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Diurnal Activity Patterns of Captive Sub-Adult Male Blackbuck in Winter and Spring Seasons

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ABSTRACT

The blackbuck, scientifically known as *Antelope cervicapra*, is a type of antelope that inhabits Pakistan, Nepal, India, and the United Arab Emirates. The population of blackbucks has been impacted by habitat destruction, hunting, and diseases, but some protected areas have seen an increase in their population. Blackbucks are herbivorous species that displays grazing and browsing behaviors and prefers semi-arid grasslands as their habitat of choice. The study aimed to observe the diurnal activities of a sub adult male blackbuck during the winter as well as spring seasons. The observation was done twice a week (Saturday and Sunday) for ten hours (600 minutes) a week. The animal's activities were recorded after every five minutes, and an ethogram was used to record the activities. The study observed standing, sitting, walking, running, feeding, drinking, scratching, licking, aggression, sexual display, defecation, urination, sniffing, and Flehmen response. The lowest activity observed in both spring and winter season is Flehmen response. The result showed that the activity which was maximum in winter season is feeding (29.09 ± 8.78) and in spring season, it was walking (27.99 ± 4.83). The study found no noteworthy difference between the winter and spring seasons concerning the behavior of the animal, but the maximum duration of standing and running behavior was higher during the winter season than in the spring season. The study highlighted the importance of studying animal behavior in zoos for the welfare of captive animals and developing effective preservation.

Keywords: Blackbuck, Diurnal activities, Welfare, Conservation, Ethogram

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INTRODUCTION

An evaluation on personality of captive blackbuck males can be useful and insightful to the behavior and welfare of blackbuck. The research may span various places including naming personality variables, examining what influences personality, personality correlations with behavioral outputs, comparing captive and wild populations and assessing the utility of personality tests [1]. Comparison personality traits of captive blackbuck males can aid scientists, biologist to develop a better understanding of individual differences in the blackbuck animals and the ways it can influence their natural behavior [2]. By exploring various environmental, genetic, and social factors, one can get to know more about personality development mechanisms in blackbucks [3]. Relating personality to behavioral outcomes can be a source of information on the functional importance of various character traits. The comparison between the captive and wild could assist researchers to understand whether there is any effect of captivity on character development [4]. Finally, the utility of personality valuations can be evaluated to see whether the valuations might be utilized practically in the selection of animals or welfare nursing [5].

There are numerous limitations to keep in mind when we are studying a personality assessment of black buck male in captivity [6]. First of all, we should remember that captive animals can act differently than their wild ones, and this fact restricts the validity of research results. The sample size that is vital in any research may also influence the validity of the research findings a larger sample size would enhance accuracy of the findings [7]. The moral issues related to keeping animal's captive have to be resolved, since it might influence the health of the blackbuck and their character and attitude [8]. Personality in animals is extremely hard to assess because it is a complicated and subjective concept and researchers can vary in the tools and methods used, which can cause discrepancy in the results [9]. Finally, captive research studies are not usually long-term, and this restricts the inferences that can be made concerning the personality of animals. Although these studies have these limitations, they still offer important insights into animal behavior and enable us to know more about them and their characteristics and social relations [10].

The current study on black bucks aimed to investigate several key aspects. The primary objectives were to identify the behavioral traits exhibited by captive male blackbucks and measure the consistency and stability of their personality traits over time and across various conditions. Additionally, the study sought to explore how environmental changes may influence the personality of captive blackbuck males. Ultimately, the research aimed to provide recommendations for future studies and practical applications that could enhance the well-being and conservation of captive blackbuck populations.

MATERIAL AND METHODS

Study Site

This study was conducted in Jallo Park Lahore. It was situated 20 km east of Lahore along Wagha – Amritsar Railway Line and ½ km from Lahore Canal Branch on its left

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side. This area 837 acres was a reserve forest since 1922 and was being managed for production of timber/fuelwood and for conducting forestry research. Out of 837 acres, the Park was established over 456 acres under various development schemes since 1978. Moreover, during 2007-08 to 2009-2010 a development scheme namely “Addition of Recreational Facilities in Jallo Park Lahore” with the total cost of Rs.19.280 million has been launched. The Park has been conceived as a theme Park with a combination of cultural, educational and amusement facilities.

People can visit this park without entry fee and recreational facilities at economical charges, provide wilderness where the nature speaks itself and to educate the public about forests and forest trees. There are more than 120 species of different trees bushes and climbers. Thus, it is an important botanical garden with rare and important species.

Sample Size

The enclosure of blackbuck was selected for the detailed study. The Black Buck, also known as the Indian antelope, is an indigenous species to Nepal and India. Although blackbucks have been introduced to Argentina and the United States On the other hand, they have become extinct in Bangladesh and only found in protected areas and captivity in Pakistan. In the state of Punjab, the Black Buck is classified as a protected species under the Wildlife Act. Blackbucks are typically found in open woodlands and semi-desert regions, although they also inhabit areas with dry deciduous or thorny forests. They tend to stay close to grasslands, as these areas provide them with suitable vegetation. During hot days, Blackbucks seek refuge from the sun by resting in the shade. A herd of 34 Black bucks is preserved in an enclosure. Thirteen are the adult male and others are females and fawns. Green fodder and a feed additive are supplied to the animals. The adult male will be selected for the Comprehensive study. It is easily distinguishable from the other members of the species due to antlers and body size. Blackbuck males are noticeably bigger than the females and other groups within the same species.

Study Design

The diurnal activities of the selected animal will observe from January to march for two days in a week (Saturday and Sunday). Observations will observe from 10:00am to 02:00pm (4 hours) on Saturday and from 9:00am to 03:00pm (6 hours) on Sunday. Total ten hours (600 minutes) of observation will observe in a week. The animal will observe after every five minutes. Total time of the observation during the research will be 80 hours (4800 minutes). The time spent by the selected animal in different activities will be record using both direct observation and video recording. The data collection process will involve the use of an ethogram. Following activities will observe during the research:

Walking behavior: various movements such as stepping, striding, and straw pickin

Running: activities like chasing, jumping, and so on.

Standing: absence of movement or change in position.

Sitting: bending of the legs

Feeding: type of food preferred, type of leaf preferred

Flehmen response: curl back their upper lip and inhale through their nostrils

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Sexual display: highly rutted males walk with deliberate steps. Head raised and nose up horn laid back

Others like: scratching, licking, drinking, sniffing, urination, defecation and aggression etc.

All these activities were recorded with minimum disturbance.

Statistical Analysis

Mean $\pm$ S.D is calculated from obtained data using software Minitab 16 and graphs were plotted from comparison between different behaviors using Microsoft excel.

RESULTS

The Table 4.1 presents the season-wise mean (%) activities of a sub adult male blackbuck observed for 80 hours (4800 mins). The activities observed were standing, sitting, walking, running, feeding, drinking, scratching, licking, aggression, sexual display, defecation, urination, sniffing, and Flehmen response. The table reports the maximum, minimum, mean, and standard deviation ($\pm$ SD) for each activity for both winter and spring seasons. Highest activity in winter was feeding (29.09 ± 8.78) and in spring it was walking (27.99 ± 4.83). Lowest activity in winter was Flehmen response (0.65 ± 1.07) same as it in spring (0.44 ± 0.63).

Major activities shown by blackbuck in both seasons were standing, sitting, walking and feeding. All other activities (drinking, scratching, licking, aggression, sexual display, defecation, urination, sniffing, and Flehmen response) were shown less in both (winter and spring) seasons. Second highest activity in winter was sitting and in spring it was feeding (26.35 ± 8.84). After that sub adult male blackbuck spent more time walking (20.7 ± 4.16) during winter and sitting during spring (17.68 ± 2.23). Standing was shown at the fourth number for both seasons, winter (11.24 ± 4.52) and spring (12.32 ± 1.5).

Among minor activities, running (3.19 ± 2.33) was shown at the maximum rate during winter, while sexual display (3.8 ± 1.37) was shown at the maximum rate during spring. The second highest minor activity in winter was scratching (2.66 ± 1.58), and in spring it was running (2.47 ± 1.17). All other minor activities were shown for small time period during both seasons (winter and spring).

These results can be used to compare the frequency and duration of different behaviors during different seasons and to analyze the impact of environmental factors on the behavior of the animal. The winter and spring seasons had no significant effect on most of the behaviors, as the mean and standard deviation values were relatively similar for both seasons. However, it is worth noting that the maximum duration of standing and running behavior was higher during the winter season compared to the spring season.

Table 4.1: Mean Time spend (%) and $\pm$ SD in different seasons

	Winter				Spring			
	max	min	mean	$\pm$ SD	max	min	mean	$\pm$ SD
Standing	22.45	6.12	11.24	4.52	14.29	10.67	12.32	1.5

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Sitting	40.82	9.52	21.23	8.05	20	14.67	17.68	2.23
Walking	30.61	14.29	20.7	4.16	32.65	21.33	27.99	4.83
Running	8.16	0	3.19	2.33	4.08	1.33	2.47	1.17
Feeding	40	10.2	29.09	8.78	38.67	18.37	26.35	8.84
Drinking	5	0	1.43	1.86	2	0	0.67	0.94
Scratching	5.26	0	2.66	1.58	2.67	0	1.57	1.14
licking	2.67	0	1.26	1.03	2	0	0.67	0.94
Aggression	2.67	0	1.53	1	2.04	0	1.12	0.85
Sexual Display	5	0	2.59	1.55	5.33	2	3.8	1.37
Defecation	4.76	0	1.82	1.62	2.04	1.33	1.79	0.33
Urination	2.67	0	1.45	0.97	2.04	1.33	1.79	0.33
Sniffing	2.67	0	1.16	1.11	4	0	1.33	1.89
Flehmen	2.63	0	0.65	1.07	1.33	0	0.44	0.63
Response								

In winter, the sub-adult male blackbuck showed different activities that were presented in figure 4.1, with feeding being the most common (mean % value of 29.09), followed by sitting (mean % value of 21.23) and walking (mean % value of 20.7). Standing (mean % value of 11.24) and running (mean % value of 3.19) were also observed, albeit less frequently. Furthermore, the blackbuck engaged in different minor activities such as drinking, scratching, licking, aggression, sexual display, defecation, urination, sniffing, and Flehmen response. Scratching (mean % value of 2.66) and sexual display (mean % value of 2.59) were the most observed minor activities during winter. After these activities, defecation (mean % value of 1.82) was more common than others. It was followed by aggression (mean % value of 1.53), urination (mean % value of 1.45), licking (mean % value of 1.26), and sniffing (mean % value of 1.16). The least observed activity was Flehmen response (mean % value of 0.65) in winter.

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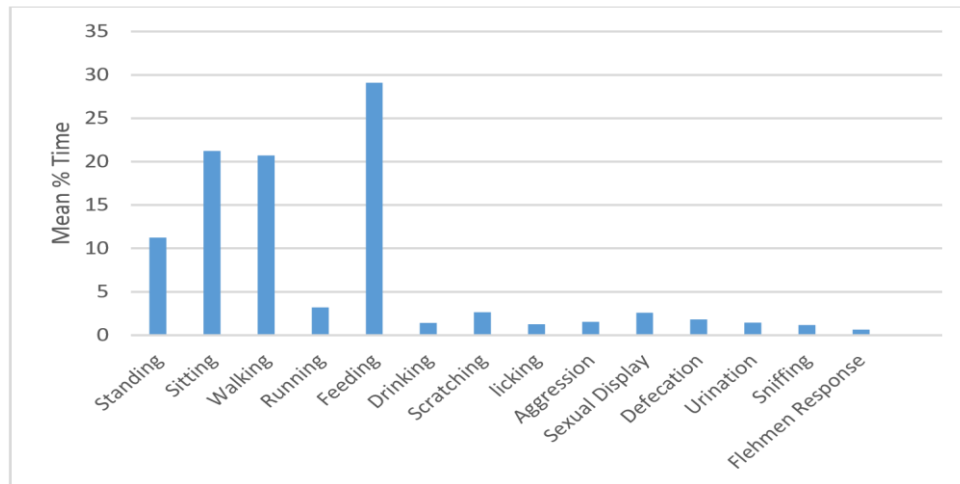


Figure 4.1: Mean % Time in different activities during winter season

During spring, sub-adult male blackbucks engaged in various activities, as illustrated in Figure 4.2. Walking was the most frequent activity, with a mean percentage value of 27.99, followed by feeding (mean % value of 26.35) and sitting (mean % value of 17.68). Standing (mean % value of 12.32) was also observed, but less frequently. In addition, minor activities such as drinking, scratching, licking, aggression, sexual display, running, defecation, urination, sniffing, and Flehmen response were observed. Sexual display with the mean percent value of 3.8 was the most commonly observed minor activity during spring. The second highest minor activity that was observed in spring was running with the mean value of 2.47. After running, defecation (mean % value of 1.79) and urination (mean % value of 1.79) were more common than remaining minor activities, followed by scratching (mean % value of 1.57), sniffing (mean % value of 1.33), aggression (mean % value of 1.12), licking (mean % value of 0.67) and drinking (mean % value of 0.67). The least observed activity during spring was Flehmen response (mean % value of 0.63) as same in winter.

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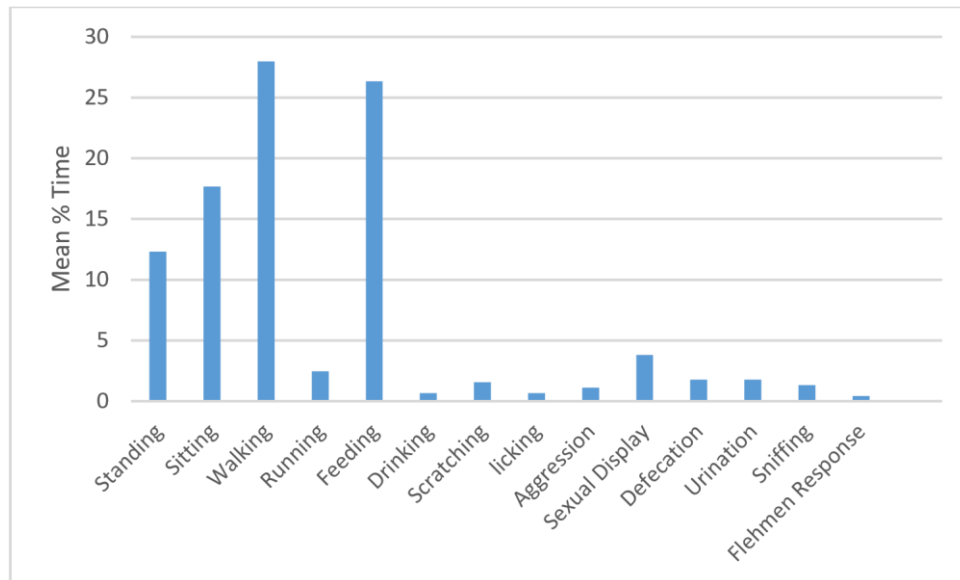


Figure 4.2: Mean % Time in different activities during spring season

Figure 4.3 shows two columns, one for the winter season and one for the spring season. The vertical dimension of each column signifies the mean percentage value of standing of the sub adult male blackbuck observed during that season. The average percentage value of standing observed in the winter season was 11.24%, while the average percentage value of standing observed in the spring season was 12.32%. This indicates that on average, the sub adult male was observed standing more commonly observed in the spring season than in the winter season.

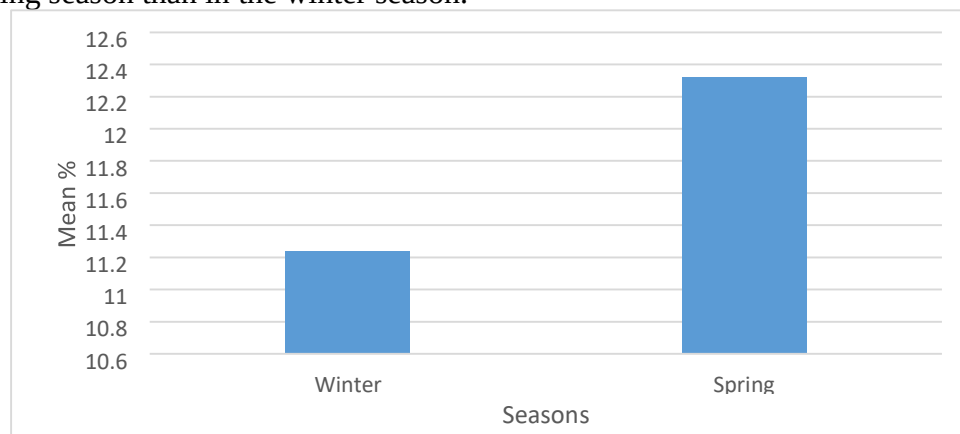


Figure 4.3: Mean % Time in standing during both seasons

The data existing in Figure 4.4 shows two separate columns demonstrating the winter and spring seasons. Each column symbolizes the mean percentage of time adult male blackbucks were observed sitting during that season. The average percentage of sitting observed in the winter season was 21.23%, while the average percentage of sitting observed in the spring season was 17.68%. Adult male blackbucks were noticed sitting

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more during the winter season as compared to the spring season.

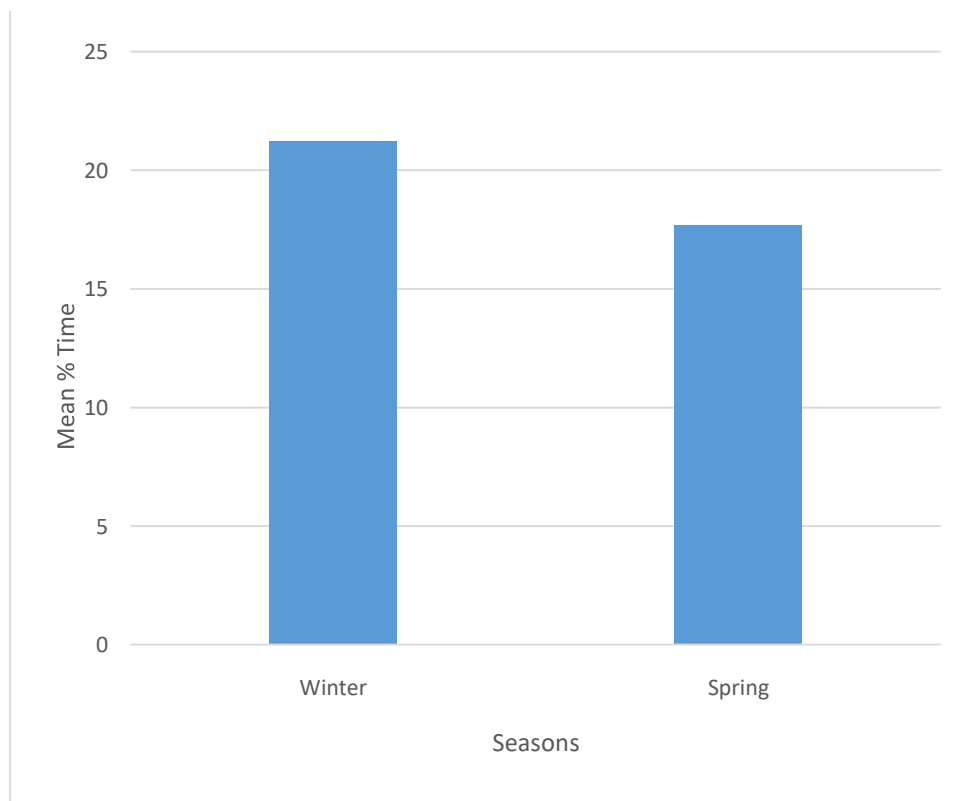


Figure 4.4: Mean % Time in sitting during both seasons

There are two separate columns as shown in Figure 4.5 that represent the percentage of the walking behavior exhibited by the adult male blackbucks in the season of winter and spring. The top of each column represents the average percentage of walking activity shown in corresponding season. The statistical model which represented the mean percentage value of walking actions of adult black buck in the winter season was 20.07% whereas the same observed in the spring season was 27.99%. These results indicated that the adult male blackbucks had more frequency of walking behavior in spring season than winter season.

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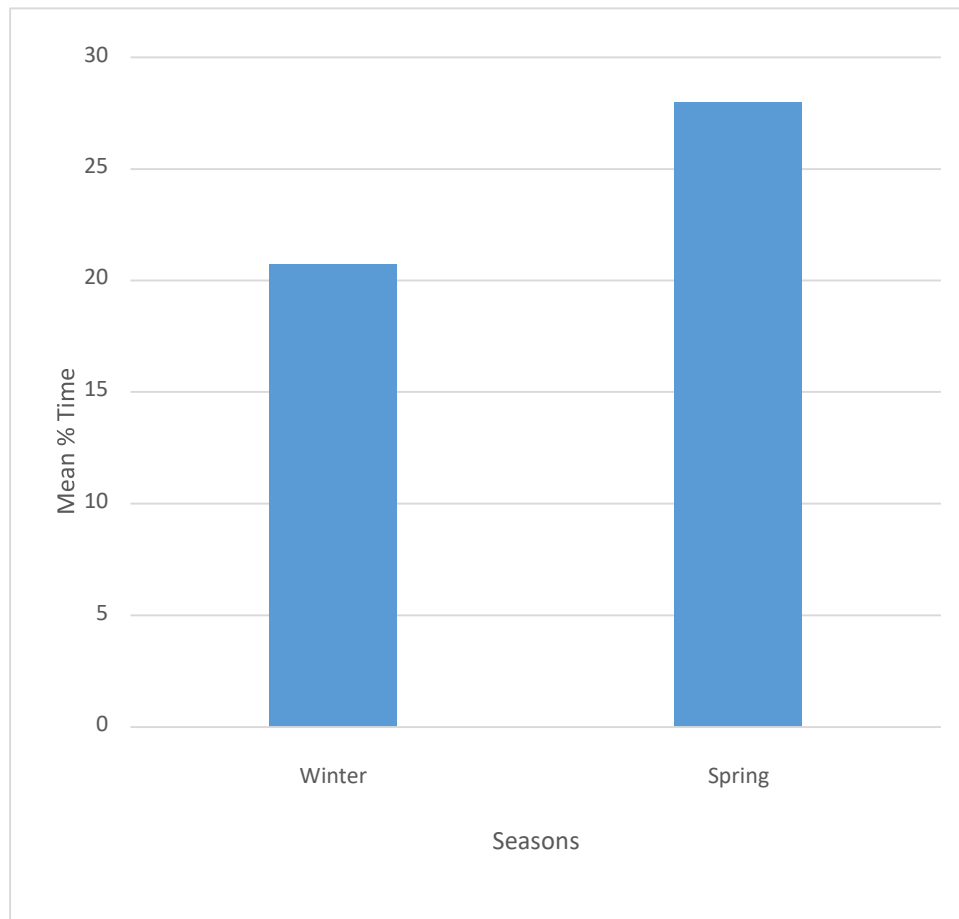


Figure 4.5: Mean % Time in walking during both seasons

The graphical illustration in Figure 4.6 has two different columns that illustrate the percentage of walking behavior exhibited by adult male blackbucks during winter and spring seasons. The height of each column represents the average percent of the feeding behavior of the respective season. Statistical analysis of the data will clarify that the average percentage of walking behavior in winter season was 29.09 percent, but in the spring season it dropped to 26.35 percent. These statistical observations indicate that adult male blackbucks were observed exhibiting higher rate of feeding behavior in the winter season than they were in the spring season.

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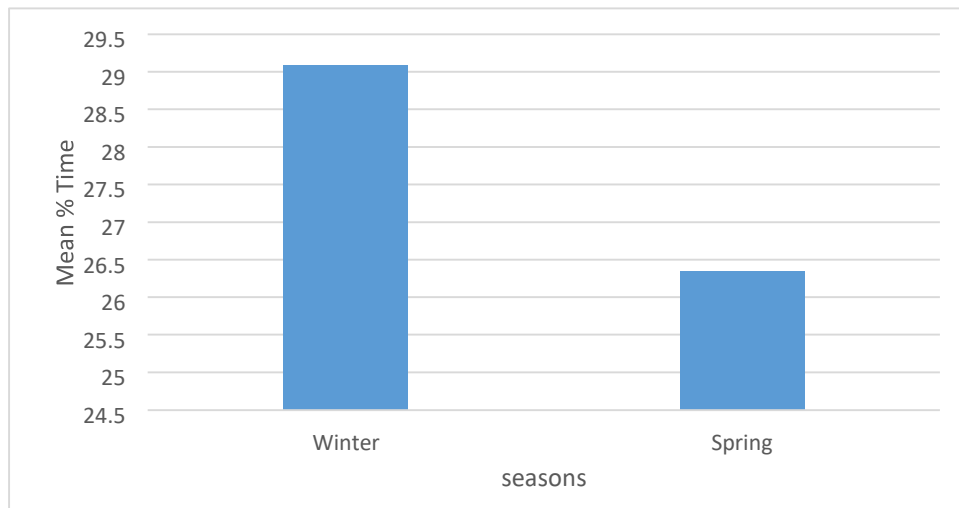
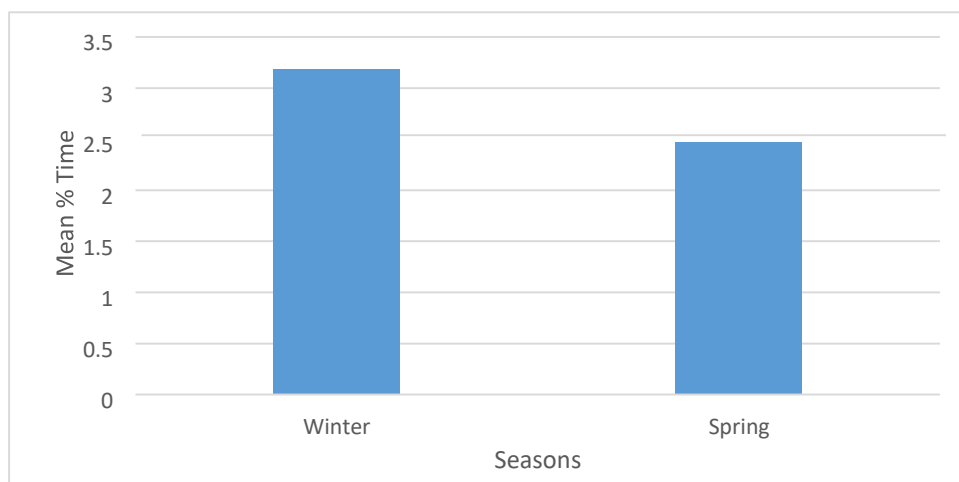


Figure 4.6: Mean % Time in feeding during both seasons

Figure 4.7 illustrates the percentage of running behavior of adult male blackbucks in the winter and spring seasons, and two columns provide the mean percentage value of running behavior observed in both seasons. The height of every column is similar to the mean percentage of running behavior of respective season. The statistical analysis performed shows that walking behavior as an average percentage value was 3.19% in winter and 2.47% in spring. Therefore, data suggests that the frequency of walking behavior was higher in adult male blackbucks in winter as compared to spring season. The visual illustration in Figure 4.8 shows two different columns that show the percentage of drinking habit that was disclosed by adult male blackbucks in winter and spring seasons. The size of each column is the average percentage of the drinking behavior that was observed in the particular season. The average percentage of drinking behavior in winter season was 1.43 % but in spring season it went down to 0.67 % on the other hand. These statistical interpretations indicate that drinking behavior was observed to have more frequency in adult male blackbucks in the winter season than in the spring season.



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Figure 4.7: Mean % Time in running during both seasons

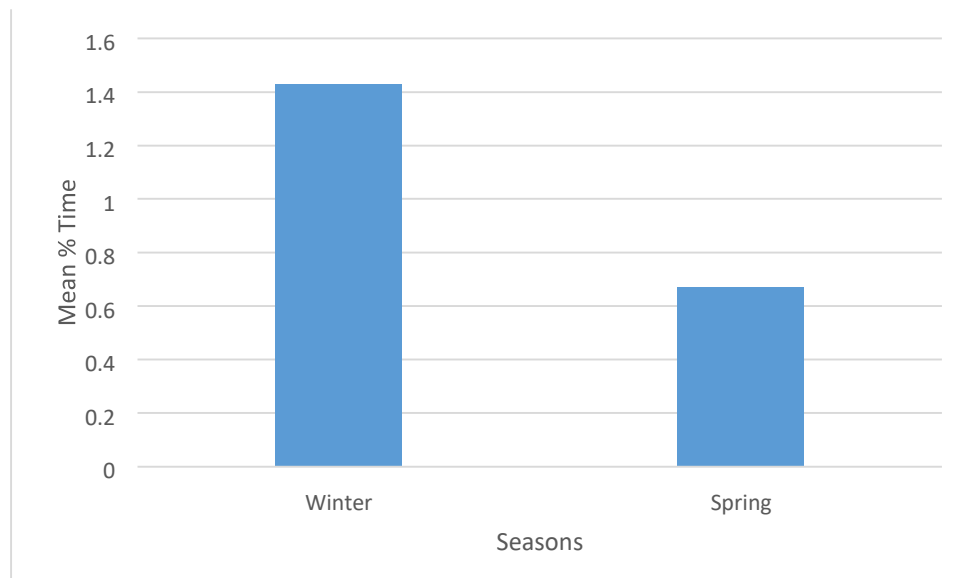


Figure 4.8: Mean % Time in drinking during both seasons

Figure 4.9 Showed two columns that represent the percentage of scratching behavior exhibited by adult male blackbucks in the winter and spring seasons, respectively. The height of each column corresponds to the mean percentage value of scratching behavior observed in the both season. The statistical analysis of the data displays that the mean percentage value of scratching behavior during the winter season was 2.66%, whereas during the spring season, it reduced to 1.57%. These statistical findings imply that sub-adult male blackbucks were observed displaying a higher frequency of scratching behavior during the winter season in comparison to the spring season. It indicates that the changing seasons may have influenced the drinking behavior of adult male blackbucks.

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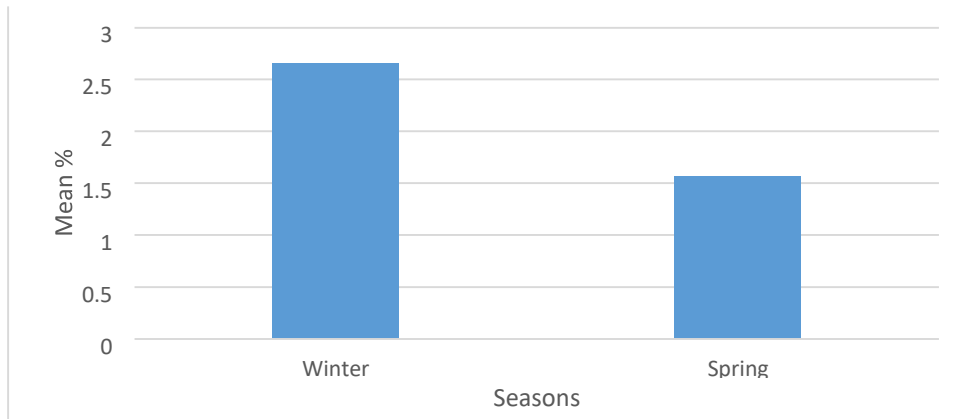


Figure 4.9: Mean % Time in scratching during both seasons

Figure 4.10 shows two columns demonstrating the mean percentage of licking behavior displayed by adult male blackbucks during the winter and spring seasons, correspondingly. The height of each column shows the mean percentage value of licking behavior detected in the respective season. Statistical analysis reveals that the mean percentage value of licking behavior during the winter season was 1.26%, whereas during the spring season, it decreased down to 0.67%. These statistical findings suggest that adult male blackbucks revealed a higher frequency of licking behavior during the winter season associated to the spring season. The data suggests that the seasonal changes could have played a role in the variant of licking behavior displayed by adult male blackbucks.

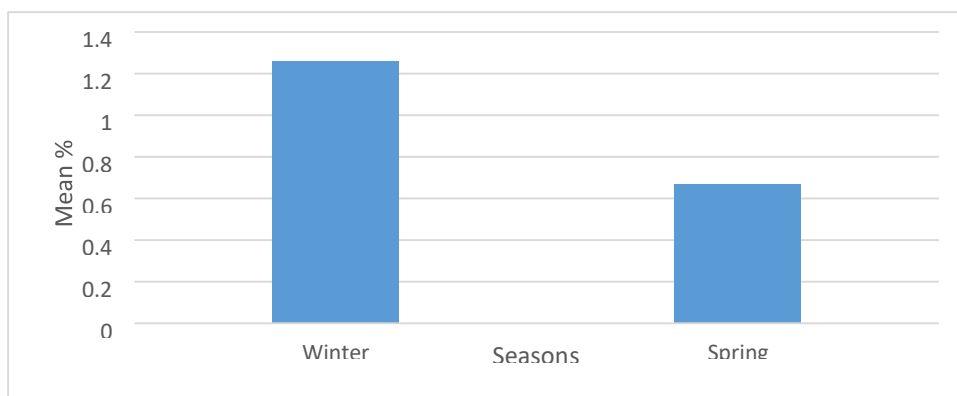


Figure 4.10: Mean % Time in licking during both seasons

In figure 4.11, there are two columns representing winter season and spring season. The maximum height of each the columns indicates the average percentile score of aggression of the adult male blackbuck observed in that season. The mean percentage level of aggression during winter season was 1.53 and that of spring season was 1.12. This implies that the average adult male was aggressive in the winter season, as opposed to the spring season.

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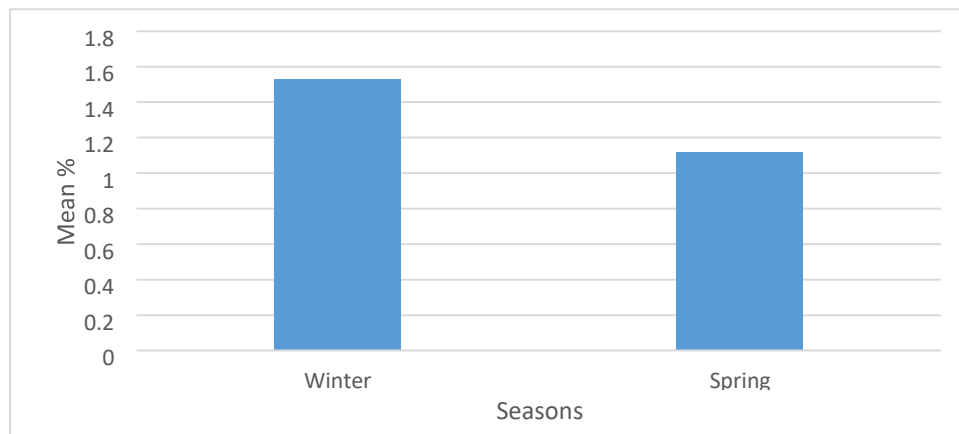


Figure 4.11: Mean % Time in aggression during both seasons

Figure 4.12 illustrates two columns that show the average percentage of sexual display behavior exhibited by adult male blackbucks in winter and spring seasons respectively. The height of every column shows the average percentage of the observed sexual display behavior during the respective season. Statistical analysis depicting that the average percentage rate of sexual display behavior in winter was 2.59 % and in spring it rose up to 3.8% According to the data, it can be said that the change in the sexual display behavior as shown by the adult male black bucks was affected by the change in seasons.

The Figure 4.13 presentation shows two columns which indicate the average percentage of defecation behavior exhibited by the adult male blackbucks in the winter and spring seasons respectively. The columns depict the average percentile data of the behavior of defecation as observed during each season. Based on the statistical analysis of the data the average percentage figure of defecation behavior in the winter season was 1.82% and during the spring season it was 1.79%. These statistical interpretations imply that the frequency of defecation behaviour in adult male blackbucks was seen to be higher in the winter season than in the spring season. The result indicates that the variation in defecation behavior imposed by adult male blackbucks might have been due to the changing seasons.

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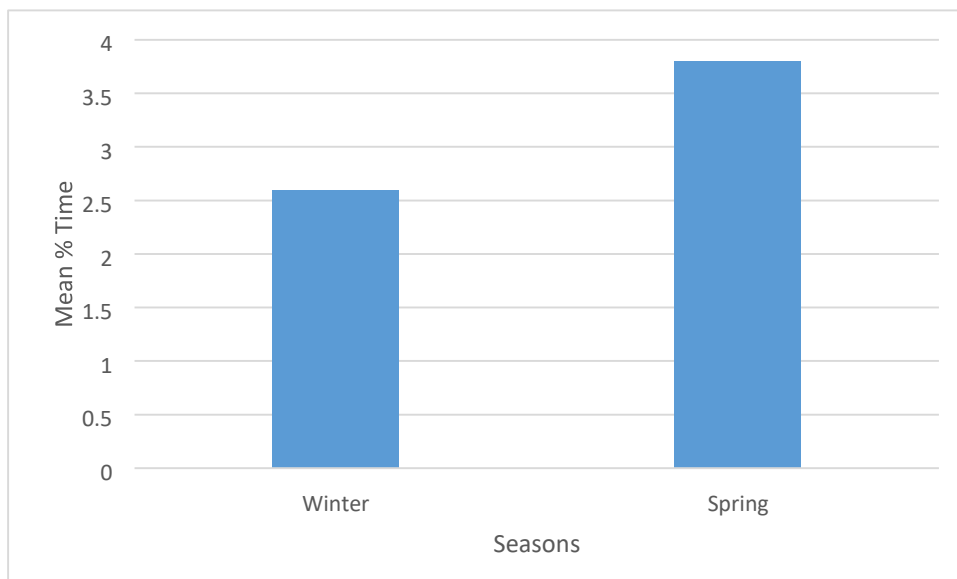


Figure 4.12: Mean % Time in sexual display during both seasons

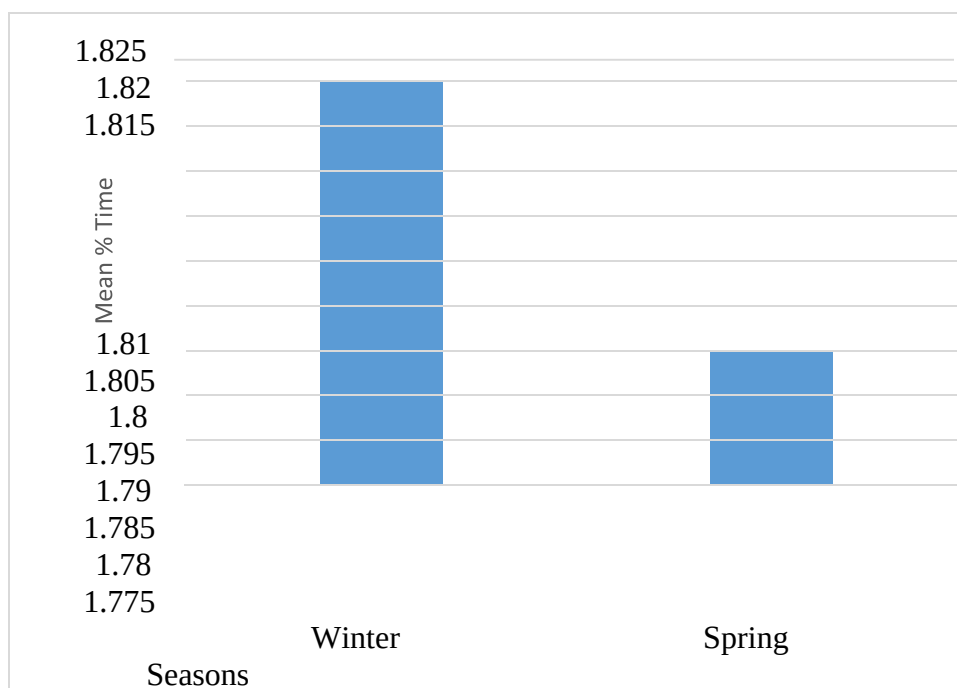


Figure 4.13: Mean % Time in defecation during both seasons

Figure 4.14 representing two columns depicting the average percentage of urination behavior exhibited by the adult male blackbucks in the winter and spring seasons. The mean percentage value of urination behavior as observed in each of the seasons is represented by the height of the respective column. Statistically, the average percentage of the urination behavior in winter is 1.45, whereas in spring it was 1.79. The statistical

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statistical findings are an indication that the frequency of urination behavior illustrated by adult male blackbucks was more in the spring season than in the winter season. The findings suggest that seasons might have influenced the change in defecation behavior exhibited by adult male.

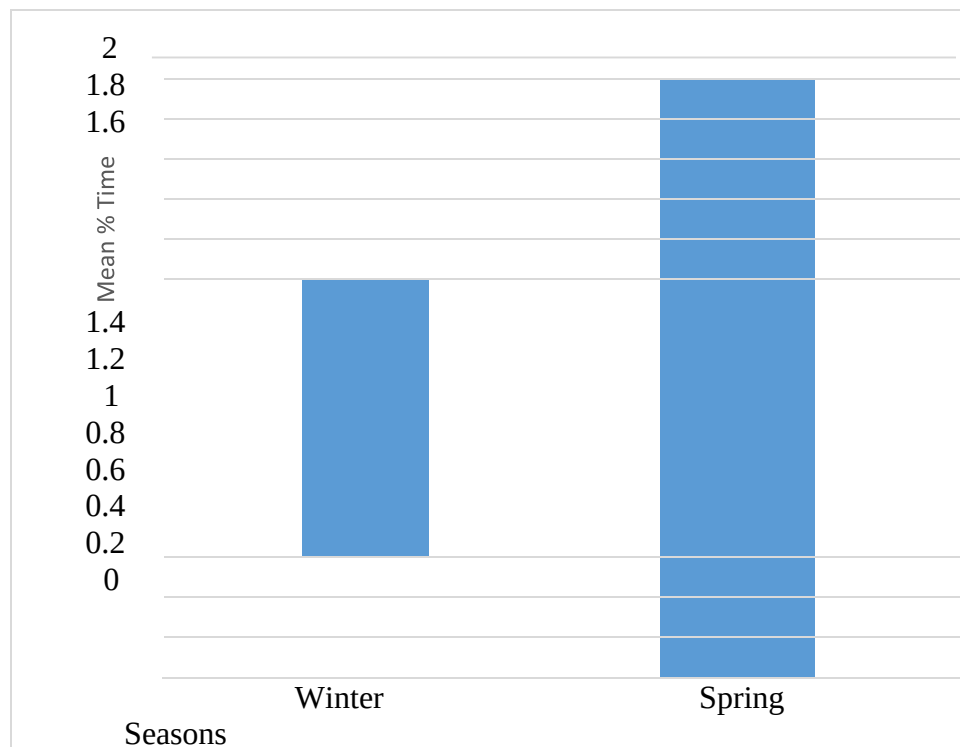


Figure 4.14: Mean % Time in urination during both seasons

Figure 4.15; it presents two different columns of the percentage of sniffing behavior carried out by the adult male blackbucks during winter and spring seasons. The height of each column represents mean percentage value of sniffing behavior observed during that season. The statistical test indicates that the average percentage of the sniffing behavior in winter season was 1.16, and in the spring season it was raised to 1.33. These results indicate that most of the adult male blackbucks exhibited high rate of sniffing behavior in spring season than in winter. These findings suggest that the varying seasons may have influenced the sniffing behavioral variation shown by adult male blackbucks.

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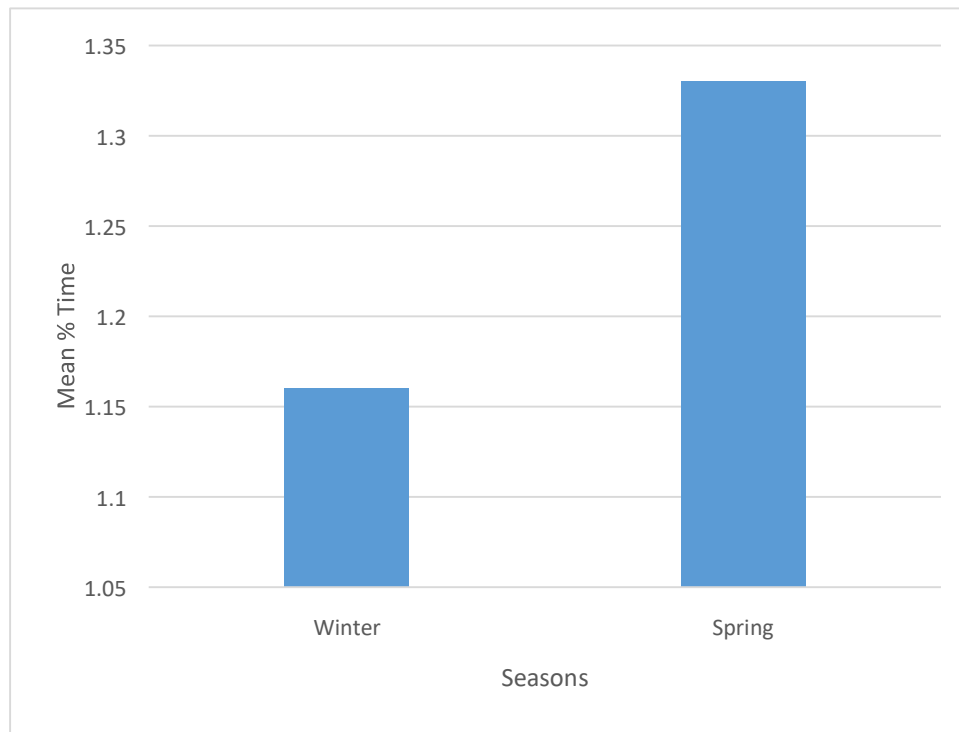


Figure 4.15: Mean % Time in sniffing during both seasons

Figure 4.16 presented two columns which reflect the mean percentage of Flehmen response exhibited by adult male blackbucks in the winter and spring seasons. The height of each column gives the mean percent value of Flehmen response measured in each season. The analysis of the statistics shows that the average percentage measure of the Flehmen response in winter season was 0.65% and in spring season it went as low as 0.44%. Such statistic findings imply that the frequency rate of Flehmen response was greater among sub-adult male black bucks in the winter season than it was in the spring season. The findings suggest that seasonal variations might have contributed towards the variation of Flehmen response as exhibited by adult male black bucks.

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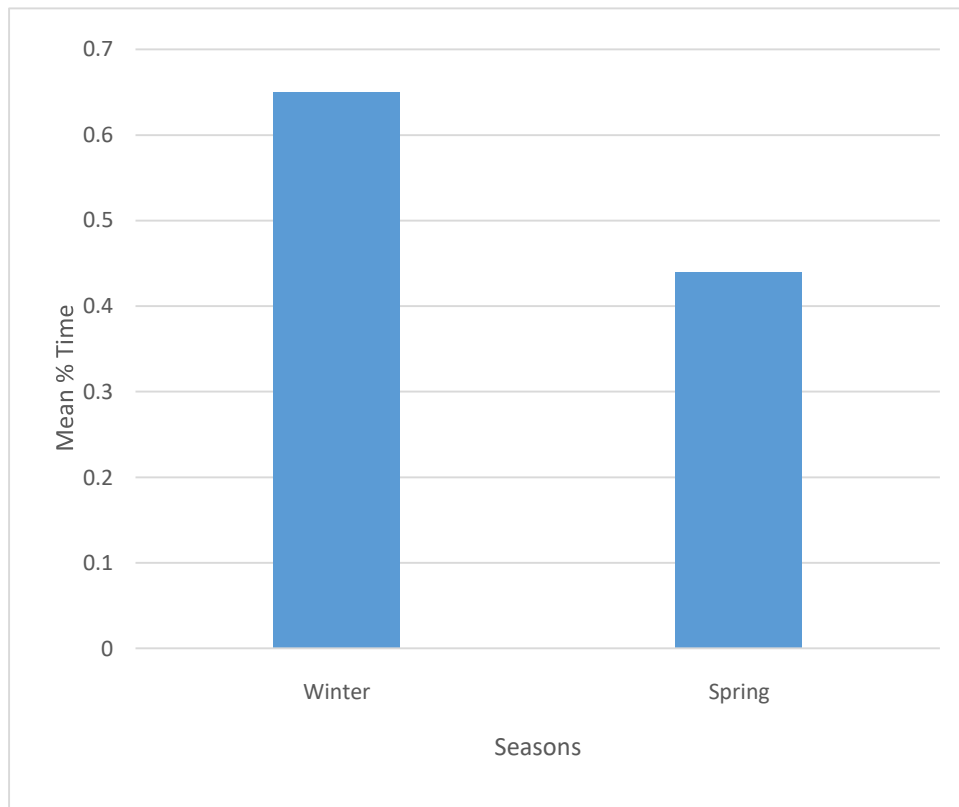


Figure 4.16: Mean % Time in Flehmen response during both seasons

DISCUSSION

The knowledge of animal behavior is important in formulating good supervision and preservation policies. Although observing animals in the wild is the most accurate method of investigating their behavior, it may be a challenging activity, particularly with timid ones. Conversely, the behavioral annotations of the captive animals are more easily documented because studies on them are more systematized and controlled. It is so due to the ability to study the captive animals closely as compared to their free counterparts [10]. Studies of captive animals may have many benefits compared to the wild studies.

As an example, it allows researchers to examine the behaviors that are challenging or impossible to observe in the wild. Moreover, animals in captivity may be exposed to tests and forces, which would otherwise be impossible in the wild. This leads to more complete and accurate insight into the behavior of the animal that can be gathered by the researchers. Also, captive animals can be studied to give valued information about their behavior and ecology that can be used to maintain the wild populations of the animal. This is particularly significant with the endangered species where conservation can be helped by the information found in captive studies.

Based on the research findings, blackbucks under captive enclosure conditions had an average of 27.72 percent daily time in feeding and foraging practices. As an

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example, blackbucks that were in the wild were also found to spend around 65 percent of their time foraging [11]. Conversely, blackbucks in the Texas Zoo were discovered to spend 36-40 percent of their time foraging [12]. The findings of the study imply that the variations noted in the foraging duration between the current study and past literature could be as a result of various factors. This is because any animal behaviour i.e. the availability and distribution of food items may have a significant role in determining the time blackbucks use in foraging. As an example, the blackbucks in the wild might have to spend longer hours scavenging to find food sources and evade other herbivores [13]. By differentiating the behavioral changes of blackbucks across various habitats, conservationists and managers can be in a better position to adjust their conservation efforts to save this species [14]. As an illustration, it is possible that providing a wide range of food with quality and quantity could be essential to the survival of wild blackbucks, whereas supplementary feeding of blackbucks in captivity can act as a stress reliever. According to the findings of the study, blackbucks in the enclosure used approximately 29.09% and 26.35% of their daily time in the appeal of foraging and feeding activities in winter and spring respectively. During winter in past research, it used 22.3 percent of the day in foraging and during spring it used 13.8 percent of the day in foraging [14]. The current study also discovered that the blackbucks in the enclosure used a larger percentage of their time in searching and eating in winter and spring compared to the former study. This disparity can be attributed to dis in environmental factors, i.e. temperature and food supply, and changes in the design of the enclosures and the gauges used to calculate foraging time. To illustrate, the enclosures used in this study have offered a narrower and accessible food supply that biased the foraging behavior of blackbucks [15].

In general, the changes in foraging time in the current study and the last one support the idea that it is crucial to keep in mind the environmental influences and the issue of operations when interpreting the research findings. Upon embracing the aspects that shape the foraging behavior of blackbucks, it is possible to establish superior policies that can be used by managers and preservationists to protect and conserve this species. On average, male blackbucks spent 11.78 percent of their time standing, with the numbers in the past being 15.18 percent [16], 9 percent [17], and 19.38 percent [18]. The following are some ways to explain why the percentages of time male blackbucks spend standing may vary in different studies. Researchers might have sampled male blackbucks of various inhabitants or at distinct times of the year and this might influence their behavior. As an illustration, in case a sample of male black bucks was collected on the breeding season, they could become more active or standing longer than they would have been in the non-breeding season [19]. Male blackbucks in the above study spent 11.78 percent of their time standing, and it is more compared to other earlier studies due to the fact that the study was conducted between January and March, which is the mating season of blackbucks [20-21].

Other reasons being that various researches could have employed varying techniques in studying and noting the behavior of male black bucks in Captivity or in wild. As an example, some studies might be having direct observation with

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trained researchers whereas others might be having remote cameras [22]. Such alternative approaches may influence the correctness or thoroughness of the obtained data. The surrounding in which the black bucks are seen can also shape their behavior. As an example, in one study conducted in a high predation-risk area, the black bucks might spend a lot of time standing and alert as compared to a low predation-risk area. In captivity perhaps that variation can be attributed to the presence of visitors [23].

As in the case of humans or other animals, male blackbucks can have an individual variation in behavior. Some people can be more active than others or spend more time on their feet and this could influence the overall average that would be reported in a study. The recent study reports the average percentages of time that male blackbucks spend walking at 24.35%. Nonetheless, other researchers have called out other values, such as 15.18% [24], 13% [25], and 25.9% [26]. The causes of these changes are identical with those of standing. According to a recent study, male blackbuck sits averagely to 21.23 percent and 17.68 percent in winter and spring respectively. On the other hand, a similar study has indicated different values, i.e., 22.6 percent in winter and 26.7 percent in spring [27]. Sitting period of blackbuck may differ across studies because of several reasons. Difference in habitat is one of the reasons. The habitat of blackbuck varies and they can be found in grasslands and shrub lands, and their habit environment can influence them in their behavior. In the two researches, the habitat varied with one another, hence the reason why there is a variation in results.

One other factor that may influence their sitting time would be the time of the day. Blackbuck are usually most active in early morning and late afternoon and they rest in between. Research carried out during various hours of the day might thus record varied sitting hours. Blackbuck behavior can be affected by seasonal changes and, therefore, affect the time they spend sitting. The males can be more active in their territories during the breeding season and be more active with the females and the non-breeding season can be more restful. Finally, the population variation may influence the behavior of the blackbuck and their sitting time. The behavior and the social organization of blackbuck populations may fluctuate and this may influence their sitting time. As an instance, blackbuck in larger groups could spend more time resting and socializing, and those in smaller groups could spend less time sitting. In Lahore Jallo Park, the herd size was small and this is the reason why male blackbucks sat less than in the other study.

In the captive environment of the enclosure, it was seen that the blackbuck on an average spent 2.83 percent of their daily time on running. During the research that was conducted earlier, it was found that it spent 2.57 percent of the day in running (Farooq et. al., 2022). There exist possibilities that the cause of running blackbuck in captive environment might be due to human disturbance. Animals under captive conditions, in most cases, are in a very different environment as compared to their natural environment. This may make them be stressed and anxious and this can influence their behavior. Also, when captive environment is poorly designed or managed, it may cause a scenario where animals are in some way disturbed or agitated by other human beings or other elements.

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Blackbuck is a fast and agile animal and in the wild, they escape predators through running. When they are in captivity, when they are stressed or threatened, they can run in order to cope with stressful situation. This may be the probable reason of the running behavior especially when it is humans who are disturbing. It is also worth noting that the captive environment should be designed and constructed in a manner that is less stressful and disruptive to the animals.

Human beings should also treat captured animals in a manner that is respectful and non-intrusive to reduce stress or anxiety that may lead to irregular behaviors like running away. The research explained above how blackbuck spend most of their time in carrying out five main activities namely feeding, sitting, walking, standing and running. Some of the minor activities blackbucks are also involved in include drinking, scratching, licking, aggression, sexual display, defecation, urination, sniffing and Flehmen response. Interestingly, time spent by blackbuck on these trivial activities differs with different studies. In the studies mentioned above, blackbucks invested 13.87 percent of time in such appeals in such minor activities. The current study allows us to learn about captive black buck behaviour. Conversely, prior research [28-29] indicated that blackbuck engaged in these only 2.32 per cent and 3 per cent of its time, respectively. A potential explanation of this difference is that the number of minor activities that were witnessed in the past research works was less than those witnessed in the research above [30]. The duration of the study used in the above research might have been higher to enable the full valuation of the behavior of black buck. The second aspect that might influence the outcomes is the geographical location and the environmental setting of the study sites which alter them [31]. Thus, the behavior of the blackbuck might have been influenced by the differences in the environmental conditions of the study sites and might have led to the emergence of various levels of activity. Finally, [32] time spent by blackbuck on small activities may vary across studies, and the trend in the above research was higher than the proportion of time spent on these activities in the past studies. This may vary because of study different design, number of animals, time of the study, environmental effects, and way of recording the behavior of the animals.

CONCLUSION

The author observed the behavior of a adult male blackbuck on a stretch of 80 hours in the winter and spring season. The activities observed were as follows standing, sitting, walking, running, feeding, drinking, scratching, licking, aggression, sexual display, defecation, urination, sniffing and Flehmen response. The results indicated that the most common activity was feeding in both the seasons whereas walking was more common in spring. Behavior activities of adult male blackbucks were different during the winter and spring seasons. The two seasons had similar activities in feeding, sitting and walking, but the frequency patterns varied. The minor activities also exhibited small differences between seasons with sexual display as the most common minor activity in spring whereas running was more observed in winter. The information of this research would be applicable in comparing the frequency and duration of various behaviors per season and how environmental factors influence the behavior of the

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blackbuck.

RECOMMENDATIONS

Some recommendations that could help improve the facilities for animals Conservation in the park

Blackbucks enclosure should be large that allows them to move around, exercise and interact with their other group members easily. It should also consist of natural basics such as trees, bushes, and rocks to mimic their natural habitat and provide accommodation.

Environmental upgrading should be provided to keep the animals mentally stimulated and prevent dullness. This can be attained by providing different types of food, toys, and materials to them.

A well balanced diet that meets their nutritious requirements is essential for the health and well-being of blackbucks. Animals should make sure that they got grass and other food items for animals.

Healthcare is very important factor for animals. There should be proper veterinarian for animals who can perform their duties efficiently and do proper daily checkups of animals. Consistent veterinary care is crucial to maintain the health of captive blackbucks.

Staff that perform their duties for animals should be properly trained so that they can handle animals properly and provide best care to them. Park Staff should receive proper drill in animal care and handling to provide the best possible care for the blackbucks.

Park Staff should monitor the behaviour of blackbucks on daily basis and keep eye on their movements to identify the issues or abnormalities.

Education and outreach programs can help raise attentiveness about the importance of preserving blackbucks and their habitat.

By applying these recommendations life quality of black bucks can be improved.

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