TECHNOLOGICAL QUALITY OF RABBIT MEAT (BELGIAN GIANT BREED) AND HARE MEAT *(LEPUS EUROPAEUS PALLAS)*

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Abstract

The purpose of this study was to determine the technological quality of meat by making a comparison between hares (Lepus Europaeus Pallas) and rabbits (Belgian Giant breed). The meat quality concept is continuously changing and the consumer is interested in the healthiness of meat, sensory properties, cooking easiness and swiftness and its price. Technological quality of meat can be evaluated through determining the pH of the meat and cooking water loss. Measurements were performed on the muscles Longissimus dorsi, Psoas major and Semimembranosus at 24 hours after slaughter. To measure the acidity of rabbits and hares meat was use digital pH meter Hanna, who performs automatic reading of pH and temperature at which this is done. The highest average values for boiling water losses were found for rabbits at Semimembranosus muscles, with a percentage of 36.45% for females and 35.95% for males. For hares, they were generally more low compared to those determined for rabbits. After statistical evaluation (applying the test of analysis of variance ANOVA) on the results achieved for rabbits and the hares, were observed insignificant differences by gender for all muscle groups examined.

Key words: rabbit, hare, meat, technological quality

INTRODUCTION

Rabbit meat is highly digestible, tasty, low in calories and often recommended by nutritionists over other meat types[1,3,5,7]. For this reason, meat processing industries in most part of the world, including Europe (especially in Spain, France and Italy) are gradually expanding and improving the availability of rabbit meat in a large variety of processed ready-meat in order to meet the demands of consumers [2,4,6,1]. Konjević D., 2007 and Martin D. et al., 2012, shows the importance of the controlled hunts referring to the potential of hare meat (*Lepus Europaeus* Pallas) in the diet of people today. The pH value of meat influence the water holding capacity, show the freshness of it to, as well as suitability of meat conservation. Technological properties of meat influence the sensory quality (texture, consistency, tenderness, color, palatability) and the period of it to of storage[6,7,8]. The aim of this paper was to determine the technological quality of meat by making a comparison between hares (*Lepus Europaeus* Pallas) and rabbits (Belgian Giant breed), through determining the pH and cooking water loss of the meat.

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The manuscript was received:22.02.2015
Accepted for publication: 26.03.2015

MATERIAL AND METHOD

In order to determine the **technological** quality of rabbit meat, the biological material used was harvested from 46 Belgian Giant breed rabbits (15 males and 31 females) and from 49 hares (24 males and 25 females). The rabbits had an average body weight of 11.5 kg and the hares have had an average weight of 5.6 kg, both species being at the age of reproductive maturity (adults: 11-12 months).

In order to achieve the determination of losses by cooking of meat of rabbit and hare was realized identifying the samples, weighing of them with an analytical balance and then individual packaging in thermo resisting polyethylene bags, adequately labeled and subjected to heat treatment. The thermal treatment consisted in keeping the muscle samples after pre-weighing it, to a temperature of 80 ^{0}C for one hour in a

temperature controlled water bath. After this period of time, samples cooked, removed from the water bath, are subjected to forced cooling in ice flakes for 30 minutes, after which stood at ambient-temperature (21 ^{0}C) for another period of 30 minutes. After cooling, the samples were weighed again with analytical balance after previously removal, with tissue paper, of meat juice resulting from the heat treatment. Cooking losses were expressed as percentage.

The measurement of acidity of meat is done by calibrating the pH meter (Hanna Hanna Electronics, 212) with two standard solutions of known pH (one with a pH of 4.01 and the second with a pH of 7.01). After the balancing of device, the reading electrode is inserted into the meat broth, previously prepared and the pH reading is performed.

The results obtained were interpreted statistically. In this process, the first step consisted of common statistical estimators calculation-arithmetic mean ($\overline{\mathbf{X}}$), standard deviation (s), variance (S^2) and coefficient of variation (V%), using the software algorithm. To test the statistical significance of differences between the studied characters we used the ANOVA Single Factor algorithm included in Microsoft Excel software package ($p>0.05$; $p<0.01$; $p<0.001$).

RESULTS AND DISCUSSION

After determining the weight loss by cooking which was performed on the muscles *Longissimus dorsi*, *Psoas major* and *Semimembranosus*, sampled from rabbits (Belgian Giant breed) and hares (*Lepus Europaeus* Pallas), were able to observe higher average values for rabbits compared to hares (table 1).

Table 1 Cooking weight loss (%) for rabbits and hares meat

Animals		$\overline{X} \pm s_{\overline{X}}$	S^2	V%	Min	Max
Belgian Giant	L.D. females	31.261±0.806	3.898	6.92	28.900	34.200
	L.D. males	31.548±1.245	9.300	10.59	28.200	37.200
	S.M. females	36.451±0.678	2.760	4.99	34.200	38.500
	S.M. males	35.951±0.997	5.960	7.43	31.500	38.500
	Psoas females	35.396±0.911	4.982	6.90	31.500	38.500
	Psoas males	35.063±1.028	6.335	7.86	31.500	38.500
***Lepus Europaeus* Pallas**	L.D. females	27.929±0.428	1.097	4.10	26.363	29.850
	L.D. males	27.096±0.546	1.791	5.41	24.363	28.332
	S.M. females	30.949±0.463	1.286	4.01	29.560	32.560
	S.M. males	31.115±0.572	1.962	4.93	29.560	33.560
	Psoas females	32.318±0.545	1.781	4.52	29.984	34.260
	Psoas males	32.949±0.508	1.551	4.14	31.098	34.984

L.D. –*Longissimus dorsi* muscle, S.M. –*Semimembranosus* muscle

The coefficient of variation calculated for rabbits and hares for mass losses by preparation exceeded the threshold of 10% just for male rabbits in *Longissimus dorsi* muscle, thus symbolizing a relatively homogeneous population. For other individuals the coefficient of variation expressed a very homogeneous population, not exceeding the 10% threshold (table 1).

The highest average values of cooking losses have been observed for rabbits at *Semimembranosus* muscles, with a percentage of 36.45% for females and one by 35.95% for males.

For hares, average values were generally lower compared with those determined for Belgian Giant breed rabbits. Thus, were found the lowest average percentage of 27.10% at the level of *Longissimus dorsi* muscles, for females and 27.93% for males. They were followed by the value determined for the muscles *Semimembranosus*, 30.95% for females and 31.12% for males. The highest mean values for hares, were observed for the

Psoas major muscle, with 32.32% cooking loos for females and 32.95% for males.

For the muscle groups harvested from rabbits Belgian Giant breed, the lowest average values of cooking losses, have been determined in *Longissimus dorsi* muscles, with a percentage of 31.26% for females and one by 31.55% for males (table 1.).

Following the comparative statistical evaluation of the results observed for the cooking losses, obtained for females and males, for the rabbits and hares were observed insignificant differences by gender for all muscle groups analyzed (table 2).

Table 2 The statistical significance of differences off the cooking losses for rabbits (Belgian Giant breed) and hares *(Lepus Europaeus Pallas)*

The muscle groups		**Females vs Males**
Belgian Giant	*Longissimus dorsi*	$\hat{F}$ =0.068; $F_{5\%}(1;22)$=4.301; $\hat{F} < F_{5\%} \Rightarrow$n.s
	Semimembranosus	$\hat{F}$ =0.315; $F_{5\%}(1;22)$=4.301; $\hat{F} < F_{5\%} \Rightarrow$n.s
	Psoas major	$\hat{F}$ =0.108; $F_{5\%}(1;22)$=4.301; $\hat{F} < F_{5\%} \Rightarrow$n.s
Lepus Europaeus	*Longissimus dorsi*	$\hat{F}$ =2.645; $F_{5\%}(1;22)$=4.301; $\hat{F} < F_{5\%} \Rightarrow$n.s
	Semimembranosus	$\hat{F}$ =0.941; $F_{5\%}(1;22)$=4.301; $\hat{F} < F_{5\%} \Rightarrow$n.s
	Psoas major	$\hat{F}$ =1.315; $F_{5\%}(1;22)$=4.301; $\hat{F} < F_{5\%} \Rightarrow$n.s

Applying the analysis of variance test (ANOVA) on the cooking losses obtained for rabbit and hare females were observed very significant differences in all muscle groups analyzed (table 3).

Table 3 The statistical significance of differences off the boiling weight losses for rabbit (Belgian Giant breed) and hare (*Lepus europaeus Pallas)* females

The muscle groups	**Rabbits vs hares - females**
Longissimus dorsi	$\hat{F}$ =24.439; $F_{5\%}(1;22)$= 4.301; $F_{1\%}$=7.945; $F_{0.1\%}$=14.380; $F_{5\%} < \hat{F} > F_{1\%} > F_{0.1\%} \Rightarrow$***
Semimembranosus	$\hat{F}$ =82.322; $F_{5\%}(1;22)$= 4.301; $F_{1\%}$=7.945; $F_{0.1\%}$=14.380; $F_{5\%} < \hat{F} > F_{1\%} > F_{0.1\%} \Rightarrow$***
Psoas major	$\hat{F}$ =15.414; $F_{5\%}(1;22)$= 4.301; $F_{1\%}$=7.945; $F_{0.1\%}$=14.380; $F_{5\%} < \hat{F} > F_{1\%} > F_{0.1\%} \Rightarrow$***

For rabbit and hare males, by application the analysis of variance test have observed very significant differences in the *Longissimus dorsi* and *Semimembranosus* muscles. For *Psoas major* muscles the differences determined were significant (table 4).

Table 4 The statistical significance of differences off the boiling weight losses for rabbits (Belgian Giant breed) and hare (*Lepus Europaeus Pallas*) - males

The muscle groups	**Rabbits vs hares - males**
Longissimus dorsi	$\hat{F}$ =19.656; $F_{5\%}(1;22)$= 4.301; $F_{1\%}$=7.945; $F_{0.1\%}$=14.380; $F_{5\%} < \hat{F} > F_{1\%} > F_{0.1\%} \Rightarrow$***
Semimembranosus	$\hat{F}$ =32.466; $F_{5\%}(1;22)$= 4.301; $F_{1\%}$=7.945; $F_{0.1\%}$=14.380; $F_{5\%} < \hat{F} > F_{1\%} > F_{0.1\%} \Rightarrow$***
Psoas major	$\hat{F}$ =6.233; $F_{5\%}(1;22)$= 4.301; $F_{1\%}$=7.945; $F_{5\%} < \hat{F} < F_{1\%} \Rightarrow$*

For pH_{24} the coefficient of variation calculated for *Psoas* muscles for hares (*Lepus Europaeus Pallas*), females and males, the recorded values did not exceed a percentage of 3.5%, thus representing a very homogeneous population (table 5).

Table 5 The pH_{24} values for rabbits (Belgian Giant breed) and hares *(Lepus Europaeus Pallas)* meat

Species/ gender		$\bar{X} \pm s_{\bar{X}}$	S^2	V%	Min	Max
Belgian Giant	L.D. females	5.732±0.072	0.031	3.08	5.560	5.989
	L.D. males	5.715±0.053	0.023	2.64	5.600	5.989
	S.M. females	5.805±0.063	0.024	2.66	5.590	5.989
	S.M. males	5.786±0.041	0.013	1.98	5.680	5.989
	Psoas females	5.887±0.066	0.026	2.75	5.680	6.110
	Psoas males	5.830±0.064	0.025	2.69	5.570	5.989
***Lepus Europaeus* Pallas**	L.D. females	5.623±0.029	0.003	1.04	5.560	5.690
	L.D. males	5.637±0.019	0.002	0.87	5.600	5.700
	S.M. females	5.683±0.311	0.386	1.38	5.590	5.910
	S.M. males	5.732±0.024	0.004	1.04	5.680	5.810
	Psoas females	5.855±0.099	0.039	3.37	5.68	6.11
	Psoas males	5.843±0.050	0.015	2.12	5.67	5.98

After the statistical evaluation of pH_{24}, for hares (*Lepus Europaeus Pallas*) and rabbits (Belgian Giant breed), were found insignificant differences between sexes for both species (table 6).

Table 6 The statistical significance of differences off the pH_{24} values for rabbits (Belgian Giant breed) and hares *(Lepus Europaeus Pallas)* meat

The muscle groups		Females vs Males
Belgian Giant	*Longissimus dorsi*	$\hat{F}$ = 1.305; F5%(1:54)=4.019; $\hat{F}$ < F5%⇒n.s.
	Semimembranosus	$\hat{F}$ =0.080; F5%(1:54)=4.019; $\hat{F}$ < F5%⇒n.s.
	Psoas major	$\hat{F}$ =0.028; F5%(1:54)=4.019; $\hat{F}$ < F5%⇒n.s.
Lepus Europaeus	*Longissimus dorsi*	$\hat{F}$ =0.757; F5%(1:54)=4.019; $\hat{F}$ < F5%⇒n.s.
	Semimembranosus	$\hat{F}$ =0.348; F5%(1:54)=4.019; $\hat{F}$ < F5%⇒n.s.
	Psoas major	$\hat{F}$ =0.646; F5%(1:54)=4.019; $\hat{F}$ < F5%⇒n.s.

The coefficient of variation calculated for pH_{24} specific to *Longissimus dorsi, Psoas major* and *Semimembranosus* muscles harvested from the rabbits and hares showed a very homogeneous population, this value not exceeding 5%, for both the females as well as for the males (table 6).

The average values for the pH_{24} of meat were similar for rabbits and hares, these fits with the limits found in the scientific literature for the period of 24 hours after slaughter (Blasco A. and Piles M., 1990; Arino B. et al., 2006 A., Dalle Zotte A, 2008; Hernandez P., Gondret F., 2006; Pla M., 2008, Liste G. et al., 2009, Mertin et al., 2012).

CONCLUSIONS

This study has the purpose to characterize the technological quality of rabbit (Belgian Giant breed) and hare meat, in the hope of improving the knowledge of consumers of any age to choose a healthy alternative and to have a diverse diet everyday.

Evolution of pH after slaughter may indicate the suitability for preservation, processing and preparation and can induce proper destination of meat.

The highest average values cooking loss were found for rabbits at *Semimembranosus* muscles, with a percentage of 36.45% for females and 35.95% for males.

For hares, they were generally low compared to those determined for rabbits. This is probably due to the much larger size of the muscle fibers, (specific dimensions for

the Belgian giant breed rabbits) compared with those of hares (*Lepus Europaeus Pallas*), that have much smaller size.

After the statistical evaluation of pH_{24}, for hares (*Lepus Europaeus Pallas*) and rabbits (Belgian Giant breed), were found insignificant differences between sexes for both species.

Therefore, given the evaluations presented in the current study, we strongly recommend the consumption of rabbit and hare meat.

REFERENCES

[1] Apata E.S., Eniolorunda O.O., Amao K.E., Okubanjo A. O., 2012: Quality evaluation of rabbit meat as affected by different stunning methods, International Journal of Agricultural Sciences, vol. 2(1), p. 054-058.

[2] Ariño Beatrice, Hernández Pilar, Pla M, Blasco A., 2007, Comparison between rabbit lines for sensory meat quality, Meat Science; Vol. 75(3), p. 494-498.

[3] Blasco A., Piles M., 1990 - Muscular pH of the rabbit, Ann Zootech, Elsevier/ INRA, Vol. 39: p. 133-136.

[4] Hernandez Pilar and Gondret Florence, 2006: Rabbit meat quality and safety; Recent Advances in Rabbit Science, pg 267-290, Belgium, ILVO.

[5] Konjević D., 2007: Hare brown (Lepus Europaeus Pallas) and potential in diet of people today, Professional Work, vol. 9, pg. 288-291.

[6] Liste G., Villaroel M., Chacon G., Sanudo C., Olleta J.L., Garcia-Belenguer S., 2009: Effect of lairage duration on rabbit welfare and meat quality, Meat Science, Vol 82, p. 71-7.

[7] Mertin D., Slamečka J., Ondruška L., Zaujec K., Jurčík R, Gašparík J., 2012: Comparison of meat quality between european brown hare and domestic rabbit, Slovak J. Anim. Sci., Vol. 45(3), p. 89-95

[8] Pla M., 2008*:* A comparison of the carcass traits and meat quality of conventionally and organically produced rabbits, Livestock Science, Vol. 115, p. 1-12.