



Population Structure of Kokok Balenggek Chicken in In-situ Area as Indigenous Chicken of Indonesia

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Abstract | Kokok Balenggek Chicken (KBC) is a local chicken in West Sumatra as a crowing chicken. This study aims to obtain primary data on population structure and management of KBC maintenance in in-situ areas. The respondents of this study were fifty-seven farmers who kept the KBC. The method was survey method and purposive sampling to determine the respondents. The observed variables were breeder profile, maintenance management, number of KBC, actual population (Na), effective population (Ne), and inbreeding rate. The total population of KBC in Nagari Batu Bajanjang, Tigo Lurah District is 1960, with an actual population of 610 chickens, an effective population of 600 chickens, and an inbreeding rate of 0.08%. The result showed the farmer's profile 89.47% of respondents was in 25-55 years old, 47.37% respondent was educated in elementary school, 42.11% respondents has 5-10 years farming experience, 56.14% respondents distributed in Jorong Koto Tuo, 98.2% respondent raising KCB as a side business, 56.1% of KCB was for breeding purposing, and 50.88% respondents owned of 25-50 chickens. The farmers still used a traditional maintenance system with natural mating, own seed sources, and hatching methods in maintenance management. There were cuts in KBC 59.65% with 277 chickens and sales of KBC 64.91% with 397 chickens, It concluded that the increase in the KBC population in in-situ areas is still slow, so it is necessary to improve maintenance management strategies in order to maintain indigenous chicken Indonesian especially in West Sumatera.

Keywords | Kokok Balenggek Chicken, Population Structure, Management, in-situ area, West Sumatera

Received | December 23, 2021; **Accepted** | January 27, 2022; **Published** | March 25, 2022

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Citation | Husmaini, Putra RA, Juliyarsi I, Edwin T, Suhartati L, Alianta AA, Harmaini (2022). Population structure of kokok balenggek chicken in in-situ area as indigenous chicken of Indonesia. Adv. Anim. Vet. Sci. 10(5): 993-998.

DOI | <http://dx.doi.org/10.17582/journal.aavs/2022/10.5.993.998>

ISSN (Online) | 2307-8316



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INTRODUCTION

West Sumatra is rich in genetic resources (SGD) of local livestock, one of it is the Kokok Balenggek Chicken (KBC). The KBC is a specific local chicken in West Sumatra determined by the Ministry of Agriculture no. 2919/Kpts/OT.140/6/2011. This KBC needs to be protected, developed, and preserved, as stated in the Ministry of Agriculture (2011). This local chicken clump comes from Payung Sekaki District, and Tigo Lurah, Solok Regency, West Sumatra. These four breeds categorised as crowing

chicken were Kokok balenggek chicken from West Sumatra, Bekisar chicken from East Java, Gaga chicken from southern Sulawesi (Zulistiana and Abinawantoa, 2018), and Pelungchicken from Cianjur District, West Java Province (Daryono et al., 2020)

The advantage of KBC is that it has a distinctive sound, namely a large number of crowing shrieks, so it has a high economic value to be entered in livestock contests. However, not all KBC have many crowds, so farmers in in-situ areas also use KBC for consumption as a source of

protein. Nowadays, KBC lovers are increasing, it proved by the existence of a KBC lover community formed, and the frequent KBC contest events are held.

The efforts to develop the potential of KBC as a local chicken of West Sumatra, both as crowing chickens and potential as broilers type. The reserchers needs to have primary data in the form of KBC population structure and KBC maintenance management, especially in the in situ area of KBC origin. The actual population is the number of adult male and female cattle used to produce seedlings. The effective population size (Ne) is related to the genetic variability needed to estimate the rate of inbreeding per generation (Subandriyo, 2003).

Based on that explanation, this study aims to calculate population structure, calculate effective population size (Ne), actual population size (Na), inbreeding rate per generation (ΔF), and breeder profiles, and KBC maintenance management in situ areas in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency, West Sumatera.

MATERIAL AND METHODS

The respondents of this study was KBC farmers in the in-situ area of Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency. The method used was survey method. The sampling was used purposive sampling. The variables calculated were the number of adult roosters, the number of adult hens, the number of young roosters, the number of young hens, the number of chicks, the actual population (Na), the number of effective populations (Ne), the rate of inbreeding per generation (ΔF), profiles of breeders and breeders' businesses, as well as management of KBC livestock rearing.

The actual population is calculated by adding the adult roosters with the adult hens: $N_a = N_m + N_f$. The number of effective population measured according to Hamilton (2009):

$$N_e = \frac{(4N_m N_f)}{N_m + N_f}$$

The inbreeding rate per generation was measured according to Hamilton (2009):

$$\Delta F = \frac{1}{2N_e}$$

Description:

N_m = number of breed male

N_f = number of breed female

N_a = Actual population

N_e = Effective population

F = rate of inbreeding

RESULT AND DISCUSSION

PROFILE OF THE KOKOK BALENGGEK CHICKEN BREEDER IN NAGARI BATU BAJANJANG, TIGO LURAH DISTRICT, SOLOK REGENCY

The profile of KBC breeders in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency showed in Table 1. Based on the Table 1, 89.47% KBC farmers were 2555 years old. Almost all farmers were in productive age for their physical ability to run their business. Central Statistic Agency stated that based on the composition of the population, the age of the population grouped into three: 014 years where the age is not productive yet, the age 1563 is the productive age and >63 is the unproductive age.

Table 1: Profile of the Kokok Balenggek Chicken Breeder in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency

No	Parameter	Range	Total	Percentage (%)
1.	Age	< 25 years	1	1.75
		25–55 years	52	89.47
		> 55 years	5	8.77
2.	Education	No school	3	5.26
		Primary school	27	47.37
		Junior high school	14	24.56
		Senior high school	12	21.05
		Bachelor	1	1.75
3.	Farming experience	< 5 years	22	38.60
		5–10 years	24	42.11
		10 > years	11	19.30
4	Farmer distribution	Koto Tuo	32	56.14
		Kampung tengah	11	19.30
		Batu Bajanjang	12	21.05
		Sungai Pincuran	2	3.51

The education level of KBC breeders dominated elementary school graduated with 47.37%, and only 1.75% graduated at the undergraduate level. Meanwhile, based on farming experience, 19.30% of farmers breeders have more than ten years of experiences, and 38.60% have less than five years of experiences. The level of education and farming experiences on raising the livestock can affect the skills,

insight, and use of technology to develop their farms.

The business profile of KBC farmers in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency showed in Table 2. Most the business status of farmers are side businesses (98.2%) and the using the KCB for for consumption (40.04%) as breeding purposive as much 56.1% and as a hobby 3.51%. It was contrast based on the function of KBC in ex-situ areas. KCB used, mostly hobbies to be included in singing chicken contests. Concerning the status of the breeder's business which is only a side business, 50.88% the average number of KCB owned by the farmers is around 2550 heads. While, only 15.79% farmers owning more than 50 KBC.

Table 2: Business Profile of KBC Breeders in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency

No	Parameter	Type	Total	Percentage (%)
1.	Business status			
		Main business	1	1.8
		Side business	56	98.2
2.	Livestock function			
		Cultivation	32	56.1
		Hobby	2	3.5
		Consumption	23	40.4
3.	Number of Live-stock	<25	19	33.33
		25-50	29	50.88
		>50	9	15.79

POPULATION STRUCTURE OF KOKOK BALENGGEK CHICKEN BREEDER IN NAGARI BATU BAJANJANG, TIGO LURAH DISTRICT, SOLOK REGENCY

The population structure and percentage of KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency showed in Table 3.

The total population of KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency is 1960, with the highest population found in Jorong Koto Tuo, namely 1005 individuals and the least in Jorong Sungai Pincuran, as much 63 individuals. These population increased based on Mukhdi's (2011) research results, with a population of 368 KBC in Nagari Batu Bajanjang. There is an increase of 1592 heads in 10 years or 160 birds/year. Akbar (2014) reported that the KBC population in Nagari Rangkiang Luluh was 548 heads. Meanwhile, in the ex-situ KBC population in the KBC lovers association was 1154 (Iswanto, 2018).

The slow increase in the KBC population in-situ was due

to the traditional raising system and the status of a side business so that farmers are not serious about developing their KCB population. While the KBC raising system in ex-situ is already on an incentive basis, the increase in the ex-situ population is also in line with the increase in KBC lovers.

The population structure of KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency, based on Table 3. were 13.52% adult males, 17.60% adult females, 14.69% young males, 17.70% young females, and 36 chicks, 48%. The ratio of adult male and female KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency is 1:1.3. The study results by Rusfidra et al. (2015) showed that the sex ratio of KBC raised in-situ was 1:1.7 and 1:3 for KBC ex-situ (Rusfidra et al., 2014). The recommended sex ratio is 1:8-1:10. The high sex ratio causes males to be underutilized, so it is necessary to increase hens to ensure the proper utilisation of males (Hagan et al., 2013).

The high sex ratio of males to females caused by the population of adult males in Nagari Batu Bajanjang is high. This was due to the high selling value of KBC in adult males, which used as crowing chicken for those who have much crowing while those who do not have long crowing will consumed as a source of protein.

The actual population (Na) of KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency is 610 heads. There was an increase in the actual population, as much 83 head of chickens (Mukhdi, 2011) and 184 head of chickens (Sari, 2014) in Nagari Batu Bajanjang. The highest actual population founded in the Jorong Koto Tua, 280 individuals, and the least in the Jorong Sungai Pincuran, 38 According to Subandriyo (2003), the actual population is the number of adult male and female cattle that will produce seeds. The actual population of adult males and females of productive livestock is the most important factor to be taken into account in livestock development efforts.

In Table 4. showed that the effective population (Ne) of KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency is 600 head of chickens. Mukhdi (2011) reported that the effective population of KBC in 2011 was 83 and 168 in 2014 (Sari, 2014). The value of Ne will be smaller than the value of Na, because Ne is an adult male and female cattle selected to produce good seeds. Ne can also be used to determine the status of a population (Warwick et al., 1990). In addition, the value of Ne can also estimate the rate of inbreeding per generation in a population.

In Nagari Batu Bajanjang, Tigo Lurah sub-district, KBC had an inbreeding rate of 0.08%. This indicates that natural marriages still occur randomly and have no kinship in

Table 3: Population Structure of Kokok Balenggek Chicken Breeder in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency

NO	JORONG IN NAGARI BATU BAJANJANG	Adult		Young		Chicks	TOTAL
		Rooster	Hen	Rooster	Hen		
1	Koto Tuo	131	149	168	175	382	1005
2	Kampung tengah	70	119	61	114	183	547
3	Batu Bajanjang	43	60	49	54	139	345
4	Sungai Pincuran	21	17	10	4	11	63
	TOTAL	265	345	288	347	715	1960
	PERCENTAGE (%)	13.52	17.60	14.69	17.70	36.48	100.00

Table 4: Actual Population (Na), Effective Population (Ne) and Inbreeding Rate of KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency

No	Parameter	Koto Tua	Kampung Tengah	Batu Bajanjang	Sungai Pincuran	Total
1	Number of males (Nm)	131	70	43	21	265
2	Number of females (Nf)	149	119	60	17	345
	Actual Population (Na)	280	189	103	38	610
	Effective Population (Ne)	279	176	100	38	600
	Inbreeding rate (%)	0.18	0.28	0.50	1.33	0.08

Jorong Koto Tua (0.18%), Kampung Tengah (0.28%), and Batu Bajanjang (0.50%). Meanwhile, KBC in Jorong

Sungai Pincuran, the inbreeding rate has reached (1.33%). So there was a decreased in production and performance of KBC in the jorong Sungai Pincuran. The rate of inbreeding in other singer chickens is like pelung 0.88% (Daryono, et al., 2021). According to Praharani et al. (2009), an increase in the inbreeding rate of 1% can reduce production, which causes a decrease in the performance of the livestock. Therefore, it is necessary to regulate the marriage system and selection program to avoid inbreeding and improve the genetic quality of KBC, which has high economic value, namely the number of longans (singing chickens) and body weight. Rusfidra et al. (2014) reported that the KBC inbreeding rate in ex-situ areas was 0.31%. One effort to minimize inbreeding is to maximize the effective ratio in the KBC population (Rusfidra et al., 2014).

KBC MANAGEMENT IN NAGARI BATU BAJANJANG, TIGO LURAH DISTRICT, SOLOK REGENCY

Management of KBC raising in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency as an in-situ area can showed in Table 5. The source of 100% of KBC seeds comes from own breed chickens with a natural mating system. The KBC farmers in Nagari Batu Bajanjang kept traditionally. The KCB are released and caged around the house and given makeshift feed in rice, bran, and leftover rice. The hatching method still uses broodstock with a hatchability of 89%. There was no hatching technology in producing day old chick KBC. One of the causes of the

slow development of the KBC population in the in-situ area there were only 1849 KBC eggs/year that incubated with an average of 2 egg-laying periods/year.

Another obstacle that be the factor of slowing increase and development of the KBC population in in-situ areas was 26% of cages and inadequate locations, 11% of weather, which has an impact on disease incidence, which is 23%, because most of the livestock business is a side business (Table 2) and traditional raising methods (Table 5) In terms of the cage and feed management, it has not been carried out correctly. According to Pius et al. (2021), poultry management as a critical factor to solving food and nutrition security with special faocus on chicken breeding. Disease control and mortality in local chickens can conducted by improving management (Ozian et al., 2019).

In Table 5. there were 59.65% cuts in KBC in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency as an in-situ area. There were 115 adult males, 131 adult females, and 16 KBC chicks farmers slaughtered. The highest cutting was that KBC had a poor crowing that was 52.94%, then it was consumed as a protein source 29.41%, as a treatment 8.82% and the rest with the reason that most of the females were 8.82%. In contrast to KBC reared in ex-situ, KBC cutting was rarely done. The related to maintaining KBC in ex-situ areas, mainly as a hobby, namely singing cocks for contests.

In addition to being consumed, KBC farmers in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency also

sell their chickens, 64.91%. The number of cattle sold is 218 adult males and 179 adult females. The selling price range of KBC also varies, starting from IDR 50,000 to over IDR 1,000,000. The selling price of KBC is directly proportional to the quality of KBC livestock by considering gender, the number of crows, and the quantity of crowing of KBC chickens.

Table 5: KBC Management in Nagari Batu Bajanjang, Tigo Lurah District, Solok Regency

No	Parameter	Type	Total
1	Source Livestock breeding	Own Chicken (%)	100
2	Marriage system	Natural marriage (%)	100
3	Management	Traditional (%)	100
4	Type of feed	Rice, bran (%)	100
5	Hatching aspect	Hatchability(%)	89
		Number of eggs (eggs/year)	1849
		Incubation (%)	100
6	Obstacles	Insufficient cage (%)	26
		Inadequate location (%)	26
		expensive feed (%)	14
		Weather (%)	11
		Disease (%)	23
7	KBC Cutting	Yes (%)	59.65
		No (%)	40.35
8	number of chickens cut	Number of males	115
		Number of females	131
		Number of chicks	16
9	Reason for Cutting	Consumption (%)	29.41
		Crow is not good (%)	52.94
		Treatment (%)	8.82
		Most hens (%)	8.82
10	KBC Sales	Yes (%)	64.91
		No (%)	35.08
11	Amount sold	Number of males	218
		Number of females	179

CONCLUSION

The total population of KBC in Nagari Batu Bajanjang, Tigo Lurah District is 1960, with an actual population of 610 chickens, an effective population of 600 chickens, and an inbreeding rate of 0.08%. The breeder's profile consists of breeders aged 25–55 years 89.47%, elementary school education 47.37%, farming experience 5–10 years 42.11%, distribution of breeders 56.14% in Jorong Koto Tuo, 98.2% a side business, 56.1% livestock for cultivation,

with a quantity of livestock ownership of 25–50 chickens 50.88%. 100% is still a traditional maintenance system with natural mating, own seed sources, and hatching methods in maintenance management. There were cuts in KBC 59.65% with 277 chickens and sales of KBC 64.91% with 397 chickens.

ACKNOWLEDGEMENTS

The authors want to thank the Directorate General of Higher Education, Ministry of Education, Research and Technology, for funding our research with contract number 021/E4.1/AK.04.PRN/2021 and LPPM Andalas University with Contract Number T/4/UN.16.17/PT.01.03/PRN-Pangan/2021.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

NOVELTY STATEMENT

The authors found that the total population of KBC in Nagari Batu Bajanjang, Tigo Lurah District is 1960 chickens, with an actual population of 610 chickens, an effective population of 600 chickens, and an inbreeding rate of 0.08%.

AUTHORS CONTRIBUTION

Husmaini, Riza Andesca Putra, Indri Juliyarsi, Tevina Edwin, Linda Suhartati, Aditya Alqamal Alianta, Harmaini contributed to conducting research, data processing and writing this manuscript.

REFERENCES

- Akbar F (2015). Population Structure Of The Kokok Balenggek Chicken In Nagari Rangkiang Luluh, Tigo Lurah Sub-District, Solok District. Skripsi (Unpublished). Faculty of Animal Science Andalas University, Padang.
- Daryono BS, Mushlih M, Perdamaian ABI (2020). Vocalization characters and Forkhead Box P2 (FoxP2) polymorphism in Indonesian crowing-type chicken (*Gallus gallus domesticus*). Iran J. Appl. Anim. Sci., 10(1): 131-140.
- Daryono BS, Mushlih M, Perdamaian ABI (2021). Crowing sound and inbreeding coefficient analysis of *Pelung* chicken (*Gallus gallus domesticus*). Biodiversitas, 22(5): 2451-2457. <https://doi.org/10.13057/biodiv/d220501>
- Hagan JK, Bosompen M, Adjei IA (2013). The production performance of local chickens in three ecological zones of Ghana. ARPN J. Agric. Bio.Sci, 8:51-56
- Hamilton M B (2009). Population Genetics. Blackwell Publishing, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO198SQ, UK

- Iswanto D (2018). Population structure and productivity of Kokok Balenggek Chicken in the Association of Kokok Balenggek Lovers in West Sumatra. Skripsi (Unpublished). Faculty of Animal Science Andalas University, Padang.
- Indonesia Ministry of Agriculture (2011). SK. Menteri Pertanian No. 2919/Kpts/OT.140/6/2011 about Kokok Balenggek Chicken as The Nation Animal Genetic Resources.
- Mukhidi E (2011). Population Structure of Kokok Balenggek Chicken in Tigo Lurah Sub-District, Solok District. Skripsi (Unpublished). Faculty of Animal Science Andalas University, Padang.
- Ozian N, Agustina F, Moelyo H (2019). Sistem Pemeliharaan dan Kontribusi Usaha Ternak Ayam Lokal (*Gallus Domesticus*) terhadap Pendapatan Rumah Tangga Peternak. J. Integrated Agribus., 1(2): 107-114. <https://doi.org/10.33019/jia.v1i2.1070>
- Pius LO, Staurz P, Kusza S (2021). Overview of Poultry Management as a Key Factor for Solving Food and Nutritional Security with a Special Focus on Chicken Breeding in East African Countries (Review). Biology, 10(8): 1-20. <https://doi.org/10.3390/biology10080810>
- Praharani LE, Juarni, Budiarsana LGM (2009). Parameter indicator inbreeding rate pada populasi ternak kerbau di Kabupaten Lebak Provinsi Banten. Makalah pada Seminar dan Lokakarya Nasional Kerbau. Bogor.
- Rusfidra, Gusrizal M, Gusrin Y, Abbas M, Husmaini (2015). Flock Composition, Effective Population Size, and Inbreeding Rate of Kokok Balenggek Chicken Breed under In-situ Conservation. I.J. Poult. Sci. 14 (2):117-119. <https://doi.org/10.3923/ijps.2015.117.119>
- Rusfidra, Marajo SDT, Heryandi Y, Oktaveriza B (2014). Estimation of inbreeding rate in Kokok Balenggek Chicken (KBC) population under ex-situ conservation. Int. J. Poult. Sci., 13:364-367. <https://doi.org/10.3923/ijps.2014.364.367>
- Sari DY (2015). Population Structure of Kokok Balenggek Chicken In Nagari Batu Bajanjang, Tigo Lurah Sub-District, Solok District. Skripsi (Unpublished). Faculty of Animal Science Andalas University, Padang.
- Subandriyo (2003). Konservasi sumberdaya genetik ternak, pertimbangan, kriteria, metoda dan strategi. Lokakarya Nasional Pengelolaan dan Perlindungan Sumber Daya Genetik di Indonesia: Manfaat Ekonomi untuk Mewujudkan Ketahanan Nasional, Hal. 124-137
- Warwick EJ, Astuti JM, Hardjosubroto W (1990). Pemuliaan Ternak. Gadjah Mada Universitas Press, Yogyakarta.
- Zulistiana T, Abinawanto A (2018). Morphometric and bioacoustic analysis Gagachicken (*Gallus gallus domesticus*) at Bangkalan, Kamal Madura. AIP Conf. Proc. 2023:<https://doi.org/10.1063/1.5064139>
- Zulistiana T, Abinawanto A (2018). Morphometric and bioacoustic analysis Gagachicken (*Gallus gallus domesticus*) at Bangkalan, Kamal Madura. AIP Conf Proc 2023:020142. <https://doi.org/10.1063/1.5064139>