

After slaughtering the chickens at 6 weeks, was establish the intestinal viscosity at duodenum and jejunum levels and the values are presented in table 4 and figure 3.

**Table 4**

The evolution of intestinal viscosity at duodenum and jejunum level at 6 weeks broiler chickens

Crt. nb.	Experimental group	Barley inclusion percentage	Viscosity cP		Viscosity cP	Percentage evolution
			Duodenum			
			1	2	Media	
1	CL	0	1.82	1.87	1.84	100
2	EL1	20	2.41	2.45	2.43	132.06
3	EL2	30	2.69	2.64	2.66	144.56
4	EL3	40	3.04	3.02	3.03	164.67
			Jejunum			
1	CL	0	2.69	2.38	2.53	100
2	EL1	20	3.20	3.40	3.30	130.43
3	EL2	30	3.66	3.50	3.58	141.5
4	EL3	40	4.14	3.96	4.05	160.07



**Figure nr. 3.** Viscosity at duodenum and jejunum level at 6 weeks broiler chickens

From table data above it may be seen that the viscosity at duodenum level rise with the rising of barley proportion from the combined forage and is with 64.67% greater at experimental group with 40% barley. At jejunum level the viscosity was greater with 60.07% at experimental group with 40% barley comparative with control group fed with combined forage without barley.

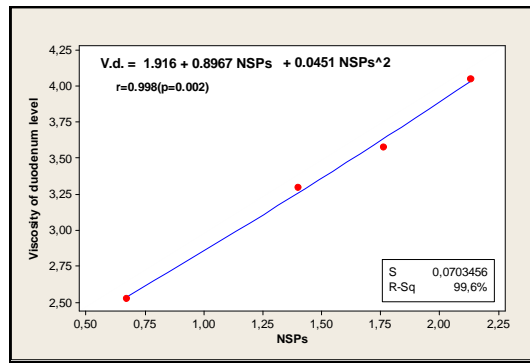
At 6 weeks were establish the correlation coefficients between the NSP content of combined forages fed to broiler chickens and the viscosity at duodenum and jejunum levels (table 5).

Table 5

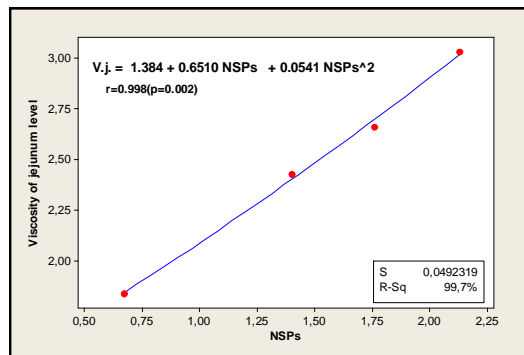
The coefficients of simple correlation at 6 weeks

Specification	Viscosity	
	jejunum	duodenum
NSPs	0.998 (p=0.002)	0.998 (p=0.002)
NSPi	0.997 (p=0.003)	0.997 (p=0.003)
NSPt	0.997 (p=0.003)	0.998 (p=0.002)

In figures 4 and 5 are presented the polynomial regressions and the graphical representation for NSPt, NSPs and NSPi correlated with the viscosity at duodenum and jejunum levels.



**Figure 4:** Polynomial regression of two degree of viscosity at duodenum level function of total NSPs (at 6 weeks)



**Figure 5:** Polynomial regression of two degree of viscosity at jejunum level function of total NSPs (at 6 weeks)

### Conclusions

- the viscosity at duodenum level rise with 54.14% at 3 weeks and 64.67% at 6 weeks at experimental group with 40% barley incorporated in the structure of combined forage and at jejunum level the viscosity rise with 60.07%;
- at 3 weeks the correlation coefficients between NSP content and viscosity at duodenum level are positive, the greatest correlation coefficient was registered in the case of NSPs (0.92) showing that the intestinal viscosity is influenced by the forage content in NSPs;
- at 6 weeks the correlation coefficients between NSP content and viscosity at duodenum and jejunum levels are positive, the greatest correlation coefficient was registered in the case of NSPs (0.998) showing that the intestinal viscosity is influenced by the forage content in NSPs;

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