

RESEARCH ARTICLE



Population of The Javan Surili (*Presbytis comata*) in The Taman Safari Indonesia Bogor Forest Area

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Abstract

Taman Safari Indonesia Bogor is a buffer zone for the Mountain Gede Pangrango National Park conservation forest area and is one of the habitats for the Javan surili (*Presbytis comata*), but there is no research data on wild Javan surili populations. The object of research is to find out how many populations of Javan surili are in the TSI Bogor forest area. The research method used the line transect method by collecting data on the number of individuals, the number of groups, the sex ratio, and the age structure. The research was conducted at four observation locations with a duration of three months, observations were made from 06.00 WIT to 17.00 WIT, and four repetitions were carried out on each observation path, the results obtained were a total of 16 Javan surili individuals found which were divided into one group, and the estimated population density is 0.06 individuals/hectare. The sex composition of male and female Javan surili in the TSI Bogor forest area is 1:6 where there are more female Javan surili than male Javan surili, and for the age structure of the Javan surili the most are in the adult age class with a percentage of 43.75%, juvenile 31.25%, and the percentage of infant by 25%.

Keywords: buffer zone, Javan surili, population, *Presbytis comata*, Taman Safari Indonesia Bogor

1. Introduction

The Javan surili (*Presbytis comata*) is a primate from the island of West Java. The Government of the Republic of Indonesia designated the Javan surili as a protected primate through a Decree of the Ministry of Environment and Forestry Number. 106/MENLHK/SETJEN/KUM.1/12/2018 concerning protected plant and animal species (24). The International Union for Conservation of Nature (IUCN) Red List (2020) includes the Conservation status of the Javan langurs in the endangered (EN) category, and the Convention on International Trade in Endangered Species (CITES) classifies the Javan surili in the category Appendix II (13).

The Javan surili population has continued to decline until now and the number recorded in the IUCN (2020) is estimated at 1400 to 1500 adult individuals (Nijman and Setiawan 2020) (16). The existence of the Javan surili is endangered due to several factors. As revealed by Supriatna and Wahyono (2000) Javan surili are threatened due to a reduction in their habitat which has reached 96%, from an area of 43.274 km² to 1608 km² (18). Alikodra (2002) added that the Javan surili experienced disturbances such as a decrease in population numbers and loss of habitat due to human activities such as hunting, destroying habitat, and polluting the environment (2). Declining populations of Javan surili in nature can cause changes to populations of other types or ecosystem processes because these primates have an important role in the structure, function, or productivity of ecosystem habitats (habitat, soil, and seed dispersers) (Roberge and Angelstam 2004) (17).

One of the habitats of the Javan surili forest Javan surili in West Java where there is concern that the Javan surili population is threatened is the buffer zone area, especially the Taman Safari Indonesia (TSI) Bogor Forest area, which has been designated as a Conservation Institution. The TSI Bogor forest area which has an area of 2.650.000 m² (265 ha) is a former tea plantation and mixed garden owned by the South Cisarua tea plantation company which is no longer productive. In the General Spatial Plan (RUTR) for the Puncak Area (Keppres 79/85), the TSI Bogor area is included in the Agricultural Cultivation Area, which is designated as a Tourism Area, namely the Puncak Indah Tourism Area (covering 3 sub-districts namely Ciawi, Megamendung and Cisarua). At the time of its construction, TSI Bogor had planted

more than 600 thousand trees for reforestation so as not to eliminate the area's essential function as a water catchment area. In 1981 the construction of TSI Bogor began, after five years of development and reforestation of the former South Cisarua tea plantation area. In 1986, TSI Bogor was opened to the public.

Based on information from Mount Gede Pangrango National Park (MGPNP) and the West Java Natural Resources Conservation Agency (NRCA West Java), the population of the Javan surili in this area has no data on the number and population of Javan surili in the TSI Bogor forest area as a buffer zone. It is possible that within the area there are several threats that could possibly interfere with the existence of Javan surili, such as community activities in forest area boundaries for hunting, gardening, and taking other forest products.

There is no data on the Javan surili population in this area, so there is a need for research on the Javan surili population so that it can become a database for the Javan surili conservation program in West Java, especially in the TSI Bogor forest area as a MGPNP buffer zone in (Figure 1).

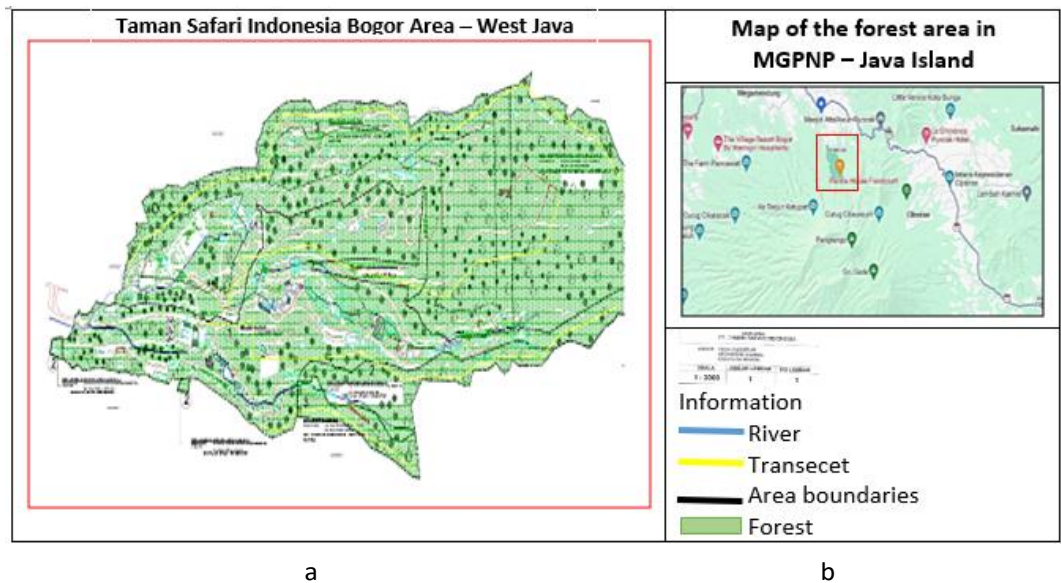


Figure 1. a. The map of the TSI Bogor forest area and the Java surili observation area is green and b. MGPNP area map. Description: All areas colored in green are locations where researchers observed the Javan Surili group. The red line represents the main road that is usually passed by people and vehicles. Blue represents waterways and pools. The yellow line represents the Javanese surili observation transect

2. Research Methodology

2.1. Study Area

This research was conducted in the TSI Bogor forest area. The research was conducted for 3 months, starting from January to March 2023. The length of time the observations were made in one day was 8 hours, with a total observation time of 66 days. Total forest area about 265 ha with diverse green land cover of 245 ha. Land cover consists of secondary natural forest and mixed natural forest vegetation. This area has a topography of hills and mountains with slightly sloping areas, and altitudes ranging from 1000 to 1550 m asl. In general, the TSI Bogor forest is an area with a wet climate with an average rainfall of 3000 to 4000 millimeters/year. The average temperature at TSI Bogor is 16° to 23°C with relatively high humidity throughout the year, which is around 80 to 95%.

2.2. Data Collection

Methods of collection data, including a preliminary survey of forest areas where the object is active and making research paths. Preliminary surveys were carried out by identifying the forest area which was carried out by researchers to adjust field conditions to the work map.

Apart from that, determine the paths and observation points, as well as know the characteristics of the Javan surili habitat, and each path and observation point were marked with a marking using a survey tape.

The data collected are the number of individuals, the number of groups, the sex ratio (female, male, juvenile, and infant), and the age structure (Table 1). Population data consists of primate species and numbers of members in the group.

Table 1. Individual physical characteristics by age (Napier and Napier 1967) ⁽¹⁴⁾.

Category	Age range (year)	Explanation
Infant	0-4	Orange yellow in color, still suckling and in its adult female.
Juvenile	4-8	Sexual characteristics are not very visible yet, the color resembles an adult individual, is able to mobilize itself, but is still around its adult female.
Adult	8-20	Dominant watching behavior, physical organs are fully developed, especially sexual organs (sexually mature), and generally have the largest body size compared to the lower age class.

2.3. Population Data Collection

The effective number of hours spent during the survey was 528 hours (average 8 hours per day). Data collection on the population of Javan surili was carried out using the transect method (Anwar 1995) ⁽¹⁾ in (Figure 2). The method is the best method for low population density estimation (Caughley 1977) ⁽⁷⁾. Even though the ideal transect is a straight strip, the direction of the transect in this study was diverted when encountering a ravine, or topographical conditions that made it impossible to pass but still oriented in the direction that had been determined at the starting point of observation. Data recorded when encountering primate groups are primate species, number of group members, observer distance to primate individuals first seen (*r*), and angles formed into primate position (θ), observer position and observation path direction. The observation line is 4 lanes, and the length of each lane is 1 km. The number of replications on each line is 20 times. The length of the path made by the researcher was at least 1000 m (1 km), the width of the path on each observation path was 50 m to the right and 50 m to the left, the total width of the observation path is 100 m, this is to make it easier for observers to see objects Javan surili along the stripe. The survey was conducted by researchers with walking slowly (1 km/hour) and stopped several times minutes to find a swaying branch and the sound of a Javanese surili. The researcher was accompanied by a security person to observe until 17.00, with a break during the day from 12.00 to 13.00 WIT. Number of individuals, age classes, and groups from the Javan surili noted in prepared worksheet.

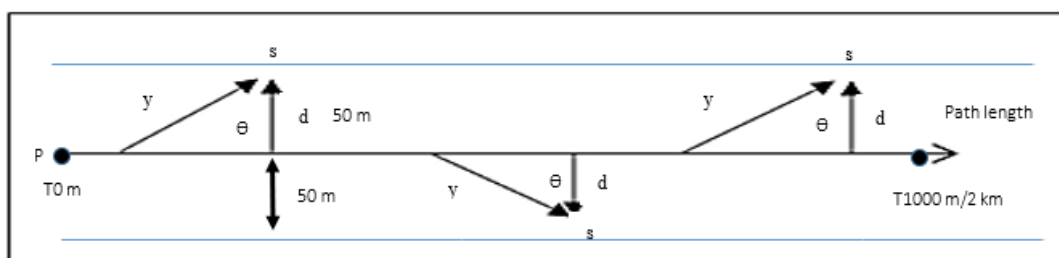


Figure 2. Strips transect method. Description: T0 m (starting point); T1000 m/1 km (endpoint); P (observer); *y* (distance between animals and observers); θ (angle between the animal's position and the observation path); *d* (distance perpendicular to the animal's position and the observation path); and *s* (animal position). Source Anwar (1995).

2.4. Data Analysis

The data analysis for the population was the estimation of individual density of each primate species. The first step is to calculate the perpendicular distance (*y*) of each primate position to the observation path: the observer's distance from the animal (*r*) multiplied by the angular sinus (θ). The perpendicular distance is used to estimate the width of the observation path.

In this study, the perpendicular distance used is the widest distance after eliminating the outlier data. Thus, the population density is calculated using the formula (Directorate General of Forestry 1978) ⁽⁹⁾: If we were doing a complete count in a strip transect of width *w*, this should be number counted/area covered.

$$D = n / I$$

Description:

D = population density

n = total primate encountered (individual)

I = wide research area (hectare)

Identification of the age structure of Javan surili in the field based on Siahaan (2002) (20), while for data analysis using the following formula:

Composition sex ratio = amount of males / number of females

Age structure (Santoso et al. 2014) = number of individuals / total number of individuals x 100% (22).

Observations were made by walking along the path and stopping at each observation point, each observation path was repeated 22 times. Observations on each route started at 06.00 AM to 17.00 PM. Data collected were the number of individuals, number of groups, sex ratio and age structure

3. Results

3.1. Population density

Population density is the relationship between the number of individuals per unit area and the volume of space it occupies at any given time. The number of individuals of Javan surili that were found in the TSI Bogor forest area was 16 individuals with an estimated population density of 0.06 individuals/ha. The Java surili population found is in Table 2. The number of these individuals was not spread over all observation lines, the path that found the Javan langurs was only in the second line, in line two there was only 1 group, while on the other lines, there was no Javan surili population found, one of the factors causing the Javan surili not to be found on all these routes it is suspected that there are no other Javan surili in this area.

Another thing is that the Javan surili were not found in the TSI Bogor forest area. Apart from disturbing the existence of the Javan surili forest, it is also feared that it could have an impact on the loss of the Javan surili population and habitat in the TSI Bogor forest area. If seen from the boundaries of the TSI Bogor area, which to the east is already bordered by tea plantations to the west it is bordered by residential areas, plantations, and tourist attractions, and to the south, it is directly adjacent to densely populated settlements. Automatically the Javan surili only moves in the northern part which is directly adjacent to the MGPNP forest area. In principle, wildlife populations can also experience changes in the dynamics of the existing environment. Changes in forest quality that occur due to various human activities have a negative effect on wildlife populations in nature. Alikodra (2010) suggests that human activity can be the cause of the decline in the quality of the forest environment as a habitat and the state of the Javan surili population in its natural habitat (3). The surili population has continued to decline until now and the number recorded in the IUCN (2020) is estimated at 1400 to 1500 adult individuals (Nijman and Setiawan 2020) (13). According to other researchers, the loss of surili populations in nature can cause changes to populations of other types or ecosystem processes, because these animals have an important role in the structure, function, or productivity of ecosystem habitats (habitat, soil, and seed dispersers) (Roberge and Angelstam 2004) (17).

Table 2. Population density and groups of Javan surili in each lane of the TSI Bogor forest area

Transect	Coordinate point	Groups	Composition (individual)				Amount per group (individual)	Density per transect (individual/ ha)
			Male	Female	Juvenile	Infant		
1	59°33'62,44"S 169°40'04,4"E	0	0	0	0	0	0	
2	62°86'64,48"S 179°69'68,6"E	1	1	6	5	4	16	

Transect	Coordinate point	Groups	Composition (individual)				Amount per group (individual)	Density per transect (individual/ ha)
			Male	Female	Juvenile	Infant		
3	64°97'60,55"S 205°04'76.3"E	0	0	0	0	0	0	
4	76°89'85,18"S 119°81'14,5"E	0	0	0	0	0	0	
Total number of individuals		1	1	6	5	4	16	1.6

Population density is the size of the population in a space unit area or volume, the density value is needed because it can support the carrying capacity of the habitat (Alikodra 2002) ⁽²⁾. The population density of Javan surili in the TSI Bogor forest area was 0.06 individuals/ha. This density is lower compared to the density of Javan surili in other areas, including Javan surili in the Mount Salak Unocal Geothermal Indonesia (UGI) area, namely 2.98 individuals/ha (Siahaan 2002) ⁽²⁰⁾, Supartono et al. (2016), the average size of the surili group did not change as the distance from the edge of the forest increased. The surili population density at a 95% confidence interval ranged from 44.39 to 82.36 with an average of 60.47 individuals/km² ⁽²³⁾.

3.2. Groups

The group of Javan surili in the TSI Bogor forest area based on observations found 1 group. Javan surili are animals that live in groups and each individual member of the group has their own role in detecting disturbances in their environment. With a true arboreal pattern, Javan surili can more easily detect the presence of predators or predators that pose a threat to their group members (Siahaan 2002) ⁽²⁰⁾. The groups found in the TSI Bogor forest area were very few, with only shom 16 individuals in groups (Figure 3). Movement in this group is led by the dominant adult male.

The size of the Javan surili group in the TSI Bogor forest area is currently not much different from the size of the Javan surili group in several other places, such as in the Situ Nature Reserve area of 3 to 8 individuals/group Siahaan (2002) in the UGI area. Mount Salak found a population size of Javan surili of many as 984 individuals with a group size of 3 to 8 individuals. The results of other studies related to the size of the Javan surili langur population size are Heriyanto and Iskandar's (2004) study of 3 to 6 individuals ⁽¹¹⁾. Supartono (2010) in Mountain Ciremai National Park found 186 individuals of Javan surili with an average size of 7 individuals/group ⁽²¹⁾. This indicates that in fact the Javan surili in the Mount Burangrang Nature Reserve area can still be maintained. When viewed from the size of the groups, they are not much different from groups in other places, only the number and distribution are small. This is thought to be due to the disturbance of community activities in the area, thus disturbing the existence of the Javan surili langur's forest in the area.

As with other types of primates, surili also live in groups. Each group consists of several adult males and females, immature juvenile, and several young infants. The large number of individuals in a primate group is strongly influenced by the availability of feed sources (Irwanto 2006) ⁽¹²⁾.

3.3. Sex Ratio

The results of observations in the field, the Javan surili population in the TSI Bogor forest area has one dominant male, more than one young juvenile, and more than one adult female with an average sex ratio of 1:6. For juvenile male and female he sexes ratio cannot be known. Fom these results, the number of female individuals is greater than the number of male individuals. Comparison of sex composition is the ratio between the number of male individuals and the number of female individuals from one population, usually expressed as the number of males in 100 female individuals (Alikodra 2002) ⁽²⁾.

The greater number of females in a Javan surili group is thought to be related to the characteristics of the Javan surili group. Supriatna and Wahyono (2000) stated that Javan surili are a group of primates consisting of only alfa male nd several females. So that in one group the Javan surili can be more dominated by the female Han the male. ⁽¹⁸⁾

The sex ratio of the Javan surili in the TSI Bogor forest area has the same value as the Javan surili in other places, as found by Hidayat (2013) that the total sex ratio of the Javan surili in the Mount Ciremai National Park area is 1:2 ⁽¹¹⁾, while Siahaan (2002) also stated that the

sex ratio of the Javan surili in the UGI Mount Salak area was 1:1.27. This proves that the sex ratio of Javan surili in Mount Burangrang NR can reproduce normally. (20).

3.4. Age Structure

For the age structure the largest Javan surili are in the adult age class with the percentage of 43.75%, juveniles 31.25%, and the percentage of infants is 25%. Age structure is the ratio of the number of individuals in each age class of a population. Grouping individuals into age classes is very useful for assessing population size developments. However, in nature determining the age of everyone is very difficult, so in this study, the determination of the age structure was based on a qualitative characteristics approach to differentiate between the age classes of infants, juveniles, and adults. Individual physical characteristics based on age in Javan langur species (Napier and Napier 1967) (14) (Table 2).

Observations by researchers in the field of infant Javan surili are white in color with a slightly blue face, still in the mother's arms, not yet able to eat leaves, and still small. The characteristics of juvenile Javan surili are that their sexual organs are not very visible, their body color resembles that of the parent individual, they are able to move independently (predominantly play and rest), and they are still under the supervision of their parents. For adults, the size is much larger, the reproductive organs are perfect, they carry out their own activities (independently), the colors are very clear, they can speak (when threatened), and they can reproduce. Social behavior, broadly defined, is any type of interaction between two or more animals, generally of the same species. For some time the infant surili will be with and under the care of the adult female. Although most sexually reproducing species must socialize throughout their life cycle in order to reproduce, some species spend most of their lives in close association with conspecifics (Campbell et al. 2004). (8)

Based on field observations, the age structure of Javan surili in the TSI Bogor forest area showed that there were 7 adults Javan surili, 5 juveniles, and 4 infants. As for the groups of adults, juvenile, and infant of Javan surili in the field based on observations (Figure 4). There are more adult age classes than juvenile and infants. This shows that there is an imbalance in the composition of age classes, where the number of age classes for infants is smaller than the age classes for teenagers and adults. However, when viewed from the reproductive aspect, the number of adolescents and infants shows a good increase in breeding. This is in line with Bismark et al. (2002) who state that young individuals can form new groups, in addition to the existing groups can produce new generations (6). Further more, Hidayat (2013) added that more individuals in the age class of adolescents and infants guarantee population sustainability because the reproduction rate or birth rate remains high (11). Individual physical characteristics based on age based on research results, which refers to the research of Napier and Napier 1967 (14) (Table 3).

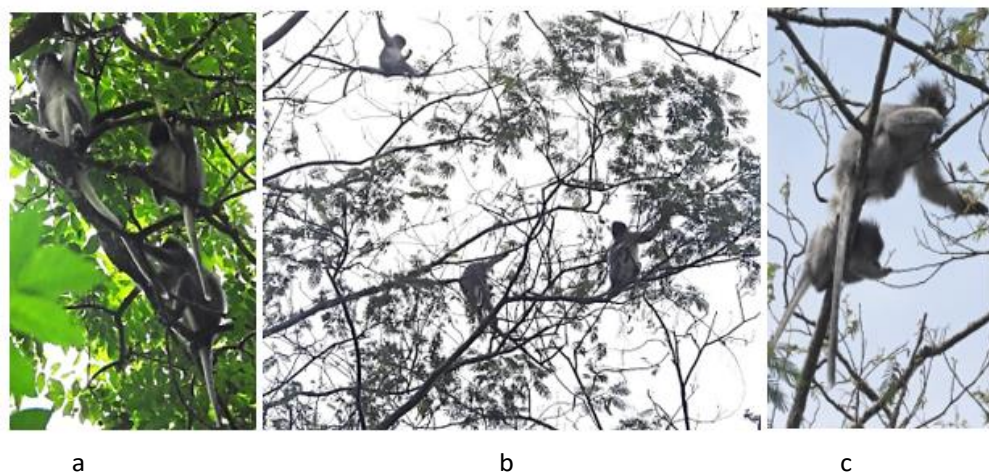


Figure 3. A group of Javan surili was found in the TSI Bogor Forest area. a) juveniles, b) feeding, and c) parents when together with an infant at mealtime. Document photo: Walberto Sinaga

Table 3. Individual physical characteristics based on Javan surili based on the research results

Category	Age range (year)	Explanation
Infant	0-2	Gray white in color, still breastfeeding, fine hair and not too long, small body size and still in the care of parents.
Juvenile	2-4	The sexual characteristics are not very visible, the color starts to resemble an adult individual, is able to move independently, has a higher activity in playing activities, has a medium body size, has started to consume leaves, but is still around the adult female.
Adult Male & Female	4-12	Their physical organs are fully developed, especially their sexual organs (sexually mature), their color is very bright, their activity is high, and their body size is generally the largest compared to the age group below them.

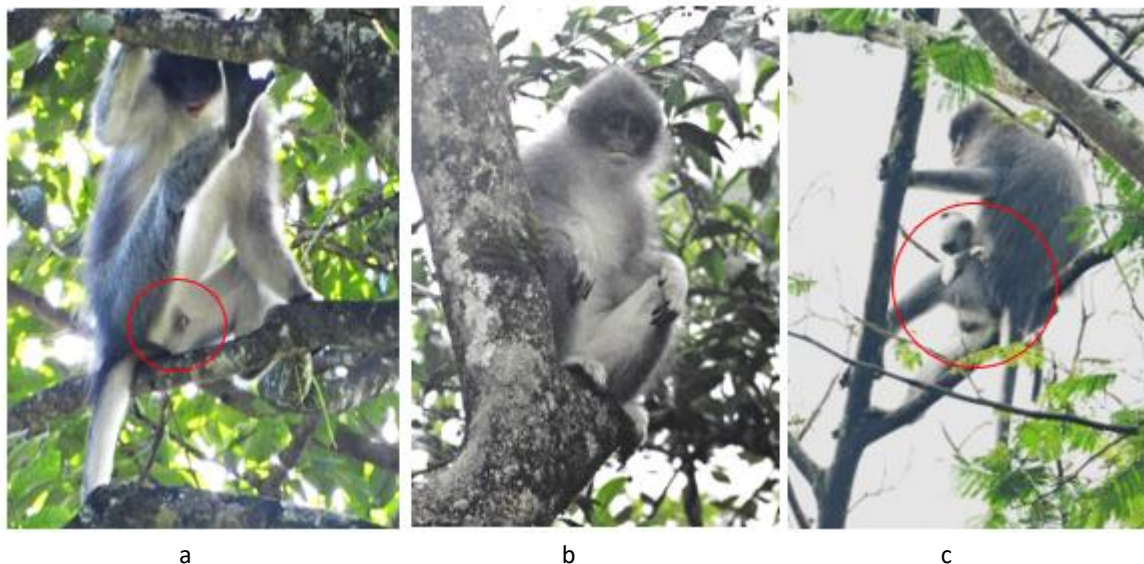


Figure 4. The Appearance of a) adult female, b) juvenile, and c) infant in the adult female Javan surili in the TSI Bogor forest area. Document photo: Walberto Sinaga

4. Conclusion

TSI Bogor is a buffer zone for the conservation forest area of MGNP and is one of the habitats for the Javan surili. The results showed that there were 16 individuals Javan surili only one group, and the estimated population density was 0.06 individuals/ha. The sex composition of male and female Javan surili in the TSI Bogor forest area is 1:6 where the female langurs are more numerous than the male Javan surili, and for the age structure the largest Javan surili are in the adult age class with the percentage of 43.75%, juveniles 31.25%, and the percentage of infants is 25%.

Author contributions

JM: Conceptualization, Methodology, Project administration, Data Curation, Writing – Original Draft, Writing – Review & Editing; **WS:** Conceptualization, Methodology, Project administration, Data Curation, Writing – Original Draft, Writing – Review & Editing.

Conflicts of interest

The authors declare that there is no conflict of interests.

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