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An Investigation into The Frequency and Causes of Fleas in Goat Farms

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ABSTRACT

The objectives of the study are to determine the flea density in goat farms in the Bornova district of the province of Izmir, investigate the reasons, and develop remedies. This study is a situation determination to determine the flea problem in extensive goat farms. The research sample, which was carefully selected from the agricultural and livestock records kept by the Bornova District Directorate, consisted of 39 goat farms. According to research, 84.61% of sheep and goat farms experience flea problems, and 94.87% of those farms lose animals as a result of flea infestations. 33.33% of the body colours of animals with fleas are black. The most frequently infested animals by fleas were goats (28.21%) and young animals (33.33%). The main symptoms of a flea infestation are itching and hair loss (17.95% and 20.51%). Removing manure from the barn was the most widely used flea management technique (38.46%), followed by using pesticides (17.95%). Cats or dogs were reported to have flea issues in 89.74% of the farms. As a result, if flock management activities including hygiene and sanitation, animal welfare, and health-protection techniques are done well, the damage caused by ectoparasites will be reduced. To prevent potential financial losses in the flock, it is recommended to emphasise to goat producers the importance of flea infestations and to apply appropriate flea control methods.

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Keçi Yetiştiren İşletmelerde Pire Görülme Sıklığı ve Nedenleri Üzerine Bir Araştırma

ÖZET

Çalışmanın amacı; İzmir ili Bornova ilçesinde keçi yetiştiriciliği yapan işletmelerde pire yaygınlığının belirlenmesi, nedenlerinin araştırılması ve buna yönelik olarak çözüm yollarının geliştirilmesidir. Bu çalışma, ekstansif keçi işletmelerinde pire sorununu belirlemeye yönelik olarak yapılan bir durum saptamasıdır. Araştırma materyalini, Bornova ilçe Tarım ve Hayvancılık Müdürlüğü kayıtlarından gayeli örnekleme yöntemiyle seçilen 39 keçi işletmesi oluşturmuştur. Koyun ve keçi işletmelerinin yüzde 84.61'inde pire sorunu olduğu ve bunların yüzde 94.87'sinin pire kaynaklı hayvan ölümlerine neden olduğu belirlenmiştir. Pire görülen hayvanlarda en çok görülen vücut rengi %33.33 ile siyahtır. Pireler, en çok yavrularda (%33.33) ve ergin hayvanlarda (%28.21) görülmüştür. Pire belirtileri arasında ilk sırada; kaşıntı ve kıl dökülmesidir (%20.5) Pireyle mücadelede, gübrenin ağıldan uzaklaştırılması (%38.46) ve daha sonra pestisitlerin (%17.95) kullanımı en yaygın uygulama olmuştur. İşletmelerin çoğunda (%89.74) mevcut olan kedi veya köpeklerde de pire sorunu belirlenmiştir. Sonuç olarak, hijyen ve sanitasyon, hayvan refahı ve sağlığı koruma tekniklerini içeren sürü yönetimi faaliyetleri iyi

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yapılırsa ektoparazitlerin neden olduğu zarar azalacaktır. Özellikle keçi yetiştiricileri açısından pire zararlısının önemi yetiştiricilere iyi anlatılarak olası hayvan ölümleri ya da sürüde oluşacak ekonomik kayıpları en aza indirecek pireyle mücadele yöntemleri uygulanması önerilir.

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INTRODUCTION

Fleas, which are blood-sucking arthropods, infect many mammals and birds, including humans (Joseph et al. 1981; Halos et al., 2014; Hastriter et al., 2018; Dahm et al., 2021; Koseoglu et al., 2021). In the domains of medicine and veterinary science, some species from the Pulicidae family (*Pulex irritans, Xenopsylla cheopis, Ctenocephalides canis, Ctenocephalides felis*), Ceratophyllidae family (*Nosopsyllus consimilis, Nosopsyllus fasciatus*), and Leptopsyllidae family (Leptopsylla segnis) rank. There have been numerous studies on the prevalence of flea species in goats raised around the world (Kusiluka et al., 1995; Yakhchali & Hosseine, 2006; Gracia et al., 2012; Tesfaheywet & Simeon, 2016; Ajith et al., 2017), but there hasn't been much research on the subject in our country (Fagbemi, 1982: Yilmaz et al., 2017; Ashwini et al., 2017; Hatami et al., 2022). The goat industry contributes to the Turkish livestock economy (Ertuğrul et al., 2010; Sezer et al., 2021). Animals without basic health restrictions are susceptible to several parasite infections, which cause financial losses. Ectoparasites play a major role in several parasitic diseases. In advanced cases in animals, flea bites have been related to severe itching, hair loss, acanthosis, hyperpigmentation, and hyperkeratinization, whereas in people, pulicosis occurs (Unat et al., 1995; Yeruham et al., 1996, 1997, 1999; Lappin, 2018). Ectoparasites: higher mortality rates in young and adult animals, reduced yields, some reproductive issues, and skin conditions, especially in farms that raise sheep and goats and breed them intensively (Sisay et al., 2013; Risa, 2021). Some African and Asian exporters of sheep and goat leather suffer significant financial losses because of these ailments and skin imperfections contributing to the poor quality of the leather (Yacob, 2013; Leahy et al., 2017; Prelezov & Nizamov, 2020). Livestock farms are under pressure from the city on a human and environmental level in the rural areas of the provinces that have reached the status of multiple metropolitan centres, such as Izmir. It has been stated that relocating to areas where their health won't be endangered is now necessary (Tosun & Demirbas, 2012). In the rural regions of the provinces that have attained the status of multiple metropolitan centres, such as Izmir, livestock farms are under pressure from the city on a human and environmental basis. According to reports, they must now relocate to regions where their health won't be in danger (Kandemir et al., 2019). It has been stated that regions can be created specifically for animal husbandry (Ünal et al., 2020; Deri et al., 2021). In the Bornova region of the province of Izmir, goat farms have high flea concentrations. This study is a situation determination to determine the flea problem in extensive goat farms

MATERIAL and METHOD

The investigation will be conducted within the bounds of the Izmir metropolitan municipality, in the rural Bornova district. Only the five districts in the district centre that engage in major animal husbandry activities were chosen, according to information and official papers provided by the Bornova District Directorate of Agriculture. There are 12 communities in the study region where raising animals is a major source of income (Figure 1.). With the introduction of the Metropolitan, all Bornova forest villages on the grounds of the Izmir metropolitan municipality were given neighbourhood status in 2012.

Figure1. Study area
Şekil 1. Çalışma Alanı

According to Table 1, while there are 39 farms where other species are grown in the whole region, 19 of them are goat farms. The Pınarbaşı, Laka, and Gökdere districts do not have any goat farms, despite the Bornova district having 12 neighbourhoods or villages.

In 89.48% of these farms, there may be two or more small ruminant farms. There are only two modest ruminant farms (1 unit each) in Kayadibi and Beşyol (1 unit). They weren't considered in the statistical study because of how little they added to the total—just 5.26%.

Table 1 Distribution of goat farms by settlements in the Bornova district
Çizelge 1. Bornova ilçesinde mahallelere göre keçi işletmelerinin dağılımı

Settlement (Neighbourhood)	Number of the all farms (n)	Number of goat farms (n)	%
Çamiçi	3	3	15.78
Kayadibi	3	1	5.26
Çiçekli	4	3	15.79
Yakaköy	3	2	10.53
Eğridere	5	3	15.79
Karaçam	2	1	-
Pınarbaşı	3	-	-
Laka	4	-	-
Kurudere	5	3	15.79
Sarnıç	2	2	10.53
Beşyol	4	1	5.26
Gökdere	1	-	-
Total	**39**	**19**	

Select Farms

In the Bornova district of the province of Izmir, the farms in these five communities are registered with the District Directorate of Agriculture (Farmer Record System). They are ready to take part, and the farms selected will represent at least 15% to 20% of all the goat farms in the district.

Survey Research

Data for a questionnaire study that asks questions on land, animal wealth and management, feeding-housing-health-protection practices, and pasture and manure management was gathered through in-person interviews. In-person interviews were used to collect information for a questionnaire study that asks questions on land, animal wealth and management, feeding-housing-health-protection practises pasture and manure management.

a.Information about the farm and the owner: Additional information about the farm's land area, production system, labour force, and housing configuration is also provided, along with more descriptive data about the breeder's age, educational background, financial opportunities, and reasons for raising livestock.

b. Information on animal stock and herd management: Some discoveries included the types of animals raised on the goat farm and their distribution by age group, their physical characteristics and methods of growth, and the possibilities for concentrate and roughage feed.

c. Information on the pasture's design and purpose: There are questions about the size, shape, and duration of use of the farm's animal pasture source.

d. The type of litter used in the shelter, how frequently it needs to be replenished, how the manure is stored and tested, and who receives it as a product are all covered in the information on manure management.

Sample Size

Izmir province's Bornova area is home to about 8400 sheep and goats. A homogenous sample of at least 10–20% of the total number of animals from each farm, which has been limited to the farms in the five villages where these animals are actively raised, was collected.

Statistical Model

All of the goat farms (39) are family businesses, and a general study without grouping them into subgroups was conducted and presented as a frequency table (SPSS 22). In the Bornova neighbourhood of Izmir, there aren't many goat farms, thus the study was designed to find out how things are there. Otherwise, it is required to do a more thorough analysis of the environmental parameters, such as the number of animals (small, medium, and big scale), demographics (age, gender, education level, etc.), and the manure management system. Only frequency analysis was performed in the absence of the specified qualities in the firms, and the situation was summarised with tables.

RESULTS

In the research, the results of the farms, the owner, herd management, and flea control methods were reviewed in chronological order and displayed in tables.

Farm Characteristics

The frequency distributions for the farms are shown in Table 2. Family farms make up 71.79% of the farms,

while 61.54% of the farms are closed shelters. A substantial section of the farm produces combined output (64.10) and sacrificial production (35.90%). As a species, sheep and goats are raised together (69.23%). Although a substantial proportion of farmers (82.05%) do not own their land, a sizable proportion of dryland farming can be carried out on the current land (79.48%).

Table 2. Frequency table for goat farm some characteristics
Çizelge 2. Keçi işletmelerinde bazı özelliklere ait frekans tablosu

Traits	Groups	n	%
Farm type	Family	28	71.79
	Commercial	11	28.21
Labour force	Family	34	87.17
	Temporary	5	12.83
	Permanent	-	-
	Other	-	-
Housing type	Closed	24	61.54
	Open	2	5.13
	Semi-open barn	9	23.08
	Shelter	4	10.25
	Other	-	
Livestock	Goat	5	12.82
	Sheep	7	17.95
	Cattle	-	-
	Sheep +Goat	27	69.23
	Poultry	-	-
	Other	-	-
Source of capital	Own capital	30	76.92
	Bank credit	-	-
	Own capital +bank credit	9	23.08
	Incentive credit	-	-
	Other	-	
Land asset(da)	No	32	82.05
	Ownership land	7	17.95
	Rental	-	-
	Other	-	-
Land type	Irrigable (da)	8	20.52
	Dryland (da)	31	79.48

Knowledge of the Farmer

Information about goat farms is included in Table 3 of the report. Goat breeders make up a substantial portion of farm owners in the study—87.17% of them are male. In total, 56.41% of people are between the ages of 41 and 60. When the education level is considered, 43.59% of them have completed primary school. In response to survey questions, most goat farm owners (43.59%) said they were farmers and that caring for livestock was their main source of income (76.22%).

The Flock Management Methods

Examples of herd management strategies for goat farms are shown in Table 4. Sheep and goats are housed collectively (84.61%) on the farms. The dairy farmer (58.98%) and their marketing plan (25.64%) come out on top when comparing the breeders' animal product marketing tactics. They are forced to purchase both roughages (43.59%) and concentrated feed (38.46%) instead because there aren't many possibilities for irrigated farming and there isn't enough land accessible to cultivate animal feed. On a sizable area of the farm, dogs (48.72%) are raised for grazing. Other farms are situated nearby (76.22%), and their distance (less than 500 m) from the goat farms is shorter (74.36%). Except for the marketing strategy for animal products, the type of intense feed supply.

Prevalence of fleas

The study's findings regarding the fight against fleas are presented in Table 5. The two seasons of the year with the highest flea prevalence are summer (48.72%) and spring (33.33%). The reason why fleas are common in the summer and spring seasons is due to the high temperature and humidity in the region. Fleas were mostly seen in the young at 25.64%, and then in the adult animals at 56.41%. The incidence rate in animals of all age groups is 17.95%. In goat herds, the flea

Table 3 Frequency table for farm ownership (%)
Çizelge 3. Keçi yetiştiricilerine ait frekans tablosu

Traits	Group	n	%
Gender	Male	34	87.17
	Female	5	12.83
Age	<20	-	-
	21-40	12	30.77
	41-60	22	56.41
	>60	5	12.82
Education level	Illiterate	2	5.13
	Primary school graduate	17	43.59
	Primary school dropout	5	12.82
	High school	6	15.38
	High school dropout	5	12.82
	Vocational school	3	7.69
	University graduated	1	2.56
Occupy	Farmer	17	43.59
	Self-employment	11	28.21
	Retired	10	25.64
	Other	1	2.56
Reason for farming	Basic income source	30	76.92
	Additional income	9	23.08
	Hobby	-	-
	Hobby + additional income	-	-
	Other	-	-
Year for farming (year)	<5	4	10.26
	6-10	9	23.08
	11-20	19	48.72
	21-30	5	12.82
	31 >	2	5.12

Table 4. Frequency table for some practices of herd management in goat farms
Çizelge 4. Keçi işletmelerinde sürü yönetimi uygulamalarına ait frekans tablosu

Traits	Group	n	%
Are sheep and goats housed together?	Yes	33	84.61
	No	6	15.39
Animal product marketing method	Own	10	25.64
	Cooperative	6	15.38
	Dairy	23	58.98
Roughage supply method	Completely own	8	20.51
	Some purchase	12	30.77
	Completely purchase	2	5.13
	No feed	17	43.59
Concentrate feed supply method	Completely own	3	7.69
	Some ownsome purchase	12	30.77
	Completely purchase	9	23.08
	No feed	15	38.46
Vaccines	Own	-	-
	Special veterinary	12	69.23
	State veterinary	27	30.77
Type of animal raised on the farms	Dog	19	48.72
	Cat	13	33.33
	Poultry	7	17.95
Is there a livestock farm near the farm?	Yes	30	76.92
	No	9	23.08
If yes, is this farm near you?	Close	29	74.36
	Very close	10	25.64

Table 5. Frequency distribution of flea symptoms and control methods in goat farms(%)
Çizelge 5. Keçi işletmelerinde pire belirtileri ile pireyle mücadele yöntemlerine ait frekans tablosu

Traits	Group	n	%
In which season of the year are fleas most common?	Summer	19	48.72
	Autumn	5	12.82
	Winter	2	5.13
	Spring	13	33.33
	Every season	-	-
What is the age group where fleas are most common?	Adult	22	56.41
	Young	10	25.64
	All age	7	17.95
The area where the flea is seen on the animal's body	Foots	7	17.95
	Back	9	23.08
	Ear	2	5.13
	Barrel	5	12.82
	Genital organ	1	2.56
	Udder and its circumference	4	10.26
	Armpit	5	12.82
	Whole body	6	15.38
Flea symptoms	Itching	7	17.95
	Hair loss	6	15.38
	Lesion	5	12.82
	Anaemia	3	7.69
	Lose weight	7	17.95
	Itching and hair loss	8	20.51
	Hair loss +lesion	3	7.69
Flea control method	Spray	7	17.95
	Powder	4	10.26
	Gas or diesel dripping	2	5.13
	painting board equipment	1	2.56
	Manure disposal	15	38.46
	Injection	6	15.38
	Using multiply methods	4	10.26
	Deep bath	0	0
Does the flea problem reappear after spraying?	Yes	30	76.92
	No	9	23.08
The body colour of the animal with fleas	White	3	7.69
	Grey	8	20.52
	Brown	10	25.64
	Black	13	33.33
	Every colour	5	12.82
Body condition of goats in the herd	Bad	16	41.03
	Moderate	20	51.28
	Good	3	7.69
Do you take a deep or foot bath for fleas?	Yes	5	12.82
	No	32	82.05
	Sometimes	2	5.13

problem is also seen in this age group, as young animals are usually taken to graze on the pasture with mature animals. The back of the animal has a prevalence of 23.08% for fleas, making it the most commonly infested area. The feet rank second with 17.95%, and the overall body's incidence rate is 15.38%. Fleas were last seen around the genitals of goats. Itching and hair loss are the most frequent flea symptoms, followed by weakness or weight loss (17.95%) and hair loss (20.51%). To control fleas, removing manure from the barn was the method most usually employed (38.46%), followed by using liquid pesticides (17.95%). 10.26% of respondents claim to use multiple strategies. Fleas were seen again after the war in a substantial area of the farm (76.92%). The majority of fleas were found on the bodies of black (33.33%) and brown (25.64%) animals. Fleas are present in 12.82% of all animals, regardless of colour. Table 5 of the study contains information on the control of fleas on farms and the answers to the

questions that were posed on this subject. When the flea symptoms and flea control techniques in the farms were assessed in the study, it was discovered that the difference defined in terms of just three criteria was substantial. The following factors are listed in order: the flea problem's worst season of the year, if it returns following the herd's fight against it, the body condition score of the animals in the herd, and finally, whether foot baths are acceptable for the animals.

Manure Management on Farms

The frequency distribution of manure management in goat farms is shown in Table 6. Straw (23.88%) and compacted dirt (25.64%) were the two materials utilised most frequently in the 84.61% of animal shelters that used litter. Other substances used as litter in addition to these are straw (15.38%), burnt manure (10.26%), concrete (10.26%), and stone (7.69%). The ease of sourcing (30.77%) and cheap cost (53.85) of the trash used as litter in the housings were the main motivating elements. Hand ploughing was the main method of manure collection on 89.74% of livestock farms. Tractor usage came in second with 20.25%. The frequency of removing or cleaning the manure from the residence is expressed as a daily application of 64.10%. It placed second with weekly (28.20%). The final procedure involved seasonal manure removal from the house (2.56%). There is a significant difference in the subjects' answers to questions about whether there is litter material, how the manure is stored in the shelter, what the manure storage method is, and finally how the produced manure is evaluated in the enterprise when the study examines the manure management system.

Table 6. Frequency distribution of manure management in goat farms (%)
Çizelge 6. Keçi işletmelerinde gübre yönetimine ait frekans tablosu

Traits	Group	n	%
Does the shelter have litter material?	Yes	33	84.61
	No	6	15.39
What is used as litter material?	Straw	6	15.38
	Stover	9	23.08
	Sawdust	3	7.69
	Burnt manure	4	10.26
	Soil	10	25.64
	Concrete	4	10.26
	Stone	3	7.69
The reason for choosing the substrate material used	Cheap	21	53.85
	Easy supplying	12	30.77
	The other reasons	6	15.38
Manure collection system/shape in the shelter	With a scraper	35	89.74
	Automatic system	-	-
	By a tractor	4	20.25
Frequency of manure collection in the shelter	Daily	25	64.10
	Weekly	11	28.20
	Monthly	2	5.13
	Seasonal	1	2.56
Manure storage method	Mass (on the soil)	26	66.66
	In an open-top manure	9	23.08
	pit	4	10.26
	Field/road near		
How to evaluate the manure	All selling	30	76.92
	All in the field	2	5.13
	I use it in my field	7	17.95

DISCUSSION

This study looked at the prevalence of fleas and their causes in goat farms in the Bornova area of the province of Izmir. Flea incidence in goat ranches was 89.74%. This percentage is 52.2% on farms with both species (goats and sheep). The results are consistent with those of Kandemir et al. (2015) in the Izmir region, Koyuncu et al. (2006) in the Canakkale region, and the outcomes of the goat farms in the provinces of Taşkın et al., (2017) when the characteristics of determining the flea problem of the farms are analysed. In their experiment in Sao Paulo, Brazil, Madeira et al. (2000) found higher levels, similar to Abdullahi et al. (2000). As flock sizes grow and housing and pasture conditions deteriorate in livestock properties with a broad production system, as in this study, the incidence of ectoparasites rises significantly (Kusiluka & Kambarage, 1996; Prelezov & Nizamov, 2020). Family-style farms had a higher prevalence of fleas, especially among younger people (33.33%) as

opposed to older people (28.11%). Commercial farms, however, have a greater frequency of fleas in mature animals than comparable family-style farms do. Young animals on family-run farms are more likely to have fleas since they don't take the same care of themselves as adults do (Pegram et al., 2004; Kebede et al., 2021). On the other hand, Lehman (1993) asserted that because of their low, licking/grooming behaviour, animals experience greater parasite issues than adults. It's been said that it happens more frequently when there isn't enough grass and there are harsh weather conditions (Hoskins & Cupp, 1991; Rust, 2017; Dahm et al., 2021). A further factor that makes older or adult animals less susceptible to ectoparasites is that their skin is thicker than that of younger animals. The animal's physiological cycles had no discernible impact on the inquiry. This result contradicts the Fagbemi (1982) study, but it backs up Ogbe's (1998) conclusions. But in contradiction to the study's findings, Makelesh (2010) found that Sertse & Wesson (2007) found that in a study conducted in the Tigray region of Ethiopia, goats have higher ectoparasite burdens than sheep. Fleas are particularly common among ectoparasites in sheep and goats that are pregnant or lactating. Herd management and the immune system's physiological sensitivity are the main contributors to this (Silaghi et al., 2012). In addition to female animals, male animals with ectoparasites significantly contribute to the spread of parasites to the other females in the flocks during the mating season (Davis et al., 2006; Rust, 2016; Akgul et al., 2019; Feyisa, 2021). Regional changes in climatic factors like temperature and humidity are important in this regard since seasonal variations are essential for the growth of ectoparasite populations like fleas (Tavasoli & Rahbari, 1998). Goat breeding makes a considerable economic contribution to the region and the country compared to other animal species (Krasnov, 2008). This is why ectoparasite research should be prioritised, particularly from an epidemiological standpoint, as it is detrimental to both human and animal health. Ectoparasites can cause severe skin damage and cause direct or indirect animal losses in farming operations. This is a very significant concern for goat farms. However, if flock management strategies, such as cleanliness and sanitation, animal welfare, and health-protection practises, are effectively implemented, the harm caused by ectoparasites will be reduced (Akgül et al., 2019; Koseoglu et al., 2021). A flock's breeding system has a significant role in the transmission and maintenance of an ectoparasite infection. Extensive grazing of animals allows for direct contact with animals, which is essential for the transmission of these parasites because the majority of ectoparasites, like lice, cannot survive for long periods away from the host body surface (Shibeshi et al. 2013; Taylor et al., 2007; Feyisa, 2021). According to past research, the prevalence of ectoparasites was highest in animals that were raised widely (Kusiluka et al., 1995; Sargison, 2020). The low incidence may be explained by the fact that most of the animals were grown in semi-intensive systems and that there was little ectoparasite transfer from grasslands. Flea infestations were not seen in animals kept in concrete sheds, and the ectoparasite burden was remarkably low (8.33%). This discovery supports the findings of Hassan et al., (2011), that ectoparasite occurrence can be decreased with adequate hygiene and a semi-intensive breeding approach. The frequency of ectoparasites, the size of the herd, hygienic conditions, the weather, breeding practices host immunological health, parasite biology, etc. It is reliant on factors such as the host, the environment, and the parasite (Syamsul et al., 2020). Although the sensitivity to age and gender in this experiment was not particularly evident, the prevalence of lice increased. According to Sarkar et al. (2010)'s findings, it was observed in goats. It has been connected to immunosuppression brought on by stress and pregnancy during colostrum feeding (Tavasoli & Rahbari, 1998; Patterson et al., 2015; Soundarajan et al., 2018).

CONCLUSION

Goat breeding has a significant financial impact on the regional and national economy, compared to other animal species. Therefore, ectoparasite research should be prioritised because of its negative effects on both human and animal health. On farms, ectoparasites can cause severe skin damage and direct or indirect animal losses. This is a major problem for farms that export sheep and goat skins. However, if flock management activities including hygiene and sanitation, animal welfare, and health-protection techniques are done well, the damage caused by ectoparasites will be reduced. Identifying ectoparasite species and their hosts will also help in the selection of efficient control measures, which will be very helpful in the treatment of many zoonotic diseases.

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Author's Contributions

The contribution of the authors is equal.

Statement of Conflict of Interest

The authors have declared no conflict of interest.

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