

## COMPARISON OF EXTERIOR TRAITS IN SELECTED GIANT AND MEDIUM RABBIT BREEDS

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**Abstract:** Generally, in recent times across the breeding spectrum, rabbits of giant, medium, small and dwarf breeds have been reared. The largest representation among breeders at most breeding exhibitions held in central European countries is amongst giant and medium breeds. The aim of this work was to evaluate the qualities and exterior faults in selected giant and medium rabbit breeds in different colour varieties according to a current book of rabbit standards. Of 1779 rabbits from 11 exhibitions held in the territory of the Czech and Slovak Republics, 646 giant rabbits weighing 5.5 kg and over and 1133 medium rabbits between 3.25 to 5.5 kg of different breeds and colour varieties were selected. Giant (large) breeds population included 210 of Giant, 187 of Giant Papillon and 249 of Lop. In the medium weight category, 308 of Big Light Silver, 184 of Chinchilla Giganta and 641 of Vienna group breeds were selected. The qualities and exterior faults of typical breed traits were evaluated in six positions: weight, shape, type, coat, top colour or markings and undercolour. The results of the work show that the most common exterior faults in these categories were in the shape, type and coat positions. In the shape position, significant exterior faults were found, such as slightly protruding hips with slanting rump, worse legs position with bowed or splayed limbs and loose skin on the body. Especially observed in the type position in all selected breeds were narrow chest, body too lean or too long and a more delicate head with finer structure of ears. The coat was usually thick and less elastic with the lighter undercolour at the base of the skin and non-sharply defined intermediate colour. The data obtained are ground-breaking, representing a new approach to assist in the characterisation of giant and medium rabbit breeds included in a study and to select individuals with the best exterior properties with a view to improving the breed quality.

**Key Words:** exhibitions, rabbit breeds, standard, exterior faults, type, coat.

## INTRODUCTION

Rabbit farming has a long tradition in the countries of central and western Europe. Originally, rabbits were bred for meat along with stabled livestock and functioned as consumers of excess feed. The advantage of breeding rabbits is that they are easy to raise, as they breed easily and give birth in less time than other traditional farm animals, with a short gestation period average of 30-31 d. Purebred rabbit breeds can possess good growth, sufficient feed efficiency and an early marketing age, but the performance traits vary depending on the specific breed. In particular, the selected medium-sized breeds show *good growth rate*, morphometric traits and slaughter characteristics and can be considered as an alternative genepool for meat production, mainly in small-scale stocks and farms (Zita *et al.*, 2010; Chodová *et al.*, 2014; Tůmová *et al.*, 2014; Rafay and Parkányi, 2016; Šimek *et al.*, 2019).

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Consequently, a gradual specialisation emerged in the form of a new discipline known as rabbit breeding. Nowadays, regarding the structure and abundance of holdings, the predominant breeding of rabbits is for meat (Szendrő *et al.*, 2012) and sports (Whitman, 2004; Alves *et al.*, 2015). Rabbit farming for the production of fur and skins is represented to a lesser extent, but the breeding of specialised genotypes for biological research and laboratory rabbits is also important in terms of economic or scientific interest (Gonzalez-Mariscal, 2004; Tůmová *et al.*, 2011).

The multifaceted production and sporting use of rabbits was an incentive to increase their number, improve breeding conditions and expand their outdoor variability. The aim of the breeding work was to create breeds that mainly differed from each other in size, colour, coat structure and pattern (Bole *et al.*, 1996), feed conversion ratio, climate adaptability, and temperament (Dalle Zotte and Szendrő, 2011; Fadare, 2015).

By 2017, there were at least 305 breeds of domestic rabbit in 70 countries around the world (Morton *et al.*, 2005). Most often, the rabbit breeds are divided by weight into different groups: giant, medium, small and dwarf. Depending on the length of the coat, the rabbit breeds are classified as normal fur breeds, Rex breeds, long-haired breeds and breeds with a special satin coat structure (Zadina, 2003; Dalle Zotte *et al.*, 2013, Šimek *et al.*, 2020). This general classification is also used in the valid edition of the European EE Rabbit Breed Standards Book, which has been used for judging at EE Shows (Meister *et al.*, 2012). Generally, in recent times across the breeding spectrum, rabbits of giant and medium breeds are reared. The giant breeds include rabbits with a live weight of adult animals 5.5 kg and over, while medium-sized rabbits include breeds with a live weight ranging from 3.25 to 5.5 kg (Pyskatý and Zigo, 2018; Neirurerova *et al.*, 2018).

From a wide range of giant-sized breeds, the gene pool listed below may be identified as the most widespread and utility breeds. The Flemish Giant, in terms of the European EE Rabbit Breed Standards Book (Meister *et al.*, 2012) known simply as Giant (G), is the biggest breed of rabbit in the world with a large, roomy and flat body and broad fore- and hindquarters (Figure 1). It is a big, solid rabbit with the impression of power. The minimal desirable live weight is 7.0 kg (BRC, 2016), while most of the representatives are heavier up to the highest allowed value of 11.5 kg. The ears are erect, robust and strong of good substance. The desirable ear length is at least 19 cm. The coat is smooth with a length of about 4 cm fitting to the size of the body, very visible kemp and a dense undercoat. There are several common colours in different countries (some coat colours like yellow are only recognised in some countries): e.g. black, blue, yellow, blue-grey (also known as opal), steel grey and red-eyed white. A grey variety of the G breed is the most common. The undercolour is in accordance with the requirements given by the colour standard (Zadina, 2003).

The French Lop, in terms of the European EE Rabbit Breed Standards Book (Meister *et al.*, 2012) known just as Lop (L), is the heaviest Lop rabbit breed (Figure 1). According to the Czech (Zadina, 2003) as well as the Slovak (Supuka *et al.*, 2009) breed standard, the representative French Lops minimally weigh 5.50 kg, but most of the French Lops range from 6 to 7 kg. The body type is massive, thickset and firm with a large, round, broad, full-cheeked head. The basal ridge of the ears appears prominent across the top of the skull to form the crowns. The ears are measured by holding them horizontally over the head. Typically, the size from one end to the other of both ears is between 40–45 cm and the ears, about 20 cm long, hang down below the jaw. The body is short, broad and well-muscled, with little visible neck. The L has a dense, soft coat that comes in two colour groups, solid and broken. Within these categories are found several different colour varieties in some countries, including grey (also known as agouti), blue,



Figure 1: From left: Giant (G), Lop (L) and Giant Papillon (GP). Source: Photo by Pyskatý and Šimek (2018).

black, chinchilla and other colours. The undercolour is in accordance with the requirements given by the colour standard (Supuka *et al.*, 2009).

The Giant Papillon (GP) belongs to giant breeds with an ideal live weight of more than 6.0 kg (Figure 1). The GP has a typically robust body, with length being emphasised by the pattern. Compared to the other giant breeds, its bone structure is lighter. The erect ears are robust and of good substance. The ideal ear length is over 17 cm. The coat is dense and glossy, with lots of guard hairs. The GP has a pure white base colour with the typical coloured pattern of the ears, eye circles, rounded cheek spots and a butterfly-shaped marking at the nose. The body marking consists of a saddle stripe and side markings. A saddle stripe runs down the spine from ears to tail. The side markings ideally count 6-8 rounded spots situated on the flanks and thighs. The colour of the markings in some countries is black, blue or Havana, according to the recognised variety, free of excessive white hairs (Zadina, 2003).

From the category of medium-sized breeds between 3.25 to 5.5 kg of different colour varieties, the gene pool listed below may be identified as the most widespread breeds. The Big Light Silver (BLS) breed belongs to the popular rabbit breeds in Central Europe. The BLS is a strong medium-sized breed with good assumptions for meat performance (Figure 2). The standard live weight is 4.50-5.50 kg, with a well-proportioned, thickset cylindrical body and strong medium length limbs. The erect ears show a good substance and holding with ideal length 13.0-14.5 cm. The coat is dense, elastic, rich in kemp and medium in length. The top colour is a typical breed trait. The overall impression is silver-milky with equally distributed dark tips of the firm kemp protruding over the surface top colour. This phenomenon forms the supposedly black ticking. The undercolour is deep blue slate (Supuka *et al.*, 2009).

The Chinchilla Giganta (ChG), with a more robust body frame, belongs to the medium-sized breeds (Figure 2). Standard adult ChG representatives weigh 4.50-5.50 kg. The erect ears are robust and firm in structure. Ideal ear length is 13.0-14.5 cm. The fur is uniformly dense and silky in texture with resilience. The ash-grey top colour with blueish shade and black ticking is a typical breed trait of this medium-sized breed. The belly, underjaw, eye circles, inside of ears and tail underpart are pure white, which forms a good contrast with the body surface colouring. The undercolour is deep blue slate, as dark as possible from the skin to at least half the length of the fur (excluding black guard hairs). This is followed by a clear pearl white intermediate colour, which does not exceed a quarter of the length of the fur (Covrig *et al.*, 2013; Neirurerova *et al.*, 2019; Šimek *et al.*, 2020).

The group of Vienna breeds (VB) comprise of five recognised medium-sized breeds, more specifically Vienna Blue (V-Blue), Vienna Black (V-Black) (Figure 2), Vienna White (V-White), Vienna Grey (V-Grey) and Vienna Blue-Grey (V-BI-Grey). The V-Grey can also be designated a Vienna Agouti breed (BRC, 2016), especially using an English-derived terminology. The blue-grey term is a more common translation name for this colour (this coat colour may be also called opal in some extra-continental countries). The Vienna Blue-Grey breed is recognised in the national rabbit breed standards books e.g. in Germany, France, Czech Republic, Slovak Republic and some others. The above-mentioned breed is also acknowledged in the European Rabbit Standard Book (Meister *et al.*, 2012).

Because of the historical development of these breeds, the above-mentioned Vienna breeds have similar body construction and coat indices. The top colour and eye colour are the main trait differences among these breeds.



**Figure 2:** From left: Big Light Silver (BLS), Chinchilla Giganta (ChG) and Vienna Blue (V-Blue) Source: Photo by Mojcher and Šimek (2018).

The Vienna breeds maintain a high, stabile popularity in the Czech Republic as well as in the Slovak Republic (Supuka *et al.*, 2009; Šimek *et al.*, 2020). Concerning the live weight (LW) of the Vienna breeds, the V-Grey (4.0-5.25 kg) with the V-Blue, the V-Blue-Grey and V-Black show a slightly higher LW (4.25-5.25 kg) as compared to the V-White (4.0-5.0 kg) as stated in the Czech (Zadina, 2003) and Slovak (Supuka *et al.*, 2009) books of rabbit breed standards. The ears are of good substance, well furred, rounded, and carried erect. The desirable ear length of the V-White is 10.5-11.5 cm and 10.0-13.5 cm for all other colour-types of VB. Normally the colour is lustrous and the coat is exquisitely dense, silky and rich in guard hairs and medium in length. Top colour of the V-Blue is dark slate blue. The V-Black breed shows deep-black top colour. Top colour of the V-White is pure white with pale blue iris and non-pigmented toenails. The top colour of the V-Grey breed seems to be the colour of wild rabbits. The V-BI-Grey breed shows an overall impression of grey-dusted fawn colour with a white-coloured belly, underjaw, eye circles, inside of ears and tail underpart (Supuka *et al.*, 2009).

The largest representation among breeders at most breeding exhibitions in the Czech and Slovak Republics is amongst the giant and medium breeds described. Determination of breeding value by assessing the exterior of rabbits was a widespread problem. To this end, many rabbit breeders take part in exhibitions to find out the breeding value of their individuals. All presented rabbits are evaluated by trained persons—the rabbit judges—according to a relevant book of standards for rabbits issued by rabbit breeders' associations. Rabbit judges are specifically educated, with training (a 3-yr course with regular meeting and seminars) facilitated by the national associations. The final judging exam is set by the national rabbit committee and consists of a theoretical section (a test, a colloquium) and a mainly practical part. The education and exam is guaranteed and overseen by national well-known rabbit judges, predominantly with the licensing of European rabbit judges (EE) (Zadina *et al.*, 2003; Meister *et al.*, 2012).

Each breeding association summarises the recognised rabbit breeds described in the current book of rabbit standards in a given country. In standard books, a detailed description of the appearance of the individual breed, which characterises the ideal representative of the breed, is provided. There is also a list of exterior deficiencies – faults from the ideal state. The faults are divided according to their relevance to minor and major or disqualification faults (Zigo *et al.*, 2019).

The aim of this work was to evaluate the qualities and exterior faults in selected giant and medium-sized rabbit breeds in different colour-types from 11 exhibitions according to the valid national rabbit breed books of standards in the Czech Republic and Slovak Republic.

## MATERIAL AND METHODS

### ***Animal selection***

A total of 1779 rabbits of the giant and medium category in different breeds and colour varieties from the Czech and Slovak Republics were selected from 11 exhibitions between 2017-2018. Of 646 giant rabbits, 210 of G, 187 of GP and 249 of Lop were selected. In the medium weight category, 308 of BLS, 184 of ChG and 641 of the group VB were selected. The group of Vienna breeds comprises a total of five recognised medium-sized breeds, more specifically Vienna Blue (V-Blue), Vienna Black (V-Black), Vienna White (V-White), Vienna Grey (V-Grey) and Vienna Blue-Grey (V-BI-Grey). Due to the similarity of VBs, in this work they were merged into one group. The number of rabbits included in individual exhibitions are shown in Table 1.

### ***Evaluation of rabbits***

The selected rabbit breeds were evaluated according to the valid books of standards for rabbits issued by associations in the Czech Republic and Slovakia. In Slovakia, there is a current book of standards for rabbits from 2009 (Supuka *et al.*, 2009). The current book of standards for rabbits in the Czech Republic was issued in 2003 and includes a total of 68 recognised breeds (Zadina, 2003). Each standard book for rabbits consists of a general and a special section. The first part describes the general conditions of the seven positions in which the exterior of the rabbits is evaluated. The special section includes standards of individual breeds and their minor or major exterior faults.

**Table 1:** The number of rabbits included in individual exhibitions.

Exhibitions	Giant rabbit breeds			Medium rabbit breeds		
	G	GP	L	BLS	ChG	VB
Slovakia						
Barca	10	12	13	17	38	22
Michalovce	17	29	10	17	14	20
Poprad	18	8	11	7	4	16
Barca	7	13	5	1	30	13
Žilina	-	-	-	-	-	169
Nitra	85	96	136	154	48	153
Czech Republic						
V. Pavlovice	4	10	10	10	8	20
Přerov	35	10	26	31	22	125
Brno	34	5	26	45	12	64
V. Bilovice	-	4	12	6	-	16
Břeclav	-	-	-	20	8	23
total	210	187	249	308	184	641
		646			1133	

(G) Giant, (L) Lop, (GP) Giant Papillon, (BLS) Big Light Silver, (ChG) Chinchilla Giganta, (VB) group of Vienna breeds.

### Characteristics of individual positions

The qualities and exterior faults of typical breeding marks were evaluated in six exterior positions: weight, shape, type, coat, top colour (occasionally markings) and undercolour (occasionally intermediate colour). However, the remaining seventh position of condition and health was not evaluated in this work, as it does not include exterior breed traits. These exterior positions are similar in most books of rabbit breed standards, but the specific name, arrangement and the maximum points depend on the specific countries. For judging at the European EE Show (held every three years), the European EE Rabbit Breed Standards Book was developed. This European Rabbit Breed Standards Book defines seven positions: 1. Type, Shape and Physique; 2. Weight; 3. Coat; 4. Specific breed traits (e.g. head and ears); 5. Specific breed traits (e.g. top colour); 6. Specific breed traits (e.g. under colour); 7. Condition.

*Positions 1. – Weight:* In each breed standard is the optimal weight range for adult animals. In young rabbits, a table of month-dependent values of weight are defined in the Czech and Slovak books of standards (Zadina, 2003; Supuka *et al.*, 2009). Before any assessment of a rabbit, its weight must be determined and recorded. Either the weighing is carried out when selecting the rabbits for the exhibition, or the assessing person will do so according to the organiser's instructions. The judge has the right to check the weight determined and, in the event of any doubt, is obliged to verify it.

*Positions 2. – Shape:* The following body criteria are considered in this position: the back line formation, position of the limbs, position of the tail, skin on the body and external genital organs. The backline begins at the first cervical vertebra and ends at the base of the tail. It should be even and nicely rounded at the back of the body, without slanting rump or protruding hips (Figure 3). The scapula must not be clearly visible in the nape. The forelegs must be straight. The length and thickness of the limbs are part of the type position. The hind legs must also be straight; the feet should lie close to the body as parallel as possible. With the correct position of all limbs, the abdominal line should not touch the mat. The tail must be complete, straight, erect, adjacent to the body in the direction of the spine, palpable to the full length. The skin should be elastic and adhere firmly to all parts of the body. The external genitalia should be prominent, undistorted. In bucks, the testicles must be as close to the body as possible.

*Positions 3. – Type:* In this position we consider the body proportions of the rabbit, the ratio of body width to its length, the thickness and length of the limbs, the proneness of the neck, and in some breeds, also the temperament in the form of the required so-called exhibition stand on upright forelegs. Especially in the case of rabbit meat breeds, we assess the muscles in this position. With respect to the national rabbit breed standards used in the Czech Republic and Slovak Republic, the head building and ears are judged in this position, except most of the red-eyed white and blue-eyed white rabbits.



**Figure 3:** Protruding hips - protrusion of the hip bumps above the sacrum line. Source: Zadina (2003).

*Position 4. – Coat:* The texture of the coat is individual for each breed. For all breeds, however, there is a required hair length, density, flexibility and balance of these features throughout the body as uniform as possible. The coat length and texture are described for each breed separately in relevant standards. The ears must also be well coated. The largest group of breeds are rabbits with normal hair, which is the same as the ancestor of today's rabbit breeds - rabbit (*Oryctolagus cuniculus f. domesticus*).

*Positions 5 and 6. – Specific breed traits:* The breeding criteria described in positions 5 and 6 are given in each specific breed standard. According to the Czech and Slovak books of the rabbit breed standards, predominantly the top colour and undercoat colour (occasionally the intermediate colour) is judged at position 5 and 6, respectively. Besides that, in patterned or spotted breeds (like the GP breed), the markings traits are evaluated at the 5<sup>th</sup> position.

*Position 7. - Condition and health:* The animal care part includes the readiness of the animal for exhibition and cleanliness. Rabbit ears must be clean and with a legible tattoo. The nails must be shortened to the required length and cleaned together with the lower limbs. The genitals and their surroundings must be clean.

### **Rabbit scoring system**

When exhibited, the purebred rabbit is evaluated by a trained person —a rabbit judge— who observes the animals' characteristics and compares them with the standard requirements. Each exterior position is assigned a certain number of points recorded by the judge on the rabbit's show remark card. These are granted with a half-point accuracy in order to detect even the smallest quality deviations. For each minor fault, according to its extent, the point deduction is 0.5-2 points, and the point deductions can be combined in one position and their sum makes up the total point deduction in the given position. Any point deduction of more than 1.5 points, excluding the weight position, must be briefly justified in writing in that position in the rabbit's show remark card.

The maximum sum of all positions equal to 100 points, therefore, represents the exterior ideal animal. Distribution of points on the rabbit's show remark card in the individual positions using the standard of Zadina (2003) and Supuka *et al.* (2009) is expressed in Table 2. For comparison, the European EE scale is also presented there. The minor faults are slight deviations from the breed standard and are resolved by deduction of points in the positions. The disqualification fault is a significant deviation from the breed standard and excludes the animal from breeding because of the supposed hereditary defect. The rabbit may also be non-classified due to acquired character faults such as injury, hair contamination and bad or insufficient identification, among others (Zadina, 2003; Supuka *et al.*, 2009).

The sum of points awarded in the individual positions in the assessment gives us the overall score of the animal and is expressed as several classifications which slightly vary in the monitored countries (Table 3). For comparison, the classification scale used in the European EE Rabbit Breed Standards Book is also presented in Table 3.

### **Statistical analyses**

Using the Chi square test (Kabrt, 2013), relationships were evaluated in selected categories of rabbits. Comparison of individuals faults and advantages in positions: weight, shape, type and coat of the rabbit show remark cards were summarised as the statistical differences between the giant and medium-sized breeds. The dependence for all compared faults and advantages in evaluated positions was tested at a significance level  $\alpha=0.05$ , with critical value  $=5.991$ .

**Table 2:** Rabbit scoring system and distribution of points.

position number	Czech / Slovak	Czech <sup>1</sup>	Slovak <sup>2</sup>	European	European <sup>3</sup> standard
	characteristic of position	standard	standard	characteristic of position	
1	weight	10	10	type, shape and physique	20
2	shape	20	20	weight	10
3	type	20	15	coat	20
4	coat	15	20	specific breed traits <sup>4</sup>	15
5	specific breed traits <sup>4</sup>	20	20	specific breed traits <sup>5</sup>	15
6	specific breed traits <sup>5</sup>	10	10	specific breed traits <sup>6</sup>	15
7	condition and health	5	5	condition and health	5
	total	100	100		100

Distribution of points is according to the valid national Rabbit Breed Books of Standards in the <sup>1</sup>Czech Republic, <sup>2</sup>Slovak Republic and <sup>3</sup>European; <sup>4,5,6</sup>Specific breed traits are given in each specific breed standard.

## RESULTS AND DISCUSSION

A correct interpretation of the exterior traits recorded on the rabbit show remark card requires good knowledge of the rabbit's anatomy and breed standard. A specially trained person—a rabbit judge with acceptable educated expertise in this area—can determine the assessment of the breed standards at exhibitions. The judge may indirectly influence the direction of rabbit breeding. In this case, the human factor must be considered as a result of subjective judgement by one person (Zigo *et al.*, 2019). The exterior faults and advantages listed below are categorised according to the individual positions on the rabbit show remark cards.

*Position 1. – Weight.* Body weight is one of the basic and important feature of each breed (Poigner *et al.*, 2000). According to Dalle Zotte *et al.* (2013), the individual body proportions of certain parts of the rabbit's body depend on its weight, which affects their overall size or body frame. In this respect, reduced weight of the evaluated breeds was rarely observed, and resulted in the loss of points on the rabbit show remark card. The most frequent weight deficits were recorded in the medium breeds, the Vienna breed group in particular. In total, 20.4% of V-Black, 13.3% of V-Blue and 9% of V-Grey had insufficient weight. Of the other medium breeds, loss weight of BLS (4.2%) and ChG (2.1%) in the smallest deviation from the required weight standards was reported. In giant breeds, the weight of the Giant Papillon (7.5%), the Lop (8.8%) and the Giant (1.8%) were reduced (Table 4). A shorter body frame accompanied by a narrow chest and thin neck were other typical deficiencies of the shape related to the reduced weight.

*Position 2. – Shape.* This position includes general characteristics of the body that create the exterior. Five body parts were assessed: the back line formation, position of the limbs, position of the tail, skin on the body and external genital organs. Dopitova *et al.* (2018) observed very good back line formation with musculature hind legs during the evaluation of the L breed. In contrast, does occasionally show looser skin on the breast and dewlap. Looser skin on the breast passing by some individuals to dewlap was a typical fault observed in the does of L (47.4%) and ChG (45.3%). Given the assessment of L, it can be stated that fewer than 10.0% of does had no obvious defects on the skin on the breast and were without dewlap. From the monitored groups of medium rabbit breeds, very good to excellent back line formation was observed, especially in BLS and a group of Vienna breeds (Table 5).

**Table 3:** Classification scale of assessment rabbits.

classification	Czech <sup>1</sup> standard	Slovak <sup>2</sup> standard	European <sup>3</sup> standard
excellent	96.0 to 100	95.0 to 100	97.0 to 100
outstanding	not included	not included	96.5
very good	93.0 to 95.5	93.0 to 95.5	93.0 to 96.0
good	89.0 to 92.5	89.0 to 92.5	92.0 to 92.5
satisfactory	85.0 to 88.5	85.0 to 88.5	90.0 to 91.5
not satisfactory	under 85.0	under 85.0	under 90.0

Overall score of rabbits is expressed as several classifications in the monitored countries of <sup>1</sup>Czech Republic, <sup>2</sup>Slovak Republic and <sup>3</sup>Germany.

**Table 4:** The most common exterior faults in position - Weight.

breed	ideal weight <sup>1</sup>	reduced weight <sup>2</sup>	% of rabbits with less weight
Giant	7.00 kg and more	6.99-6.50 kg	1.8
Giant Papillon	6.00 kg and more	5.99-5.75 kg	7.5*
Lop	5.50 kg and more	5.49-5.25 kg	8.8*
Big Light Silver	4.50-5.50 kg	4.49-4.25 kg	4.2
Chinchilla Giganta	4.50-5.50 kg	4.49-4.25 kg	2.1
Vienna Black	4.25-5.25 kg	4.24-3.75 kg	20.4*
Vienna Blue	4.25-5.25 kg	4.24-3.75 kg	13.3*
Other Vienna breeds <sup>3</sup>	4.00-5.00 kg	3.99-3.75 kg	9.0*

Ideal<sup>1</sup> and reduced<sup>2</sup> weight - ideal and reduced weight according to current books of standards for rabbits (Zadina, 2003; Supuka *et al.*, 2009); Other Vienna breeds<sup>3</sup> - Vienna White, Vienna Grey and Vienna Blue-Grey; \* statistical significance ( $P < 0.05$ ).

Several rabbits of giant and medium breeds were excluded from breeding due to deformation of their genital organs, such as split penis and defects of the scrotum (Figure 4). Very serious faults, for example, the occurrence of loose skin under the neck or dewlap in bucks of giant breeds such as GP (6.5%) and L (5.9%) were observed. Individuals with such major exterior faults were excluded from the assessment and further breeding.

Petrescu-Mag *et al.*, (2012) noted similar changes in giant rabbit breeds. Common exterior faults were loose skin under the neck or dewlap and in the wrong tail position. Hard tail is an exterior fault where the last tail vertebrae grow into one immobile tube. This fault may be hereditary. The occurrence of the hard tail was determined in the groups of rabbits analysed, especially the giant breeds such as G (10.5%) and L (16.5%). Additionally, the medium breeds had hard tail as the most common fault in a group of Vienna breeds (7.2%).

Zadina (2003) indicates slightly protruding hips for one of the common general faults found in the evaluation of all rabbit breeds. It is actually a protrusion of the hip bumps above the sacrum line. From our results, a high incidence of this basic exterior fault was observed in the giant (53.0% of G, 36.9% of L and 41.0% of GP) and medium rabbit breeds (21.4% of BLS and 22.3% of ChG) (Figure 5) together with worse legs position (Figure 6). Least individuals with slightly protruding hips were observed in a group of Vienna breeds (13.4%) (Table 5).

Worse legs position with bowed or splayed legs was the fourth most common fault in positions shape in the observed groups of rabbits. This fault was most common in L and G with occurrence of 26.1% and 13.8%, respectively. In



**Figure 4:** Exterior ideals and disqualification faults in position - Shape. From left: Physiological development penis, split penis and missing scrotum. Source: Photo by Šimek (2018).



**Table 5:** Summary of the most common exterior faults in position - Shape.

breed/category	giant rabbit breeds			<i>P</i> -value	medium rabbit breeds			<i>P</i> -value
	G	GP	L		BLS	ChG	VB	
total rabbits	210	187	249		308	184	641	
minor faults (%)								
slightly protruding hips	53.0	36.9	41.0	<0.05	21.4	22.3	13.4	<0.05
slightly slanting rump	2.9	0.5	6.0	NS	2.6	1.1	0.6	NS
worse legs position - bowed or splayed legs	13.8	3.2	26.1	<0.05	7.5	3.3	10.3	<0.05
hard tail	10.5	5.9	16.5	<0.05	2.9	2.2	7.2	NS
loose skin on the body	30.1	15.8	47.4	<0.05	38.7	45.3	36.2	<0.05
dewlap (does)	10.6	29.5	43.0	<0.05	29.9	8.4	6.4	<0.05
disqualification faults (%)								
missing scrotum	2.0	6.5	2.2	NS	3.5	1.1	1.9	NS
split penis	2.0	3.5	2.2	NS	1.2	2.2	1.9	NS
dewlap (bucks)	1.0	6.5	5.9	NS	1.8	1.1	5.4	NS

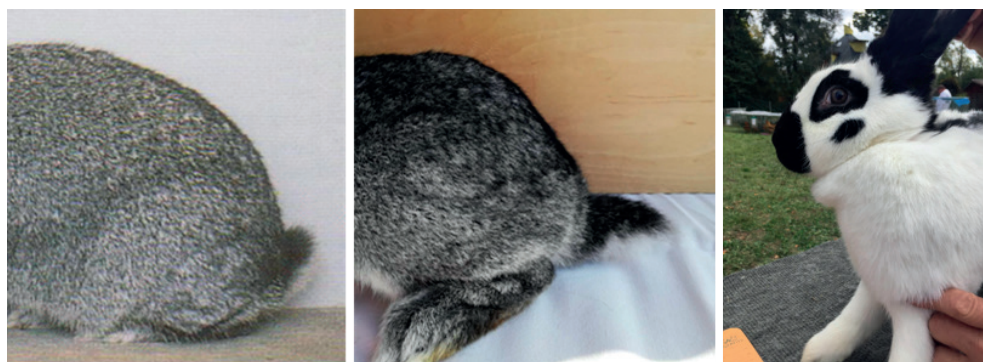
(G) Giant, (L) Lop, (GP) Giant Papillon, (BLS) Big Light Silver, (ChG) Chinchilla Giganta, (VB) group of Vienna breeds.

medium breeds, worse leg position was observed especially in a group of Vienna breeds (10.3%) and BLS (7.5%) (Table 5).

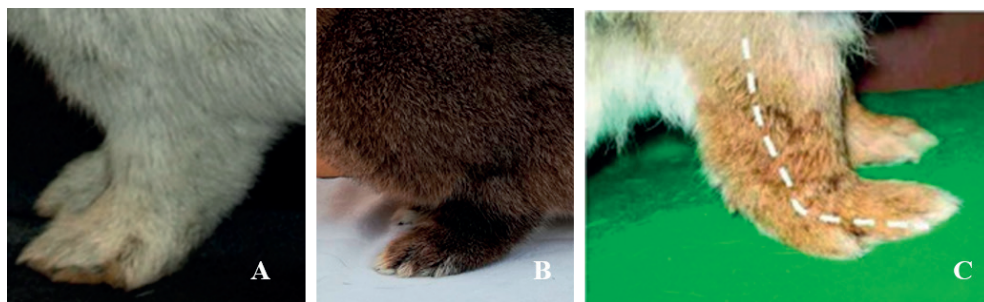
*Position 3. – Type.* According to Zadina (2003) the type is a very important position as it involves the defining features of the exterior nature of the breed. The type refers to the overall balance and compactness of individual body shapes. The partial proportions of the body that form the overall body frame of the rabbit are evaluated. There are several variants of the body frame, which may be characteristic of certain breeds, but may be undesirable defects in other breeds. The distinctness of the neck and strength and length of forelegs are assessed.

The formation of the head and ears are points of notable focus. Ears should be well coated and carried upright. The judging the fur on the ears (the specific position) vary through the national books of standards. According to the Czech and Slovak national breed standards, the fur on the ears is judged in the 3<sup>rd</sup> position (Type) but by an EE-standard this trait is judged in the 4<sup>th</sup> position (Coat).

All breeds should ideally be stable in texture, spoon-shaped and open. Their length is specified in the standard for each breed. It is necessary to consider the sexual dimorphism, which must always be clearly distinguishable between male and female (Ortiz-Hernandez *et* Rubio-Luzano, 2001).



**Figure 5:** Exterior ideals and faults in position – Shape. From left: Very well formed back line with curved rump, protruding hips with slanting rump in Chinchilla Giganta and dewlap in Giant Papillon does. Source: Photo by Zigo (2018).



**Figure 6:** Exterior ideals and faults in position – Shape. From left: Ideal standing position (A-B), worse legs position (C). Source: Photo by Pyskatý and Zigo (2018).

The results of our work suggest that the most common faults in position type were narrow chest and body too lean or too long in all observed giant and medium rabbit breeds. Except for a narrow chest, a more delicate head with a softer structure of ears was observed (Figure 7) in both groups of giant and medium rabbit breeds (Table 6).

Dopitova *et al.* (2018) reported individuals of L with very well-shaped head and sexual expression. The length and structure of the ears were optimal, although in many cases the ears were softer or finer with a poor crown. Furthermore, we confirmed a softer structure of ears in all other assessed giant and medium breeds. Jahan *et al.* (2019) affirmed during the evaluation of rabbits that the L breed meets the prescribed body frame, but was less pronounced in head formation, with softer and thinner ears. The most common faults from our observation in the position type of G were extended rump with a narrow chest (15.2%), thinner and softer ears (17.6%), which were slightly divergent is 15.7%.

According to Neirurerova *et al.* (2019), chinchillas in this position must have a broad head and optimal body frame. However, presently, many chinchillas have broad flat heads. The wide head is particularly important in bucks with regard to the development of secondary sexual characteristics and overall sexual expression. From our evaluation, this shows that the most frequent faults in ChG include the incidence of finer and thinner structure of ears (37.4%) or narrow chest (7.4%).

Šimek (2014) observed that the greatest faults in GP and Vienna rabbits were finer ears with thinner or finer front legs. Softer ears in GP and group of Vienna breeds was confirmed in our work, but faults such as the finer structure of front legs were not statistically significant. On the contrary, there were rabbits from the giant and medium



**Figure 7:** Exterior faults in the position - Type. From left: Open and finer structure of ears in Vienna black and Chinchilla Giganta, poor crown in French Lope. Source: Photo by Pyskatý (2018).

**Table 6:** Summary of the most common exterior faults and advantages in position – Type.

breed/category	giant rabbit breeds				medium rabbit breeds			
	G	GP	L	P-value	BLS	ChG	VB	P-value
total rabbits	210	187	249		308	184	641	
minor faults (%)								
narrow chest/body too lean or too long	15.2	17.1	32.1	<0.05	11.0	7.5	7.2	<0.05
finer structure of front legs	5.7	2.7	0.8	NS	5.2	6.4	3.6	NS
more delicate head	8.1	10.7	15.3	<0.05	6.2	5.3	6.9	<0.05
finer structure of ears	17.6	26.2	1.4	<0.05	19.5	37.4	11.1	<0.05
irregular shape of ears or poor crown*	15.7	12.8	34.1	<0.05	8.4	31.6	8.9	<0.05
disqualification faults (%)								
damaged or deformed ears	1.0	1.1	2.6	NS	1.6	1.6	5.4	NS
exterior ideals and advantages (%)								
very good body frame	31.9	31.0	26.9	<0.05	41.6	32.6	46.2	<0.05
very good head and ears	23.8	18.9	16.9	<0.05	26.6	17.6	30.6	<0.05
very good standing position with muscle legs	18.6	15.3	3.6	<0.05	12.3	17.1	16.5	<0.05

(G) Giant, (L) Lop, (GP) Giant Papillon, (BLS) Big Light Silver, (ChG) Chinchilla Giganta, (VB) group of Vienna breeds. Poor crown\* – was evaluated only in L.

category with a very good body frame, head shape, ears and perfect muscles of the limbs, who were able to show off their outstanding constitution and advantages in a perfect show position (Table 6).

*Position 4. – Coat.* Authors Zhang *et al.* (2011) and Rogers *et al.* (2006) were of the opinion that in the context of exhibition requirements in all rabbit breeds the following five basic coat parameters should be evaluated: length, uniformity, density, elasticity and structure. Some individuals were not in optimal condition at the time of the exhibition (moulting), which negatively influenced the properties and structure of their coat. In these individuals, the coat was in moult, often softer and less elastic. In rare cases, uneven places on the buttocks or abdomen were visible. In rabbits in an ideal show condition, the coat had a very good density and elasticity.

Most giant and medium rabbit breeds evaluated for minor faults were observed to have a thick and less elastic coat (Figure 8). This was especially noticed in giant breeds of G (23.3%) and L (10.0%) and medium breeds of BLS (19.8%) and a group of Vienna breeds (16.8%), with the coat being uneven and less elastic. In 17.9% of GP, the coat was thin and less elastic, although in a few cases (7.1%) it was of remarkable structure and density.

A softer, longer coat with more pronounced guard hairs was typical in the red-eyed white variety of the G breed. In a few individuals from the medium weight category in a group of Vienna breeds and ChG, the coat was longer, softer, almost inflexible with more pronounced guard hairs. In most medium breeds of BLS (21.1%), ChG (17.6%) and a group of Vienna breeds (14.7%), exterior ideals and advantages of exceptional density and structure of coat compared to giant breeds were observed (Table 7).



**Figure 8:** Exterior faults in the position - Coat. From left: Longer, thick and less elastic coat with uneven places on the body. Source: Photo by Zigo and Brigantova (2018).

**Table 7:** Summary of the most common exterior faults and advantages in position - Coat.

breed/category	giant rabbit breeds				medium rabbit breeds			
	G	GP	L	<i>P</i> -value	BLS	ChG	VB	<i>P</i> -value
total rabbits	210	187	249		308	184	641	
minor faults (%)								
poor structure	23.3	2.2	10.0	<0.05	19.8	4.3	16.8	<0.05
less elastic	1.0	16.8	36.9	<0.05	3.6	45.5	21.2	<0.05
dense and less elastic structure	16.2	17.9	17.7	<0.05	7.1	9.6	6.7	<0.05
soft or longer and almost inelastic	16.2	12.0	10.4	<0.05	4.9	1.1	5.3	NS
exterior ideals and advantages (%)								
very good coat density and structure	21.4	7.1	2.8	<0.05	21.1	17.6	14.7	<0.05

(G) Giant, (L) Lop, (GP) Giant Papillon, (BLS) Big Light Silver, (ChG) Chinchilla Giganta, (VB) group of Vienna breeds.

Covrig *et al.* (2013) holds the basic idea that the chinchilla has specific properties precisely for the structure of the coat. A longer and less elastic coat that delivers optical robustness in this breed is undesirable. Up to 45.5% of Chinchilla Giganta included in this study had a thick but less elastic coat, whereas only 17.6% excelled with a very good coat density and structure. Coat density usually has shorter length and with this comes less expressed ticking, to the extent that we may sometimes come across individuals whose typical ticking has completely disappeared.

In one study, Neirurerova *et al.* (2019) analysed the coat length and quality of chinchilla rabbits. From 153 samples of different individual animals, the optimal coat quality scored was 26.4%. A slightly lower-tier rating was found in 37.7% of the animals. Some 30.2% of the animals presented an even less flexible coat, and the least inflexible coat, where hair remained vertically erect, was seen in 5.7% of the animals. Some other rabbits had very soft coat structure (3.8%). Dopitova *et al.* (2018) found significant deficiencies in the coat of L. The coat was often thin and less elastic. Sometimes, the coat had a softer look with a tendency to curl. Moreover, a thick structure of coat on the back of the neck and a smaller deviation from the desired coat length was observed. The fur in our assessed L was many times less elastic (36.9%) and dense (17.7%).

*Positions 5 and 6. – Specific breed traits.* Generally, in the fifth position, the attribute most assessed is the uniformity of top colour, occasionally silvering, ticking, etc. For rabbits breeds with classical or Dutch markings, the prescribed drawing is evaluated in the fifth position. For white breeds and colour varieties in this position, evaluation is based on the formation of the head and ears (BRC, 2016).

According to Huffmon (1995) and Demars *et al.* (2018), top colour is the next assessed position, which in many cases is closely related to the actual physiological processes (moulting) and condition of the exhibited rabbits. Defects in top colour related to the exhibition condition of the individuals were frequently confirmed in this study. These faults are manifested mainly in an uneven colouring of a certain part of the body, such as flanks or chest. Common faults were slightly rusty colouring or rare white hairs in the undercolour of the Vienna blue and Vienna black. In the Vienna Grey breed, there were often paler patches on the forelegs. Neirurerova *et al.* (2018) indicated that the body colourings of chinchillas were fairly uniform, even though it is occasionally affected by rabbits brought from abroad. During the National Animal Exhibition in Nitra (Slovakia), the above-mentioned authors observed that the most common fault of body colouring in the standard chinchilla breed was the different colouring, as the head or chest area was paler than the rest of the body. Similar results were observed in our study, where 8% of 187 ChG presented less developed ticking.

Silvering in BLS should be uniform on the head, trunk and limbs (Supuka *et al.*, 2009). The most common fault in BLS by standard required colour discovered in this work was uneven silvering (20.0%), manifested mainly by a darker head and ears (17.5%) or darker nose region (11.4%) (Figure 9).

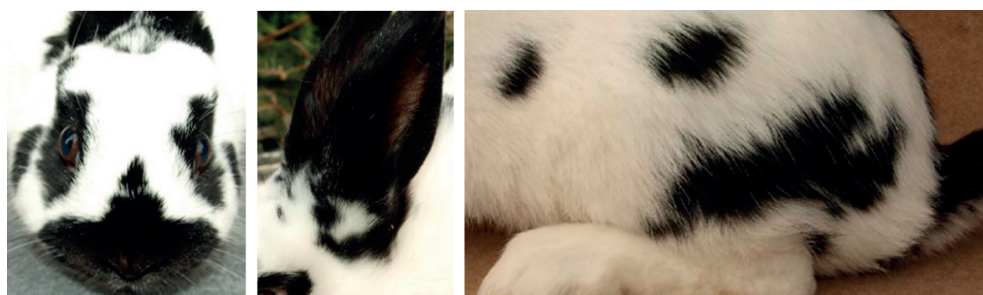
According to Gerlitz *et al.* (1993), breeding of rabbit breeds with drawing is very popular, however, achieving the required drawing prescribed by the standard is difficult. In many cases, the markings of GP had faults such as poor or too rich markings (35.3%), insufficient butterfly on the head with white spots around the ear base (29.3%), a small break in the saddle stripe from in front of the shoulder blades to the base of the tail (23.4%), the spots on the flanks joined up (9.4%) (Figure 10).



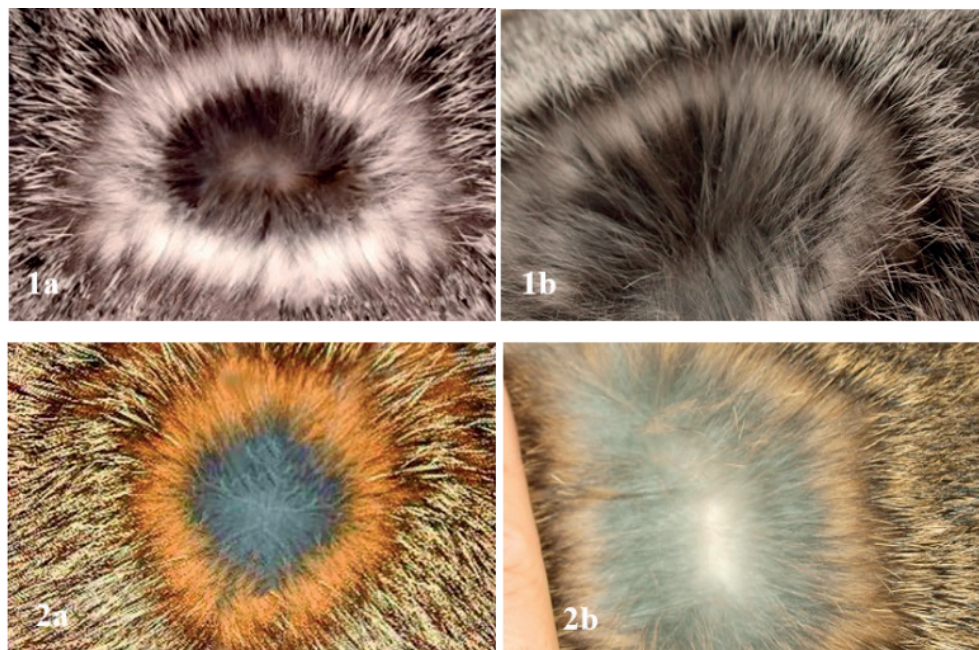
**Figure 9:** Exterior faults of Big Light Silver in the position - Top colour or Markings. Front left: Uneven silvering, darker top colour of body and nose region. Source: Photo by Pyskatý and Šimek (2018).

On the other hand, many individuals of GP (11.4%) with very good white base top colour or colour of the markings were found. The undercolour is usually evaluated in the sixth position. Exceptions are breeds with markings and white-coloured breeds, where the colour of markings and white top colour are judged respectively (Zadina, 2003). For most of our evaluated breeds, the undercolour was in accordance with the standard. There were slight variations in the giant and medium breeds with uneven or lighter undercolour. In the V-White, the undercolour was usually yellowish. The biggest problems of the undercolour were in the breeds and colour varieties with the agouti (ticking) factor (G Grey, L Grey, ChG, V-Grey, V-BI-Grey) in which the colour, width and limitation of the intermediate colour are judged. Intermediate colour is a coloured ring located between the undercolour and the top colour. In many cases, the undercolour was lighter at the base of the skin with a non-sharply defined intermediate colour (Figure 11).

According to Covrig *et al.* (2013) and Neirurerova *et al.* (2019), the important part of the chinchilla's coat colouring is the white intermediate colour, which creates a ring typical of the breed. Out of the total rabbit count, 5.7% cases of brighter undercolour were detected. Other faults were the changes in intermediate colour, which was often bright, hence, usually less bounded. Dopitova *et al.* (2018) posit their observation of lighter undercolour at the base of the skin in some rabbits of L with the agouti (ticking) factor. However, other individuals showed fine undercolour with the intensive intermediate colour. From our group of L with the agouti (ticking) factor, 47.9% of rabbits with undercolour and intermediate colour was observed in accordance with the standard. However, 36.1% of the individuals were almost brighter and less bounded undercolour. Up to 42.1% of V-BI-Grey were often optimally coloured undercolour, though with a bland intermediate colour. On the contrary, a remarkable undercolour with intensive intermediate colour was confirmed in only 23.7% of V-BI-Grey.



**Figure 10:** Exterior faults of Giant Papillon in the position - Top colour or Markings. From left: The insufficient butterfly on the head with white spots around the ears, the spots on the flanks joined up. Source: Photo by Pyskatý and Šimek (2018).



**Figure 11:** Exterior faults of Chinchilla Giganta and Vienna Grey in the position – Undercolour. Note: Very good intermediate colour in ChG (1a) and V-Grey (2a), 1b – Lighter undercolour at the base of skin with a non-sharply defined intermediate colour in ChG (1b) and V-Grey (2b). Source: Photo by Pyskatý and Šimek (2018).

## CONCLUSION

From the results obtained, it can be concluded that each breed of rabbits included in this study had certain exterior faults. In particular, slightly protruding hips, worse legs position, loose skin on the body, finer structure of ears and less elastic coat were the most commonly observed minor faults in position shape, type and coat, respectively. Major or disqualification faults including damaged or deformed ears, missing scrotum, split penis or dewlap in bucks were observed in the monitored giant and medium breeds. The knowledge of the actual analyses of the exterior faults and advantages is essential for both the rabbit judges and rabbit breeders for an accurate evaluation of the present state of the exterior in the monitored breeds and selective breeding methods, respectively.

The biggest challenge to be addressed in the future is the existence of rabbit breeds with a varied world gene pool for subsequent generations. The breeder associations have to implement rules for the creation and recognition of new variants of breeds and promote existing and established (traditional) breeds. Therefore, a governmental support would be very helpful to preserve traditional breeds. With well selected rabbits by judges with knowledge of the actual analyses of the exterior, it is possible to select individuals with the best exterior properties with the aim of improving the breed quality.

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