

**EVALUATION OF THE PORK QUALITY AND SAFETY INDICATORS IN
VARIOUS STAGES OF THE ECHINOCOCCUS
LARVAL CYSTS AFFECTION**

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Abstract. *Food quality and safety are important criteria for state security. One of the dangerous factors is the contamination of the products of slaughter of pigs by the echinococcus larvae. Meat and other products of slaughter, obtained from animals affected by echinococcus larvae, are potential sources of food poisoning in humans.*

The material for the study was the samples of the longest back muscle from 10 pig carcasses, depending on the intensity of the damage to the liver of the echinococcus larvae.

It was found that significantly ($p \leq 0.05$) more than 10,9 % were moisture, 118 % – the number of microorganisms and 22,5 %, 21,4 %, 2,33 % – the pH value in pork at high intensity of invasion. However, the dry matter content was significantly ($p \leq 0,05$) lower by 28,0 % in pork with a high intensity of invasion.

Relevance. Quality and safety of food products are important safety criteria for any state. Experts believe that the health of a person depends on the health system only by 8–12 %, 20–25 % – on the environment, and 18–20 % on genetic factors, but the main part – 52–55 % – on the socio-economic conditions

2,33 % – the pH value in pork at high intensity of invasion. However, the dry matter content was significantly ($p \leq 0,05$) lower by 28,0 % in pork with a high intensity of invasion.

According to other indicators of chemical composition, a tendency to an increase in the content of protein, fat and oxyproline, and a decrease in the content of tryptophan, and a protein-quality indicator in pork during intensive invasion were established.

Samples of pork taken from the carcasses of pigs with different intensity of echinococcosis invasion were contaminated by staphylococcus, Salmonella and Escherichia.

Key words: *pork, echinococcosis, quality, safety, methods of determination and lifestyle, where the nutrition is one of the decisive components of this aspect [1].*

Today, animal husbandry development is one of the promising and strategically important branches of Ukraine. Livestock products are the most demanded by the domestic

consumer. However, this market does not receive any state support and, as a result, stability. Insufficient quality of the functioning of the technical and technological systems in pig farming leads to overage of feed during the production of pork, which necessitates modeling of the feed conversion into livestock products; and by improving the quality of functioning of the technical and technological systems in pig farming one can improve the quality of pork [2].

Thus, it is necessary to ensure the quality of the food products, which, due to the stability of the composition and consumer properties during the shelf life, can meet human's needs in energy, nutrients and aromatics. Quality assurance, including the safety of food products for human life and health, is, above all, a lack of risk for genetic, pathological and other changes in the body [3].

In the Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products", Article 36 specifies basic rules for the circulation of food products; in particular, it states that whole carcasses or parts of carcasses of artiodactyls or other ungulates, can be sold on agro-food markets after the confirmation of their suitability by the results of tests (studies) of an accredited laboratory located at this agro-food market, made by a public inspector working on the same market [4].

One of the most dangerous factors

is the affection of the pork slaughter products with echinococcus larval cysts. Meat and other slaughter products, obtained from echinococci affected animals, are a potential source of food poisoning of people. Slaughter products obtained from affected animals should be sent to bacteriological studies to exclude contamination by their pathogenic microflora, and their sanitary assessment should be made depending on the results obtained [5].

The aim of the study is to study the quality and safety of the pork samples depending on the degree of the affection of liver with larval cysts of echinococci.

Materials and research methods.

Materials for the research were samples of the longest muscle in the back of 10 carcasses of pigs subjected to examinations in the accredited laboratory of the agro-food market. Tests were carried out in accordance with the "Rules of pre-slaughter veterinary inspection of animals and veterinary and sanitary examination of meat and meat products" [6].

To determine the degree of the meat freshness they conducted organoleptic studies according to GOST 7269-2015 [7]. During the organoleptic study of meat, a special attention was paid to the appearance, smell, color, consistency of muscle tissue on the surface and in the cutting area, the state of the fat and tendons, the transparency of the broth; and

conducted tasting evaluation of this pork.

When determining the intensity of the liver infestation with echinococci, a qualitative method for determining of the level of infestation intensity, developed by I. S. Goncharuk [8], was used. The liver, obtained from infested animals, was subjected to helminthic post-mortem examination. The affected parts of the liver were rejected and weighed. The difference between the weight of the liver and the rejected parts determined the intensity of the affection, which was conventionally shown in quarters to the liver, namely:

1 – affected less than 1/4 of the liver with echinococci means low intensity of the affection (experimental 1);

2 – affected $\frac{1}{4} - \frac{1}{2}$ of the liver – a medium intensity of the affection (experimental 2);

3 – affected less than 3/4 of the liver, or the whole liver – a high intensity of the affection (experimental 3);

Meat obtained from healthy animals was a control group.

The following physical and chemical parameters were determined: pH of meat, reaction with copper sulfate in broth, reaction to peroxidase, ammonium salt, amount of the amino-ammonia nitrogen [9,10].

The moisture content in the meat from pig carcasses was evaluated by drying in a drying cabinet at a temperature of $150 \pm 2^{\circ}\text{C}$, according to

DSTU ISO 1442:2005; ash – by an accelerated method of mineralization in a muffle furnace; protein – by Keldal mineralization method according to GOST 25011-2017, fat – in Soxhlet apparatus according to DSTU ISO 1443:2005; tryptophan – by hydrolysis, oxyproline – according to GOST 23041-78. The protein-quality index was determined basing on the ratio of tryptophan to oxyproline [11, 12, 13, 14, 15].

Bacteriological studies were carried out in accordance with GOST 21237-75 and DSTU EN 12824:2004 [16, 17].

Research results and discussion.

Results of the organoleptic evaluation of pig carcasses show that carcasses obtained from healthy and infested animals differ in their quality indicators. The meat obtained from healthy pigs had better organoleptic characteristics: muscle tissue had a light pink color; elastic consistency; a well-defined, pleasant, characteristic pork scent; the cutting surface is dense, shiny, moderately moist, elastic; the fat is shiny, solid, white; broth has pleasant flavoring properties; fatty balls were of the same size and were evenly distributed over the broth surface.

Organoleptic study of a pork meat at various degrees of echinococcosis showed: for a low degree of infestation - meat of a light pink color, a good draining of blood, the consistency is dense, the smell of meat is pleasant, tendons are elastic, white, shiny, the

broth is transparent with pleasant scent; for a medium degree of infestation – meat of a light pink color, fat with a yellowish tinge, a consistency is dense, a specific pleasant smell, a good draining of blood, the broth is slightly misty with a pleasant aroma; for a high degree of infestation – red meat, dense

consistency, fatty tissue of a yellow color, a degree of draining of blood is satisfactory, the broth contains flakes, the fragrance is weakly pronounced.

The aroma of the meat (Table 1) from pigs of experimental groups was pleasant, quite pronounced, the score ranged from 5,6 to 8,1 points.

1. Tasting evaluation of meat and broth of the experimental groups of pigs, $M \pm m$, $n=3$

Indicator	Animals groups			
	control	experimental 1	experimental 2	experimental 3
Appearance	8,3±0,45	7,3±0,28	7,9±0,18	5,2±0,12*
Aroma	8,2±0,26	7,5±0,54	8,2±0,56	4,5±0,14*
Taste	8,3±0,36	7,3±0,25	7,5±0,38	6,5±0,23*
Succulence	8,6±0,15	7,6±0,23	8,4±0,21	8,1±0,24
Tenderness	8,3±0,20	7,9±0,27	8,6±0,23	8,5±0,16
Total score	8,2±0,15	7,8±0,30	7,7±0,24	6,9±0,28*

Note * $p \leq 0,05$ – compared to the control, 1 and 2 experimental groups

According to the indicators left, it was found that the meat of the control group had better organoleptic parameters than experimental ones, namely, there was a probable difference ($p \leq 0,05$) between the indicators of appearance, aroma, taste and the overall

assessment between the third experimental group and other experimental and control groups.

Physical and chemical evaluation indicators are shown in Table 2.

2. Physical and chemical indicators of pork, $M \pm m$, $n=3$

Indicator	Animals groups			
	control	experimental 1	experimental 2	experimental 3
Number of microorganisms observed	not found	not found	5,0±0,16	10,9±1,1*
Reaction with CuSO_4	-	-	-	утворення пластівців
pH	5,37±0,03	5,42±0,04	6,43±0,02	6,58±0,05 ^o
Reaction to peroxidase	blue-green color	blue-green color	blue-green color appears in 1 minute	blue-green color appears in 2-3 minutes
Amino-ammonia nitrogen content, mg	1,22±0,04	1,20±0,05	1,20±0,03	1,25±0,05
Reaction to NH_3	-	-	-	-

Note * $p \leq 0,05$ – compared to the control and 2 experimental group

^o $p \leq 0,05$ – compared to the 1 experimental group.

It follows from the table that a probable ($p \leq 0,05$) increase in the number of microorganisms by 118% in the microscope field of view in the third experimental group was detected, compared with the second one. In this case, rod-shaped microorganisms prevailed, indicating the lifetime penetration of microorganisms to muscle tissue. The pork pH of the third experimental group was also significantly higher ($p \leq 0,05$) higher by 22,5%, 21,4%, 2,33% compared to the

control group, the first experimental group and the second experimental group, respectively.

The remaining physical and chemical indicators ensure compliance with current requirements.

Based on the results presented in Tables 1 and 2, we concluded that the chemical composition of pork should be determined by comparing the control and the third experimental group (Table 3).

3. Chemical composition of the pork, %, $M \pm m$, $n=3$

Indicator	Control group	Experimental 3
Moisture	71,8 \pm 2,50	79,6 \pm 2,15*
Dry matter	28,2 \pm 1,23	20,3 \pm 1,87*
Ash	1,20 \pm 0,45	1,25 \pm 0,28
Protein	17,4 \pm 2,35	23,8 \pm 2,27
Fat	2,85 \pm 0,24	3,12 \pm 0,22
Tryptophan, mg %	356,2 \pm 11,8	323,5 \pm 13,2
Oxiprolin, mg %	68,0 \pm 4,0	74,5 \pm 2,67
Protein qualitative index	5,24	4,34

Note * $p \leq 0,05$

According to Table 3, it is evident that the moisture indicator of pork in the third experimental group was significantly ($p \leq 0,05$) higher by 10,9%, compared with control. At the same time, the dry matter content index was ($p \leq 0,05$) lower by 28.0% in pork in the third experimental group compared to the control. Other chemical indicators

showed a tendency to increase of the protein, fat and oxypoline content; and reduce of the content of tryptophan and protein qualitative index in pork in the third experimental group, as compared to the control.

Indicators of bacterial insemination of pork of different degrees of infestation are shown in Table 4.

4. Bacterial insemination of pork of different degree of echinococci infestation, $M \pm m$, $n=3$

Isolated microorganisms	Infestation intensity			Control group
	Low	Medium	High	
<i>S. aureus</i>	–	+	+	–
<i>S. enteritidis</i>	–	–	–	–
<i>S. cholerae suis</i>	–	–	+	–
<i>E. coli</i>	+	+	+	–

Note: "+" – positive, "–" – negative

The research was conducted to find pathogenic microflora in meat samples, namely *Escherichia*, *Staphylococcus*, *Salmonella* and *Proteus*.

The study found that pig slaughter products contained various microorganisms. As can be seen from Table 4, pork is contaminated with *Staphylococcus*, *Salmonella* and *Escherichia* for the medium and high degree of liver affection with *Echinococcus* larval cysts.

Conclusions

1. Samples of meat, obtained from carcasses of healthy pigs, had better organoleptic parameters than experimental ones.

2. It was found that the moisture

value of pork in the third experimental group ($p \leq 0,05$) was higher by 10,9% compared to the control. At the same time, dry matter content index was significantly ($p \leq 0,05$) lower – by 28,0% – in pork of the third experimental group, compared to the control. Other chemical indicators showed a tendency to increase in the protein, fat and oxyproline content; and reduce of the content of tryptophan and protein qualitative index in pork of the third experimental group, as compared to the control.

3. Samples of pork obtained from experimental carcasses of pigs have been contaminated with *Staphylococcus*, *Salmonella* and *Escherichia*.

References

1. Butenko, L. M., Slobodianiuk, N. M., Androshchuk, O. S. (2013). M'iasni ta molochni vyroby dlia zdorovoho kharchuvannia. [Meat and dairy products for healthy eating.]. *Myasnoe delo*, 8–9, 23–26.

2. Shatskyi, V. V., Kolomiiets, S. M. (2008). Osoblyvosti rozvytku svynarstva ta vivcharstva v Ukraini. [Peculiarities of development of pig and sheep breeding in Ukraine]. *Pratsi Tavriiskoho derzhavnoho*

ahrotekhnolohichnoho universytetu: naukove fakhove vydannia, 8, 8, 123–128.

3. Lisovenko, V. T. (2005). Budemo z m'iasom? [Will we be with meat?]. *Zdorov'ia tvaryn i lyky*, 6, 8.

4. Zakon Ukrainy «Pro osnovni pryntsypy ta vymohy do bezpechnosti ta yakosti kharchovykh produktiv». (2018). [The Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products"]. URL:

<http://zakon.rada.gov.ua/laws/show/771/97-%D0%B2%D1%80>.

5. Artemenko, L. P., Bukalova, N. V., Nebeshchuk, O. D. (2013). Bezpechnist ta yakist m'iasnoi syrovyny, profilaktyka i zakhody borotby za ekhinokokoznoi invazii [Elektronnyi resurs]. [Safety and quality of meat raw material, prevention and control measures for echinococcosis invasion]. Naukovi pratsi Pivdennoho filialu Natsionalnoho universytetu bioresursiv i pryrodokorystuvannia Ukrainy "Krymskyi ahrotekhnolohichniy universytet". Ser. : Veterynarni nauky, 155. URL: http://nbuv.gov.ua/UJRN/Npkau_2013_155_9.

6. Pravyla peredzabiinoho ohliadu tvaryn i veterynarno-sanitarnoi ekspertyzy m'iasa ta m'iasnykh produktiv (zatverdzeni nakazom Derzhavnoho departamentu veterynarnoi medytsyny Ukrainy vid 07.06.2002, № 28 ta zareiestrovani u Ministerstvi yustytzii Ukrainy 28.01.2004 r. za № 524/6812). (2002). [Rules of pre-slaughter inspection of animals and veterinary and sanitary examination of meat and meat products]. URL: <http://zakon.rada.gov.ua/laws/show/z0524-02>.

7. Myaso. Metody otbora obraztsov i organolepticheskiye metody opredeleniya svezhesti. (2016). [Meat. Methods of sampling and organoleptic methods for determining freshness]. GOST 7269-2015. Russia.

8. Halat, V. F., Artemenko, Yu. H., Prus, M. P. (1999). Praktykum z parazytologii [Workshop on Parasitology.]. K: Urozhai, 115–175.

9. Miaso ta m'iasni produkty.

Vyznachennia pH (kontrolnyi metod). (2002). [Meat and meat products. Determination of pH (control method)]. DSTU ISO 2917-2001. Ukraine.

10. Metody khimicheskogo i mikroskopicheskogo analiza svezhesti (2017). [Methods of chemical and microscopic analysis of freshness]. GOST 23392-2016. Russia.

11. M'iasni produkty. Metod vyznachennia volohy. (2006). [Meat products. Method for determination of moisture]. DSTU ISO 1442:2005. Ukraine.

12. Antipova, L. V. (2006). Otsenka kachestva i bezopasnosti myasnykh produktov [Assessment of quality and safety of meat products]. Vse o myase, 1, 8.

13. Myaso i myasnyye produkty. Metod opredeleniya belka. (2017). [Meat and meat products. Method of protein determination]. GOST 25011-2017. Ukraine.

14. M'iaso i m'iasni produkty. Metod vyznachennia zhyru. (2005). [Meat and meat products. Method of determination of fat]. DSTU ISO 1443:2005. Ukraine.

15. Myaso i myasnyye produkty. Metod opredeleniya oksiprolina. (2017). [Meat and meat products. Method for determination of oxyproline]. GOST 23041-2015. Russia.

16. Mysik, A. T., Belova, S. M. (1986). Spravochnik po kachestvu produktov zhivotnovodstva [Handbook on the quality of livestock products]. M.: Agropromizdat, 87–95.

17. M'iaso. Metody bakterialnoho analizu. (2005). [Meat. Methods of bacterial analysis]. DSTU EN 12824:2004. Ukraine.

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ОЦІНКА ПОКАЗНИКІВ ЯКОСТІ І БЕЗПЕЧНОСТІ СВИНИНИ ЗА РІЗНОГО СТУПЕНЯ УРАЖЕННЯ ЛАРВОЦИСТАМИ ЕХІНОКОКІВ.

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Анотація. Якість і безпечність продуктів харчування є важливими критеріями безпеки держави. Одним з небезпечних чинників є ураження продуктів забою свиней ларвоцистами ехінококів. М'ясо та інші продукти забою, отримані від уражених ларвоцистами ехінокока тварин, є потенційним джерелом харчових отруєнь людей. Матеріалом для дослідження слугували зразки найдовшого м'яза спини від 10 туш свиней, залежно від інтенсивності ураження печінки ларвоцистами ехінококу.

Встановили, що вірогідно ($p \leq 0,05$) більшими на 10,9 % були показники вологи, на 118 % – кількості мікроорганізмів і на 22,5 %, 21,4 %, 2,33 % – значення рН в свинині за високої інтенсивності інвазії. Разом з тим, показник вмісту сухої речовини був вірогідно ($p \leq 0,05$) нижчим на 28,0 % в свинині за високої інтенсивності інвазії.

За іншими показниками хімічного складу встановили тенденцію до підвищення вмісту протеїну, жиру та оксипроліну та зменшення вмісту триптофану та білково-якісного показника в свинині за інтенсивної інвазії.

Зразки свинини відібрані від туш свиней з різною інтенсивністю інвазії ехінококозом контаміновані стафілококами, сальмонелами та ешеріхіями.

Ключові слова: свинина, ехінококоз, якість, безпечність,

методи визначення

ОЦЕНКА ПОКАЗАТЕЛЕЙ КАЧЕСТВА И БЕЗОПАСНОСТИ СВИНИНЫ ПРИ РАЗЛИЧНОЙ СТЕПЕНИ ПОРАЖЕНИЯ ЛАРВОЦИСТАМИ ЭХИНОКОККА.

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Аннотация. Качество и безопасность продуктов питания являются важными критериями безопасности государства. Одним из опасных факторов является поражение продуктов убоя свиней ларвоцистами эхинококков. Мясо и другие продукты убоя, полученные от пораженных ларвоцистами эхинококка животных, являются потенциальными источниками пищевых отравлений людей.

Материалом для исследования послужили образцы длиннейшей мышцы спины от 10 туш свиней, в зависимости от интенсивности поражения печени ларвоцистами эхинококка.

Установили, что достоверно ($p \leq 0,05$) больше на 10,9 % были показатели влаги, на 118% – количества микроорганизмов и на 22,5 %, 21,4 %, 2,33 % – значение рН в свинине при высокой интенсивности инвазии. Вместе с тем, показатель содержания сухого вещества был достоверно ($p \leq 0,05$) ниже на 28,0 % в свинине при высокой интенсивности инвазии.

По другим показателям химического состава установили тенденцию к повышению содержания протеина, жира и оксипролина, и уменьшение содержания триптофана, и белково-

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*качественного показателя в свинине
при интенсивной инвазии.*

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эшерихиями.*

Ключевые слова: *свинина,
эхинококкоз, качество, безопасность,
методы определения*