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Growth and Exterior Characteristics of F_2-Generation Hybrid Female Buffaloes

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Abstract. *The article presents the results of a study on the growth and development characteristics, age-related dynamics of live weight, and main exterior measurements of F_2-generation hybrid female buffaloes. The aim of the study was to determine changes in live weight and body measurements of hybrid female buffaloes at different age periods. The study was conducted on F_2-generation hybrid female buffaloes obtained through artificial insemination in private farms located in the Sheki-Zagatala region. Feeding and housing conditions of the animals were organized in accordance with zooveterinary requirements. It was determined that the live weight of the two studied hybrid females was 28 and 32 kg, respectively, at birth, 77 and 86 kg at three months of age, and 82 and 90 kg at six months of age. With increasing age, a consistent increase was observed in the main exterior measurements, including withers height, back length, rump width, chest depth, oblique body length, chest width, heart girth, and cannon bone circumference. The obtained results characterize the individual growth and development characteristics of F_2-generation hybrid female buffaloes and can be used to evaluate their growth and exterior traits in breeding and selection work.*

Keywords. *F_2 generation, hybrid female buffaloes, live weight, growth, development, exterior, body measurements, age dynamics, breeding and selection work, buffalo breeding*

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F_2 nəsli hibrid dişi camışların böyüməsi və xarici xüsusiyyətləri

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Xülasə. *Məqalədə F_2 nəsil hibrid dişi camışların böyümə və inkişaf xüsusiyyətlərinin, diri kütləsinin yaş dinamikasının və əsas eksteryer göstəricilərinin tədqiqinin nəticələri təqdim edilmişdir. Tədqiqatın məqsədi müxtəlif yaş dövrlərində hibrid dişi camışların diri kütləsində və bədən ölçülərində baş verən dəyişiklikləri müəyyənləşdirməkdən ibarət olmuşdur. Tədqiqatlar süni mayalandırma yolu ilə alınmış F_2 nəsil hibrid dişi camışlar üzərində Şəki-Zaqatala regionunda yerləşən fərdi fermer təsərrüfatlarında aparılmışdır. Heyvanların yemlənməsi və saxlanması zoobaytarlıq tələbləri nəzərə alınmaqla təşkil edilmişdir. Müəyyən edilmişdir ki, tədqiq olunan iki dişi hibridin diri kütləsi doğuş zamanı müvafiq olaraq 28 və 32 kq, üç aylıq yaşda 77 və 86 kq, altı aylıq yaşda isə 82 və 90 kq olmuşdur. Yaş artdıqca cidov hündürlüyü, bel uzunluğu, sağrı eni, döş qəfəsinin dərinliyi, bədənin çəp uzunluğu, döş eni, döş çevrəsi və pəncə çevrəsi kimi əsas eksteryer göstəricilərində ardıcıl artım müşahidə edilmişdir. Əldə olunan nəticələr F_2 nəsil hibrid dişi camışların fərdi inkişaf xüsusiyyətlərini xarakterizə edir və onların böyümə və eksteryer göstəricilərinin seleksiya-damazlıq işlərində qiymətləndirilməsi üçün istifadə oluna bilər.*

Açar sözlər: *F_2 nəsil, hibrid dişi camışlar, diri kütlə, böyümə, inkişaf, eksteryer, bədən ölçüləri, yaş dinamikası, seleksiya-damazlıq işi, camışçılıq*

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1. Introduction

At the present stage of livestock development, the study of animal growth and development characteristics is of great importance for assessing productivity and genetic potential. In particular, monitoring individual development indicators by age periods in hybrid offspring obtained from animals of different genetic origins makes it possible to determine their future economic and breeding significance.

Buffalo breeding is one of the traditional branches of livestock production in Azerbaijan, and research aimed at preserving the local buffalo gene pool and improving productivity traits is of particular importance. The biological characteristics and productivity indicators of Azerbaijani buffaloes have been extensively studied in various studies (Agabeyli, 1967, 1980; Agabeyli & Aliyev, 1960). Targeted breeding and selection work is considered one of the important directions in the development of buffalo breeding (Babayev, 1986; Bashirov, 2011).

Artificial insemination and embryo transplantation are considered modern biotechnological methods used worldwide to improve the breed composition of animals and overcome infertility. In addition to

being of great economic importance, artificial insemination and embryo transplantation form the basis of breeding and selection work (Khalilova et al., 2023).

The study of growth and development indicators in offspring obtained from the crossbreeding of buffaloes of different genetic origins is of particular importance for the evaluation of new genotypes. In this regard, live weight, body measurements, and exterior traits are considered key characteristics that reflect the level of individual development of animals. In this context, the study of the growth and development characteristics of F_2 hybrid animals obtained from the crossbreeding of Murrah and Azerbaijani buffalo breeds is of particular scientific and practical importance. A systematic study of growth and development indicators at different stages of ontogenesis makes it possible to identify genotypes of greater value for selection (Khalilova et al., 2026).

Studies aimed at determining genetic parameters of growth traits in Murrah buffaloes have emphasized the importance of age-related changes in live weight and the heritability of this trait from the perspective of selection (Joshi et al., 2022). The study of genetic markers associated with economically important traits in Murrah buffaloes is also one of the major directions of modern breeding programs (George et al., 2023).

The combined evaluation of productivity, reproductive performance, and health indicators is important for the genetic improvement of animals (Kumar et al., 2023). Studies of genetic and phenotypic variation in productive and reproductive traits in Murrah buffaloes make it possible to determine various selection criteria (Sharma, Dahiya, Bangar, Hada, et al., 2024; Sharma, Dahiya, Bangar, & Yadav, 2024). In recent years, studies have also been conducted to identify genomic regions associated with economically important traits using genomic data (George et al., 2024).

The study of growth and development processes in buffaloes at different age stages provides important information for assessing the formation of body conformation. The determination of genetic parameters of live weight at different stages of life in Anatolian buffaloes demonstrates the importance of age-related dynamics of this trait for selection purposes (Yazgan et al., 2026).

The study of growth and exterior characteristics of F_2-generation hybrid animals is particularly important. This is because the expression of genetic characteristics formed as a result of previous crosses in phenotypic traits of this generation is of interest for assessing individual development.

The aim of the study was to investigate the live weight and main exterior characteristics of F_2-generation hybrid female buffaloes at different ages and to determine changes in growth and body conformation.

2. Materials and Methods

The study was conducted on F_2-generation hybrid female buffaloes obtained through artificial insemination on private farms located in the Sheki-Zagatala region. The study material consisted of two F_2-generation hybrid female buffaloes. The housing and feeding of the animals were organized in accordance with zooveterinary requirements. The age characteristics of the animals were taken into account during feeding, and the diet included grain feeds, natural alfalfa hay, various types of straw, cottonseed meal, and salt as a mineral supplement.

At three months of age, the daily feed ration of the female buffaloes consisted of 1 kg of barley groats, 0.5 kg of corn groats, 6 kg of natural alfalfa hay, 2 kg of barley straw, 2 kg of cottonseed meal, 1 kg of wheat straw, and 0.10 kg of salt. The total amount of feed was 12.6 kg.

At six months of age, the daily ration consisted of 1.5 kg of barley groats, 1 kg of wheat groats, 0.5 kg of corn, 8 kg of natural alfalfa hay, 2 kg of barley straw, 2 kg of cottonseed meal, 2 kg of wheat straw, and 0.10 kg of salt. The total ration amounted to 17.1 kg.

During the study, the live weight of the animals was determined at birth, three months, and six months of age. In assessing exterior characteristics, the following measurements were taken into account: withers height, back length, rump width, chest depth, oblique body length, chest width, heart girth, and cannon bone circumference. The obtained data were compared by age periods, and the direction of changes in live weight and the main body measurements was determined.

3. Results

The live weight indicators of F_2-generation hybrid female buffaloes at different age periods are presented in Table 1.

Table 1
Age-related dynamics of live weight in F_2-generation hybrid female buffaloes

Age period	Female I, kg	Female II, kg
At birth	28	32
3 months of age	77	86
6 months of age	82	90

As shown by the data, the live weight of Female I hybrid was 28 kg at birth, reaching 77 kg at three months of age and 82 kg at six months of age. The live weight of Female II hybrid was 32, 86, and 90 kg, respectively, at the corresponding age periods.

Thus, in both animals, a more pronounced increase in live weight was observed from birth to three months of age. From three to six months of age, the increase in live weight was comparatively lower. The Female II hybrid had a higher live weight than Female I at all the age periods studied.

The age-related dynamics of the main exterior characteristics of F_2-generation hybrid female buffaloes are presented in Table 2.

Table 2
Main exterior characteristics of F_2-generation hybrid female buffaloes

Exterior characteristics	At birth	3 months	6 months
Withers height, cm	65	120	135
Back length, cm	60	122	141
Rump width, cm	55	130	138
Chest depth, cm	26	62	76
Oblique body length, cm	55	120	150
Chest width, cm	14	36	46
Heart girth, cm	60	160	180
Cannon bone circumference, cm	15	20	24

The analysis of the data presented in the table shows that, with increasing age, a consistent increase was observed in all studied exterior characteristics.

Withers height was 65 cm at birth, 120 cm at three months of age, and 135 cm at six months of age. Body length was 60, 122, and 141 cm, respectively. Hip width increased from 55 cm at birth to 130 and 138 cm at three and six months of age, respectively.

Chest depth was 26 cm at birth, 62 cm at three months, and 76 cm at six months of age. Oblique body length was 55, 120, and 150 cm, respectively.

Chest width increased from 14 cm at birth to 36 cm at three months and 46 cm at six months of age. An increase was also observed in hoof circumference, which increased from 15 cm to 20 and 24 cm, respectively.

The most noticeable change was observed in chest circumference. Chest circumference, which was 60 cm at birth, increased to 160 cm at three months and 180 cm at six months of age. The increase in this parameter with age characterizes the intensive formation of body conformation.

4. Discussion

The results of the study showed that live weight and the main exterior characteristics of F_2-generation hybrid female buffaloes changed consistently with increasing age. A particularly pronounced increase in live weight was recorded from birth to three months of age.

The study of genetic parameters of growth traits in Murrah buffaloes demonstrates the importance of live weight and other growth indicators from a selection perspective (Joshi et al., 2022). Studies aimed at identifying genetic markers associated with economically important traits in Murrah buffaloes also indicate the importance of investigating the genetic basis of growth and productivity traits (George et al., 2023).

In the present study, the second hybrid female had a higher live weight at all age periods, indicating individual differences in growth and development. However, since only two animals were studied, it was not possible to determine the statistical significance of these differences. Therefore, the obtained results should be considered as preliminary observation and assessment data.

The age-related increase observed in the exterior characteristics is associated with the formation of the animals' body conformation. Increases in withers height, body length, hip width, chest depth, oblique body length, chest width, chest circumference, and hoof circumference characterize the individual development of the hybrid animals.

In modern buffalo production, the comprehensive assessment of productive and reproductive characteristics is one of the main directions of breeding programs (Kumar et al., 2023; Sharma, Dahiya, Bangar, Hada, et al., 2024). The study of genetic and phenotypic variability makes it possible to evaluate various traits from a selection perspective (Sharma, Dahiya, Bangar, & Yadav, 2024).

The biological and productive characteristics of Azerbaijani buffaloes have been studied for many years (Agabeyli, 1967, 1980; Agabeyli & Aliyev, 1960). Consideration of the characteristics of the local gene pool and the implementation of targeted selection work are important for the development of buffalo production (Babayev, 1986; Bashirov, 2011).

The study of the obtained characteristics in F_2-generation hybrids on a larger number of animals in future research may allow more accurate determination of the general patterns of growth and exterior

characteristics. In this regard, the obtained results are of importance as a preliminary database for future breeding and selection work.

5. Conclusion

The study of the growth and exterior characteristics of F_2-generation hybrid female buffaloes established that live weight and the main body measurements increased consistently with advancing age.

At birth, the live weights of the first and second hybrid females were 28 and 32 kg, respectively; at three months of age, they reached 77 and 86 kg, and at six months of age, 82 and 90 kg, respectively. The second hybrid female had a higher live weight at all studied age periods.

The age dynamics of the exterior characteristics also demonstrated the consistent formation of body conformation. An age-related increase was observed in withers height, body length, hip width, chest depth, oblique body length, chest width, chest circumference, and hoof circumference.

The obtained results provide preliminary data for evaluating the growth and exterior characteristics of F_2-generation hybrid female buffaloes. The studied parameters can be used to assess the individual development and breeding and selection characteristics of hybrid animals.

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