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Anti Covid-19 face-masks increases vigilance in Nubian ibex (*Capra nubiana*)

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**A R T I C L E   I N F O**

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**A B S T R A C T**

Changes in ecosystems resulting from anthropause caused by Covid-19 relate to both abiotic and biotic factors which have both a positive or negative effect on wildlife. The lockdown was manifested by reduced air and water pollution, lower mortality of animals on the roads, an increase in animals’ body condition and reproduction success. On the other hand, the closures lead to an increase in the populations of invasive species or poaching. We studied the behavioural reaction of natural, desert-dwelling Nubian Ibex (*Capra nubiana*) on the appearance of a new element in the environment – the facial-masks. We hypothesized that the mask would trigger a response expressed through differences in the vigilance towards a potentially new threat. We applied the flight initiation distance (FID) technique to check the reaction at the approach of a human with a facial-mask and without it. The average FID was 8.8 m and was longer when the observer was wearing a mask (10.7 m) as compared to trials without the mask (6.9 m). Our study indicates that wildlife, even if habituated to human silhouette at a distance, appear to notice unusual accessories when up-close and respond by increased vigilance and what may affect their overall fitness.

1. Introduction

The Covid-19 pandemic has caused almost instantaneous changes in human behaviour and presence around the world (Manenti et al., 2020; Rutz et al., 2020; Zellmer et al., 2020; Driessen, 2021; Primack et al., 2021). The restrictions aimed at stopping the spread of the pandemic, known as “anthropause” (Rutz et al., 2020; Mikula et al., 2021), have created unique conditions to study wildlife responses to the rapid human-induced environmental changes (Manenti et al., 2020; Rutz et al., 2020; Zellmer et al., 2020; Driessen, 2021; Mikula et al., 2021). The anthropause is manifested by a reduced mortality of animals on the roads, by an increase in their condition or reproduction success (Manenti et al., 2020; Rutz et al., 2020; Zellmer et al., 2020; Driessen, 2021; Mikula et al., 2021). On the other hand, the reduction of human activity has led to an increase in populations of invasive species (Manenti et al., 2020) and increased poaching (Manenti et al., 2020; Koju et al., 2021). The pandemic, in addition to restricting the movement of people, caused abrupt changes in human presence and behaviours related to the use of hygiene-related products, mainly face masks. Thus, in a short time, face masks became a common, new element in the existing environment constituting a large amount of a new type of anthropogenic waste (Rakib et al., 2021; Thiel et al., 2021) and thus harming wildlife (RSPCA, 2020; Hiemstra et al., 2021). At the same time, masks have changed the appearance of people hiding their expressions, which can also impact wildlife that have acclimatized to humans. Animals react to the new element of masks on people’s faces by changing their behaviour, which influences their survival strategies, such as avoiding predators (Jiang et al., 2020; Mikula et al., 2021).

The optimal foraging theory suggests that foraging organisms will maximize foraging-energetic benefits and minimize the time spent to acquire energy (MacArthur and Pianka, 1966; Pyke et al., 1977). The theory, also takes into account other constraints such as perceived danger (Wojciechowski and Yosef, 2011; Morelli et al., 2018), that could affect their fitness. In a landscape of fear, prey species, such as ungulates, are expected to either pay a physiological cost by developing behavioural tolerance (Saltz et al., 2019; Charuvi et al., 2020) or reduce risks by plasticity of antipredator behaviour (Iribarren and Kotler, 2012; Bonnot et al., 2017; Saltz et al., 2019), or pay a price in fitness per se.
In this study, we observed the behaviours of natural groups of desert-dwelling Nubian ibex (*Capra nubiana*) in an Israeli nature reserve. We assumed that the appearance of a new element in the environment, in the form of masks on people's faces, would trigger a reaction in the behaviour of Nubian ibex and would be expressed through changes in their vigilance towards a potentially new threat. The studied species is desert dwelling, sexually dimorphic ungulate, that lives in mixed groups in the proximity of vegetation and water sources (Gross et al., 1995). Throughout most of the year, mature males and females are seen in separate groups except during rut season which occurs in autumn (September–November in Negev Desert Highlands; Gross, 1998) but also in December in the Eilat Mountains (pers. obs.), when mature males seek out receptive females. During this period it is equally likely to observe female/kid, mature male(s), or mixed groups (Gross, 1998). Sexual size dimorphism in the study species agrees with Rensch's Rule (1950) wherein the slope of the allometric relationship between male and female body size is higher than one (Polak and Frynta, 2009). It is thought that the larger body size of male *Caprinae* spp. allows them to more readily resist predation and to digest poor quality foods (Polak and Frynta, 2009), especially when compared to lactating females (Festa-Bianchet, 1988), or those accompanied with kids (Berger, 1991). The latter are more responsive to predation risk than males (Berger and Cunningham, 1988). Therefore, our study focused on females that are in the critical period of their life cycle, when they are particularly alert and sensitive to sudden changes in the environment.

We conducted escape-initiation distance experiments to evaluate the response of female Nubian Ibex in the wild to our approach with and without facial-masks. We hypothesized that the appearance of a new element in the environment in the form of facial-masks will cause a negative reaction in the behaviour of Nubian ibex, by increasing their vigilance by maintaining an increased distance from the potentially new threat.

2. Materials and methods

2.1. Study area and fieldwork

The study was conducted in the Eilat Mountains Nature Reserve (29°33'N, 34°53'E), southern Israel. The area is characterized by steep, rocky, mountain slopes, deep canyons, and sheer cliffs (Geffen et al., 1992). The region is considered to be an arid zone with 250–300 dry-days/year and a precipitation to evaporation ratio of less than 0.2 mm (UNESCO, 1979).

The Nubian ibex are habituated to the presence of humans in Israeli nature reserves (Saltz et al., 2019), which makes it possible to observe their behaviour from relatively short distances. Between November and December 2020, during the lockdown in Israel, we studied the reactions of Nubian ibex females (Fig. 1) with and without facial-masks which are typical personal protective equipment used extensively during the COVID-19 pandemic. We applied the flight initiation distance technique (FID; Blumstein, 2003; Moller, 2008) to elucidate their responses at the approach of a human walking at a standard pace but without looking towards them. All observations were conducted by the same observer (MH), who always dressed in the same manner in order to control for the effect of coloration (cf. Zhou and Liang, 2020). We evaluated the initial distance (ID) which was the point from which we first observed the ibex and started our approach; we then noted the alert distance (AD) when we noticed a change in the behaviour of the ibex and they either stopped foraging and looked at us or strained their necks to observe our approach; and FID as the distance at which they moved away from the observer, almost always towards the cliffs. When a female ibex was spotted, the observer parked the vehicle and approached the individual/group on foot while counting the number of steps. During each trial, she noted the number of individuals accompanying the focal female – their number, sex and age. Each of the experimental trials was conducted at different locations along Wadi Shlomo, where concentrations of individual herds are known. The ibex are known to frequent the same locations in spite of the fact that the species is not territorial. However, individuals and their accompanying ibex were photographed in order to prevent sampling of the same herds with the two different procedures – with and without facial-masks. Individual ibexes in a population can be identified by a wide range of traits which include the shape and the number of bumps (annual expansions) on the horns, or lack of a horn, locations of scars on the body, varying heights of the white “stockings” on the feet, etc. Overall, the FID of 50 ibex female: 25 when the observer was wearing a facial-mask and 25 without it were recorded. Only female ibexes were approached in the wild and no other humans were present in all the trials because the study was conducted during the COVID-19 lockdown in Israel.

2.2. Data processing and analysis

Before conducting the field experiments we performed 15 trials, when a distance of 10 steps of MH were measured using a measuring tape to the nearest 10 cm. Because the average distance of 10 steps was 6.0 m (CL: 5.8–6.1), all of obtained distances in steps were multiplied by 0.6 and rounded to the nearest meter.

We checked the possible influence of wearing a mask by the observer on 1) AD and 2) FID controlling the effect of ID and factors that may influence the ibex vigilance response such as: number of other females, males and calves (Saltz et al., 2019). We applied two separate Generalized Linear Models (GLZ) with Poisson distribution and log-link function. The calculations were performed using STATISTICA (TIBCO Software Inc., 2017). Throughout the text, mean values are presented with 95% confidence limits (CL).

3. Results

The average AD was 34.4 m (CL: 30.2–38.5, n = 50, range: 10–85) and was not influenced by the wearing of a mask by the observer (GLZ, Wald chi-square = 0.05, df = 1, p = 0.824, Fig. 2a). Furthermore, there...
was no effect of ID and group size of different sex and age classes on AD (GLZ, in all cases \( p < 0.156 \)).

The mean FID was 8.8 m (CL: 7.5–10.0, range: 2–25) and was longer when the observer was wearing a mask as compared to trials without the mask (GLZ, Wald chi-square \( = 15.83, df = 1, p < 0.001 \), Fig. 2b). Furthermore, there was no effect of ID and group size of different sex and age classes on FID (GLZ, in all cases \( p < 0.146 \)).

4. Discussion

Humans play the ecological role of ‘super predators’, which can change the behaviour of species even in the highest trophic level in many ecosystems, triggering fear responses (Darimont et al., 2015; Wilson et al., 2020). Animals adjust their behaviour when they perceive the presence of a human as a threat, even in response to their normal daily activities (Larson et al., 2016; Jiang et al., 2020; Wilson et al., 2020). The behaviour of animals is also significantly influenced by changes in their habitats, which are most easily noticed by them in non-urbanized environments (Vincze et al., 2015; Zhou and Liang, 2020; Mikula et al., 2021). The fear of novel stimuli, called neophobia, plays a major role in animal ecology including animal behaviour (Crane and Ferrari, 2017; Schaffer et al., 2021). Because predation is one of the major factors shaping animal populations (McNamara and Houston, 1987; Gilg et al., 2003), we assumed that the appearance of a new, unknown stimulus in a given area should trigger an appropriate reaction reflected in changes in the behaviour of potential victims, feeling a potential threat. This assumption is confirmed by the results of our study which substantiate our hypothesis. Although, the alert distance of the Nubian Ibex was not influenced by the wearing of a mask by the observer, the behaviour expressed by escape initiation distance was significantly greater when the observer approached with a mask compared to trials without it. The lack of a significant reaction in the form of alert distance may be due to the fact that the Ibex only identify silhouettes and behaviour of the approaching individual at a distance (Iribarren and Kotler, 2012; Goumas et al., 2020) and do not discern details to the same extent, such as facial coverings or expressions. In addition, the study area is a desert reserve, where Ibex are not disturbed by humans. To the contrary, Ibex have become accustomed to the presence of humans who observe them from relatively short distances (Iribarren and Kotler, 2012; Saltz et al., 2019). The reaction to an approaching observer with a covered face in the form of escape initiation distance, points to the fact that the mask is seen only at close range and is “perceived danger” from the Nubian Ibex’s perspective.

Our experiment was conducted during the lockdown what may have influenced the behavioural response of the ibex in that they were not habituated to humans with covered faces. Wild animals that have contact with humans can benefit from individual recognition of people and adapt their behaviour to the potential risk or profit expected from them (Lee et al., 2011; Vincze et al., 2015; Lee et al., 2016; Goumas et al., 2020). Several studies confirm the ability of animals to recognize individual people based on their facial features (Dyer et al., 2005; Marzluff et al., 2010; Davidson et al., 2015). Therefore, it is possible that also ibex are able to discern humans based on the facial appearances which makes them more wary of people wearing masks than to people without them (cf. Caro, 2005; Iribarren and Kotler, 2012; Saltz et al., 2019). This suggests that the habituation process to the new element, of humans wearing masks, had not yet started in the ibex during our study period. It appears that ibex need time to adjust and accept the new element in their environment, like in the Eurasian tree sparrows (Passer montanus), which decreased FID in response to people wearing masks over six months (Jiang et al., 2020). It is possible that Ibex will associate facial-masks with humans and acclimatize to them over time but the novel accessory resulted in an escape response during our study in late 2020. This survival related response is further substantiated by Zukerman (2021), who compared reproduction in Nubian Ibex before and during the COVID-19 lockdowns, and demonstrated that the fitness cost of ecotourism in the canyons of the Negev Desert in Israel results in reduced fitness affecting population levels and future recruitment. These findings suggest that the Nubian Ibex in general are always sensitive to the presence of people in their environment, and the reappearance of humans with an unknown accessory, like the face masks, can only aggravate this negative effect.

In conclusion, our study points out that wildlife, even if habituated to a human silhouette at a distance, appear to notice unusual accessories when up-close, and respond by increased vigilance. Future studies should verify the habituation process in other wildlife species to variations in human related stimuli in order to prevent unnecessary disturbances in the wild.
CRediT authorship contribution statement

Reuven Yosef: idea, writing and editing the manuscript.

Michal Hershko: idea, data collection.

Piotr Zdumiak: statistical data analysis, writing and editing the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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