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Roman Snail's (*Helix* Pomatia) Meat Quality in Latvia

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Abstract. The meat of Roman Snails (*Helix pomatia*) as a foodstuff enjoying popularity in many European countries, in Latvia has so far retained a status of a rare delicacy however the interest of local consumers in it is gradually growing. In 2011, the Research Institute of Biotechnology and Veterinary Medicine „Sigra", of Latvia University of Agriculture LLU, performed studies in its own trial facility for snails with an aim of establishing the biochemical indicators for the meat of wild Roman Snails found in Latvia versus meat of Roman snails cultivated and fed with different diets. The following indicators were measured both, for pedal mass and visceral mass of Roman Snails: dry matter, crude protein, crude fat, pH and minerals (crude ash, calcium and phosphorous). The dry matter content in pedal mass versus visceral mass of Roman Snails was essentially different ($p<0.05$). The crude protein amount established was equal both for wild snails and cultivated snails having received special diets (13.41). Neither in pedal mass nor in the visceral mass the pH level exceeded 7.29. In visceral mass the amount of crude ash was significantly higher than in pedal mass ($p<0.05$). The calcium level in the control group was essentially higher ($p<0.05$) than that established for wild snails.

Keywords: Helix pomatia, Snail meat, Biochemical composition

1. Introduction

Snail meat is a favoured product in many European countries (France, Italy, Spain, Belgium, Greece, Switzerland, Germany, Great Britain and Denmark), as well as in other continents: Africa, Asia, North America and Australia. Of late, its consumption is growing also in Latvia.

Roman Snail (*Helix pomatia*) is one of totally 91 terrestrial snail species found in Latvia. As part of the local fauna Roman Snail has been known since 16^{th} century. Snail cultivation however has started in Latvia only in nineties of the 20tieth century. Since 2009, there is a Roman Snail Breeding Society in Latvia incorporating more than 200 snail farms.

Snail meat is distinguished by its high dietetic value and excellent nutritional qualities [3]. Research shows that it is rich in protein at the same time being low in lipids [6],[7] and [9]. Are relatively few research data available on the impact of different feed materials on biochemical indicators of meat of *Helix pomatia*. Therefore the following objective was set forth for our research study: using biochemical data of meat as basis, evaluate the biological value of the Roman Snail meat under different breeding and feeding conditions.

2. Materials and Methods

The trial was performed in May-September of 2011 at the Roman Snail Research Facility of the Research Institute of Biotechnology and Veterinary Medicine „Sigra", of Latvia University of Agriculture LLU. Snails were dived in four groups: 3 trial groups and 1 control group. Each group consisted of 500 snails. The trial scheme is demonstrated in Table I.

Mix of wild plants, including common dandelion (*Taraxacum officinale*), stinging nettle (*Urtica dioica*), common sowthistle (*Sonchus oleraceus*), greater burdock (*Arctium lappa*), creeping thistle (*Cirsium arvense*),

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white clover (*Trifolium repens*), coltsfoot (*Tussilago farfara*), common chickweed (*Stellaria media*) etc. Mix of garden plants including, lettuce, leaves of red beet and fodder beet, cabbage, cucumbers, carrot tops, etc.

Table I: Feeding trial scheme of Roman Snails

No.	Groups	Feed materials used
1.	Control	Wild plants
2.	A	Wild plants and garden plants
3.	B	Wild plants and special supplementary feed
4.	C	Wild plants, wheat meal, wheat bran

The samples of the feed as well as of internal organs and shells of Roman Snails were drawn three times per season: in spring (May), summer (July) and autumn (September) The sampling was performed simultaneously from each partition of the snail enclosure and from the wild Roman Snails. After sampling, the snails were refrigerated for 24 hours (+4^{0}C) with and aim of desensitizing them. Post refrigeration the snails were slaughtered by mechanically breaking the shell and separating the pedal mass and visceral mass. The snail meat was analysed separately from viscera. In both, the pedal mass and visceral mass of Roman Snails the following indicators were determined with commonly accepted methods: dry matter, crude protein (LVS ISO 937:19), pH, crude ash (LVS ISO 6498), as well as minerals: Calcium (LVS ISO 6498) and phosphorous (LVS ISO 6498). Statistical processing of data was performed with the software SPSS 17.0.

3. Results and Discussion

Biochemical indicators were determined in pedal mass and visceral mass of both, Roman Snails found in Latvia in the wild and Roman snails cultivated at the trial facility. The level of dry matter, crude protein and ph is reflected in Table II. The results demonstrate that the dry matter content found in the foot (pedal mass) and in the viscera (visceral mass) of snails does not essentially differ ($p>0.05$). On the other hand, the dry matter content found in foot is significantly lower than that in viscera ($p<0.05$). The highest dry matter content (14.11 ± 0.88%) was found in foot of snails fed special plant diets (Table II). It is evident that in our case the most essential differences in dry matter content are established between wild snails and cultivated snails having received a garden plant diet.

Table II: Dry matter, crude protein and pH in foot and viscera of wild and cultivated Roman Snails of Latvia

Parameters	Snail body part	Group				
		Control (n=5) mean ± SEM	A (n=5) mean ± SEM	B (n=5) mean ± SEM	C (n=5) mean ± SEM	Wild snail (n=10) mean ± SEM
Dry matter (%)	Pedal mass	13.11±1.15	12.43±1.27	14.11±0.88	13.71±0.88	13.22±0.94
	Visceral mass	19.24±1.16	19.48±0.48	19.49±0.31	19.10±0.50	17.67±1.17
Crude protein (%)	Pedal mass	12.51±0.55	13.35±0.58	13.41±0.55	12.16±0.51	13.41±0.95
	Visceral mass	10.77±0.74	11.62±0.50	11.47±0.59	11.59±0.63	10.43±0.37
pH	Pedal mass	7.29±0.01	7.26±0.01	7.20±0.03	7.25±0.02	7.28±0.02
	Visceral mass	7.08±0.04	7.08±0.05	6.99±0.06	7.11±0.02	7.00±0.02

n – number of samples

SEM – Mean Standard Error of Mean

According to Gomot [5] dry matter in foot of the wild *Helix pomatia* was established on 13.4% level, which is by 0.2% higher than for our wild snails, while the dry matter level established in viscera was even by 6.8% higher (24.5%). Some authors [9] in the region of Kedainiai (Lithuania) have established similar dry matter content (13.23 ± 0.05%) just by 0.01% higher than that found by us. Some scientists have compared the dry matter content in Roman Snail foot (15.99 ± 0.77%) with that of pigmeat (25.65 ± 0.21%) showing that the snail foot contains significantly less dry matter ($p<0.001$) than pigmeat [10]. The dry matter content found by scientists [8] that in the snails of Africa is essentially higher (20.5%) than that established in our studies and research carried out by other scientists [7], [9] and [10]. In our case, the dry matter content in the foot of wild Roman Snails did not essentially differ from ($p>0.05$) that of the control group. The indicator found in the foot for Group A was not significantly lower than that for Groups B and C. Some researchers have found that the dry matter content reduction in the foot of wild *Helix pomatia* co-relates with the growing age of the snails [6]. The dry matter and crude protein content (%) in the foot of wild snails in Latvia is shown in Fig. 1.

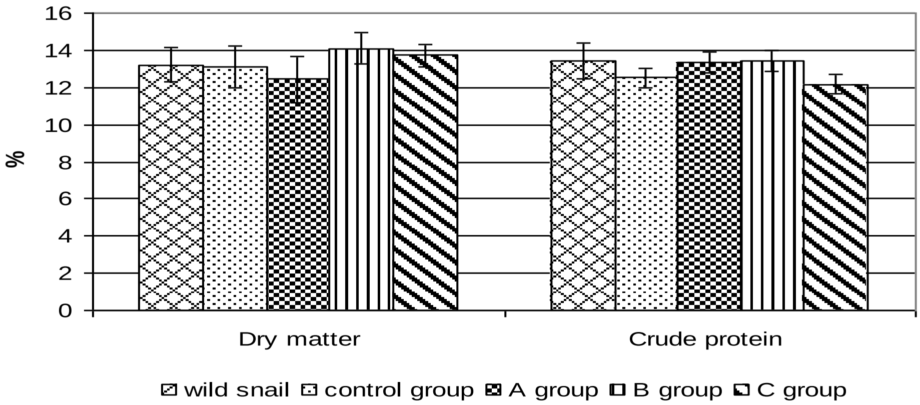

Fig. 1: Dry matter and crude protein content (%) in pedal mass of wild snails and trial groups of breeding snails

The content of crude protein (%) for wild snails and cultivated snails having received special concentrated feed (Group B) was equal (13.41%). The research of [4] shows that in pedal mass of snails of other species the crude protein content varies from 18.66% ± 0.57% (*Limicolaria spp.*) to 20.56% ± 0.05% (*Achachatina marginata*). The research results of [6], on the other hand indicate that crude protein level in pedal mass of wild snail population was higher than that of snails cultivated in breeding facilities for all age groups, while protein level for wild snails at 2-3 years of age was essentially higher ($p<0.01$). Some authors [9], examining *Helix pomatia* meat content in different regions of Lithuania have established the crude protein level from 11.51% ± 0.03% (Lape region) to 16.60% ± 0.03% (Kaunas region). According to data of [10], the crude protein level in pedal mass of *Helix pomatia* is essentially ($p<0.001$) lower (14.15% ± 0.76%) than that of pigmeat (22.80 ± 0.21). A relatively high protein and a low lipid level were established also in the pedal mass of the snail species *Archachatina*, *Archatina* and *Limiclaria* [1]. On the whole, no significant differences have been found either in dry matter or crude protein content (%) among pedal mass ($p>0.05$) and visceral mass of wild snails.

The highest pH level (7.29 ± 0.01) was established for the snails of control group, however statistically significant differences in pH levels between pedal mass of wild snails and separate groups of the cultivated snails were still not found. The pH of viscera was not essentially lower ($p>0.05$ – differences were found only in 0.14 of snails having received ration of wild plants, wheat meal and bran and in 0.28 of wild snails. In studies of Zymantiene [9] pH in different regions varies from 7.05 ± 0.02 to 8.08 ± 0.02 but the research results of Zymantiene[10] show that pH level of pigmeat is essentially ($p<0.001$) higher (5.48 ± 0.02), in comparison with meat of Roman snails (7.46 ± 0.12). Due to scarity of data in research literature on biochemical indicators of *Helix pomatia* we made comparison using data obtained from other species of snails. Similar results as in our study have been obtained in the research of Okonkwo [8] examining

Archachatina marginata snails in Nigeria: pH was established at the level of 7.40 ± 0.05. The content of dry matter and crude protein (%) in viscera of wild snails found in Latvia is shown in Fig. 2.

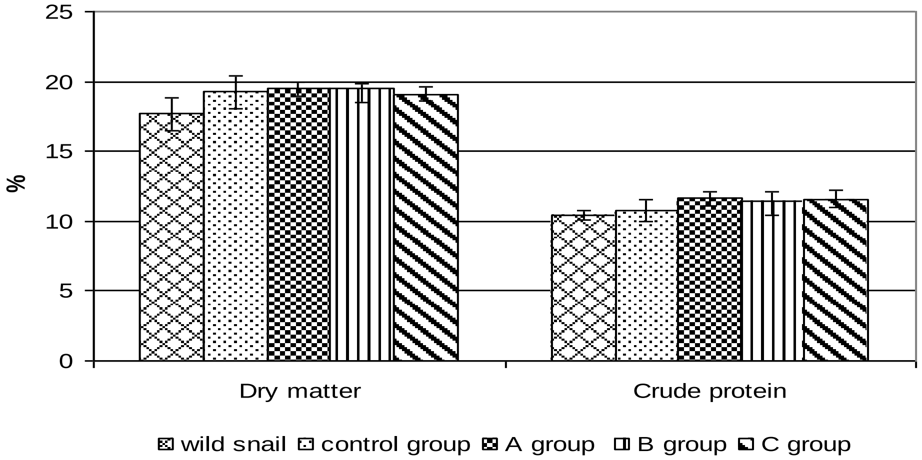

Fig. 2: Dry matter and crude protein content (%) in visceral mass of wild snails and trial groups of breeding snails

In visceral mass of Roman snails, significant differences in dry matter and crude protein levels between wild snails and separate groups of the cultivated snails were not found (p>0.05). Up to this stage, there are relatively few data the level of 24.5% and crude protein 19.6%, which essentially exceeds the levels obtained by us. In our study, the dry matter content in visceral mass of Roman snails lingered within the limits of 17.67 ± 1.17% for wild snails to 19.49 ± 0.31% for cultivated snails fed on special supplementary feed, while crude protein varied from 10.43 ± 0.37% for wild snails to 11.62 ± 0.50% for cultivated snails fed on wild and garden plants (Table II). The content of minerals (crude ash, calcium and phosphorous) in visceral mass of Roman snails is shown in Table III.

Table III: Content of minerals in pedal mass and visceral mass of Roman Snails cultivated for trial and found in Latvia in the wild

Parameters	Snail body part	Group				
		Control (n=10) mean ± SEM	A (n=5) mean ± SEM	B (n=5) mean ± SEM	C (n=5) mean ± SEM	Wild snail (n=10) mean ± SEM
Total Ash (%)	Pedal mass	2.79±0.21	2.37±0.12	2.19±0.33	2.12±0.48	1.81±0.15
	Visceral mass	6.28±0.62	5.70±0.33	4.43±0.30	5.50±0.62	4.81±0.34
Calcium (%)	Pedal mass	1.04±0.13	0.68±0.15	0.82±0.18	0.87±0.11	0.62±0.05
	Visceral mass	2.16±0.21	1.88±0.12	1.65±0.18	1.76±0.23	1.67±0.14
Phosphorum (%)	Pedal mass	0.19±0.01	0.18±0.03	0.19±0.01	0.23±0.01	0.17±0.01
	Visceral mass	0.44±0.05	0.41±0.04	0.40±0.04	0.43±0.04	0.33±0.05

n – number of samples

SEM – Mean Standard Error of Mean

The content of crude ash in viscera of wild snails as well as trial snails of all groups is significantly higher (p<0.05) than in their pedal mass. For wild snails the total ash content in pedal mass was 1.81 ± 0.15% [also according to Gomot [5] 1.8%] while in visceral mass it was 4.81 ± 0.34%. Gomot [5] has determined the crude ash at the level of 2.4%, consequently the same indicator obtained in our research study is twice as high. In comparison with pedal mass of wild Roman snails (0.62 ± 0.05%), an essentially higher (p<0.05) level of calcium was found for the control group (1.04 ± 0.13%) (Table II). In viscera on the other hand, essential differences as to the calcium level among different groups were not observed (p>0.05). Çağiltay [2] in garden snail Helix aspersa is identifiet only 1.35%, which is significantly more than in our study. In respect of phosphorous, no essential differences were found among groups either in pedal mass or visceral mass.

4. Conclusions

The dry matter and ash content found in both, the population of wild snails and the breeding snails of trial facility set up by Research Institute of Biotechnology and Veterinary Medicine „Sigra”, of Latvia University of Agriculture is essentially ($p<0.05$) lower than in visceral mass . The crude protein content for the wild snails and trial snails having received special feed was equal. The differences in pH levels between the pedal mass and visceral mass of snails were not essential ($p>0.05$). An essentially higher level of calcium ($1.04 \pm 0.13\%$) was found in the control group ($p<0.05$) in comparison with wild snails.

5. Acknowledgements

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