LGU Journal of
LIFE SCIENCES

LGU Society of Life Sciences

Research Article
Vol 5 Issue 4 Oct - Dec 2021

LGU J. Life. Sci
ISSN 2519-9404
eISSN 2521-0130

Prevalence and Associated Risk Factors of Coccidiosis in Small Ruminants in Dera Ghazi Khan, Punjab, Pakistan

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ABSTRACT: *The goal of the present research was to figure out the prevalence and risk factors of coccidiosis in goats and sheep in Dera Ghazi Khan. For this 752 (goats=376; sheep=376) fecal specimens were obtained, and were analyzed by coprological examination. The prevalence of coccidiosis in sheep (52.92 %) was significantly higher (P<0.05) than the goats (44.41 %). In females, infection with Eimeria was significantly higher (P<0.05) as compared to male animals. Coccidiosis was significantly more common (P<0.05) in sheep and goats aged ≤6 months compared to sheep and goats older than 6 months but less than a year, and older than a year. There was a clear distinction (P<0.05) in prevalence of coccidiosis in animals that are stall fed and housed in comparison with the animals that graze in open grasslands. Prevalence of coccidiosis in animals with low BCS was considerably higher (P<0.05) as compared to the animals in good health. The prevalence of Eimeria infection and fecal score had a significant correlation (P<0.05). Prevalence of coccidiosis was higher in August while in October it was lowest. The highest prevalence (56.78%) was of E. ovinoidal is followed in order by 47.23 % E. ahsata, 35.67 % E. parva, 30.15 % E. intricate, 26.63 % E. faurei and 19.09 % E. pallid in sheep. In case of goats, highest prevalence (68.86%) was of E. ninakohlyakimovae, followed by 59.88% E. alijevi, 53.29% E. arloingi, 46.70 % E. caprinaand 22.15 % E. hirci were among the most common Eimeria spp. It was concluded that different Eimeria spp. Prevailing in study area with variable risk factors and the incidence of coccidiosis in research area was affected by various risk variables.*

Keywords: *Eimeria*; small ruminants; incidence; risk parameters.

INTRODUCTION

Sheep and goats are the major farm animals of man and are particularly important in more drastic conditions of the world. About two-thirds of their global population exist in the developing countries where they make a large contribution to the agricultural enterprises (Tony, 2007).

Eimeria parasites (Apicomplexa: Eimeriidae) are known to be a significant source of intestinal disease in livestock globally (Ahmad et al., 2016). These protozoa are accountable for the deadly disease "coccidiosis", which affects vertebrates and small ruminants (Mohamaden et al., 2018). Among these animals, goats and sheep are most frequently infected by *Eimeria* species, resulting in significant financial losses, either in the form of actual costs and production, which straight away impacts the welfare of animals (Silva et al., 2014).

Multiple species of *Eimeria* have been documented in goats (~17 species) and sheep (~15 species) globally (KhodakaramTafti et al., 2013). The major species affecting sheep are primarily infected by *Eimeria crandallis* and *Eimeria ovinoidalis*, while goats are primarily infected by *Eimeria ninakohly akimovae* and *Eimeria arloingi* (Chartier and Paraud 2012; Souza et al., 2015; Sharma et al., 2017). *Eimeria* spp. are mainly transmitted through the intake of sporulatedoocysts (Bakunzi et al., 2010; Hashemnia et al., 2015). They parasitize the inner layer of the digestive tract giving rise to dysentry; often it includes (blood or mucus) and then impacts the wellbeing of animal as reduction in weight, hunger, blood deficiency, wool breaking, exhaustion and mortality (10-40% morbidity and 10% mortality) (Phil, 2017).

The disease usually occur in young animals but in extreme conditions, the mature animals are also affected (More et al., 2011). Small ruminants of all age groups and races are prone to *Eimeria* infection; nevertheless, lambs whose age is from 3 weeks to 5 months are quite seriously infected by outburst of coccidial infection, whereas the remaining herd may serve as vectors (Rehman et al., 2011). In general, *Eimeria* spp. are identified by examining the structural characteristics of sporulated oocysts under a microscope, which include oocyst remnant, mass, sporulation period, micropyle, and polar cap (Kawahara et al., 2010; Nahavandi et al., 2016).

As earlier documented for various ruminant species, a range of factors

might affect the occurrence of coccidiosis such as young age, pressure, immunological response, population of animal or animal count per unit (flock size), other factors associated with the livestock management, along with weather patterns (Cai and Bai, 2009; Carrau et al., 2018; Rehman et al., 2011; Silva et al., 2014). In the present research, we intend to look into the incidence of coccidiosis and various risk parameters associated with it.

MATERIALS AND METHODS

Geographical Position of Area of Research

Dera Ghazi Khan is located at an elevation of 112 meters above sea level and is located at 30'03 "N, 70'38" East. The weather in the area is mainly dry with little precipitation. The location receives 125 mm of rain per year. The cold season is mild, and the weather is hot for the rest of the year. During the summer, the average temperature is 115°C, while the average temperature during the winter is as low as 40°C.

Incidence of Coccidiosis in Goats and Sheep

A sum of 752 excreta specimens (goats = 376 and sheep =376) were obtained haphazardly from various regionsin Dera Ghazi Khan and investigated for the occurrence of *Eimeria* oocysts. At the time of specimen collection, information about each goat and sheep was recorded in a data record file. The following data was entered into the record file: description (owner's name and address), animal characteristics (breed, race, age, and gender), illustration of residential area (enclosed or with outside accessibility, if enclosed, floored yard or mud), and fodder method (graze, stall or both), bodily state (1 = bad, 2 = low, 2.5 = moderate, 3=good, 4=obese), faecal score (1 = regular; 2 = delicate, does not keep shape; 3 = liquidy, disperses quickly; 4=deprived of rigid material), outcomes (+ve, -ve and species identified).

Excreta Specimen Collection and Analysis

After putting on disposable gloves, 5g excreta sample was taken from the rectum of each goat and sheep. Excreta specimens were collected and placed in sealed polythene sacks, which were then labeled and kept in an ice-cold container for shipping to the Medicine Laboratory at UVAS (University of Veterinary and Animal Sciences) in Lahore.The specimens were kept in the laboratory at 4°C till treatment but lasting no longer than 48 hours. The Salt Flotation Technique and Direct Smear Method, as outlined by Zajac and Conboy, (2006)

were used to examine excreta for the presence of Eimeriaoocysts.

Recognition of Eimeria species

The morphology of the oocysts (shape, size, color, and look of the oocyst surface, presence or absence of polar cap and micropyle) were used to identify *Eimeria* species utilizing a grouping criteria defined by Iqbal et al. (2006). Eventually, the coccidiosis incidence was calculated using the formula below.

$$\text{Incidence (\%)} = \frac{\text{No. of infected subjects (n)}}{\text{Total no. of investigated subjects (N)}} \times 100$$

Statistical Analysis

The Chi-square test was used to assess the dataand a statistically significant differences was defined at probability level ($P<0.05$). For statistical examination, SPSS software edition 20 was used.

RESULTS

Facts on incidence of coccidiosis in goats and sheep were determined.

It was noticed that *Eimeria* oocysts were found in 48.67 % (366) of the 752 excreta samples (goats = 376 and sheep = 376). Sheep had a significantly higher ($P<0.05$) incidence of coccidiosis than goats, according to statistical analysis. A step-by-step Chi-Square analysis was performed on all suspected risk variables. *Eimeria* infection was significantly greater in female animals ($P<0.05$) than in males.

Fig. 1 demonstrated the facts on the incidence of coccidiosis in various age categories. Coccidiosis was significantly more common ($P<0.05$) in the 6 month or less age group, which was followed by a group older than 6 months but less than a year and older than a year age group.

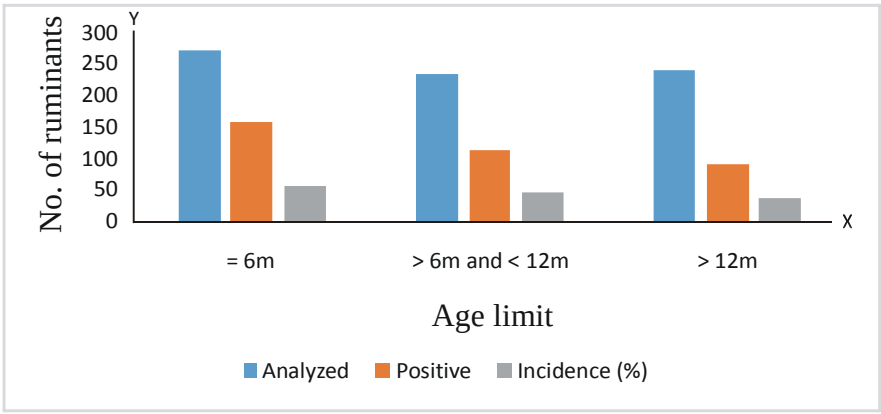

Fig. 1. Age-wise incidence of coccidiosis in small ruminants in Dera Ghazi Khan

Fig. 2 showed the prevalence of coccidiosis in various races of goats and sheep. When the incidence of coccidiosis was compared between different races of goats and sheep, there was no significant difference (P>0.05) between both species.

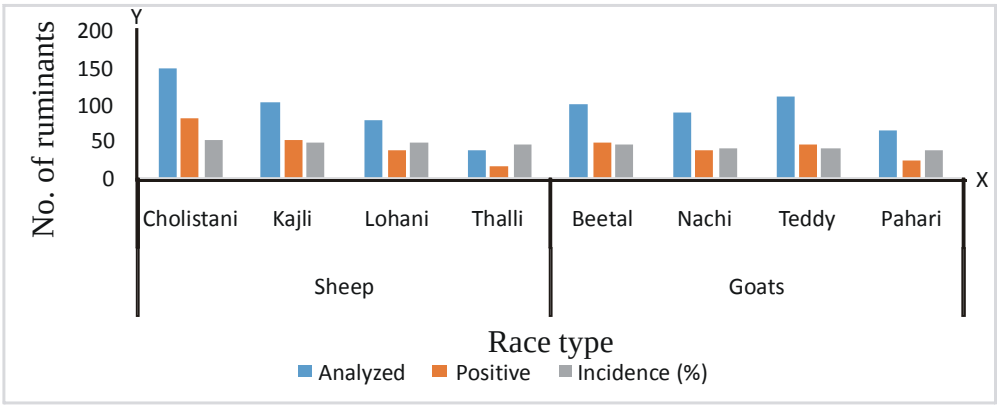

Fig. 2. Race dependent incidence of coccidiosis in small ruminants in Dera Ghazi Khan

Fig. 3 showed that the incidence was considerably greater (*P<0.05*) in enclosed and mud housed living environment relative to the outside and concreted living environment. Facts on nutritionshowed a clear distinction (*P<0.05*) in 3 fodder methods that are stall feeding, pasturing and combined stall feeding + pasturing (Fig. 4).

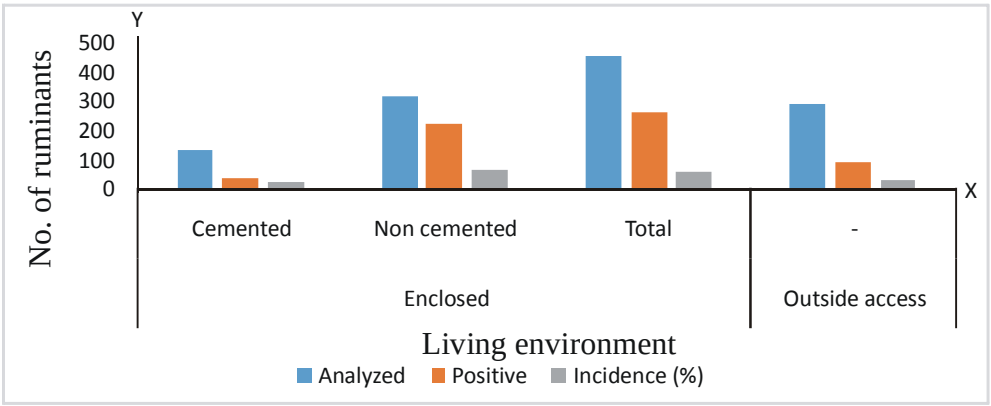

Fig. 3. Living environment dependent incidence of coccidiosis in small ruminants in Dera Ghazi Khan

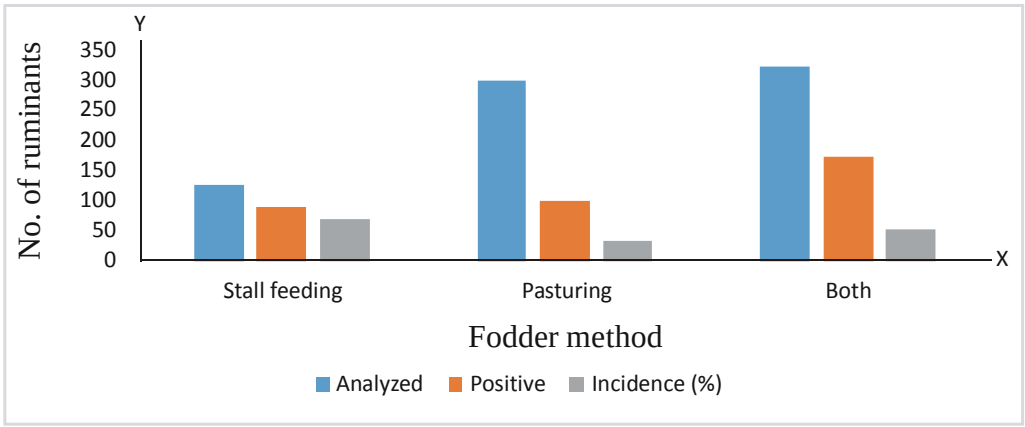

Fig. 4. Fodder method based incidence of coccidiosis in small ruminants in Dera Ghazi Khan

Fig. 5 demonstrated that coccidiosis prevalence was considerably higher (*P<0.05*) in down and sick animalsas compared to the animals having moderateand healthy bodily state.

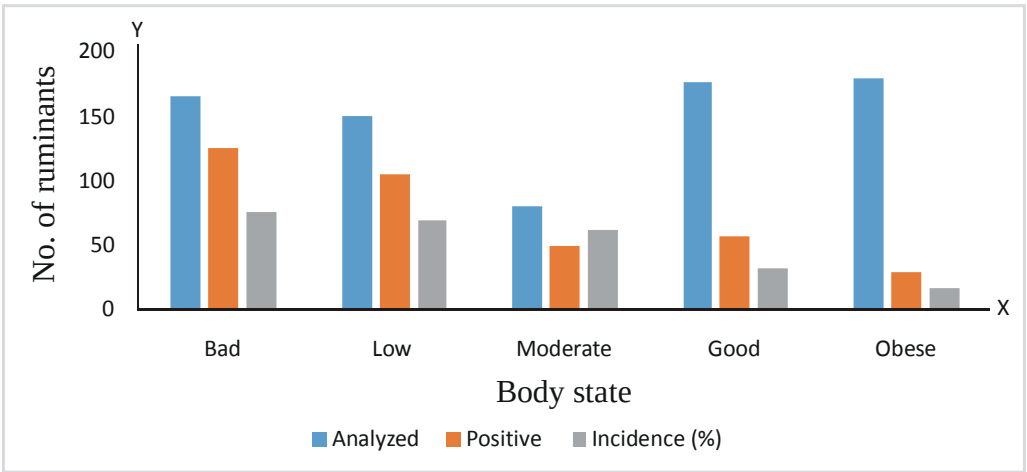

Fig. 5. Incidence of coccidiosis as affected by body state of small ruminants in Dera Ghazi Khan

In (Fig. 6) the incidence of *Eimeria* infection was found to have a strong relationship (P<0.05) with fecal score, with animals having diarrhea had a significantly higher frequency (P<0.05) than normal animals. On comparing month-by-month incidence of coccidiosis in goats and sheep, a clear distinction (*P<0.05*) was noticed.

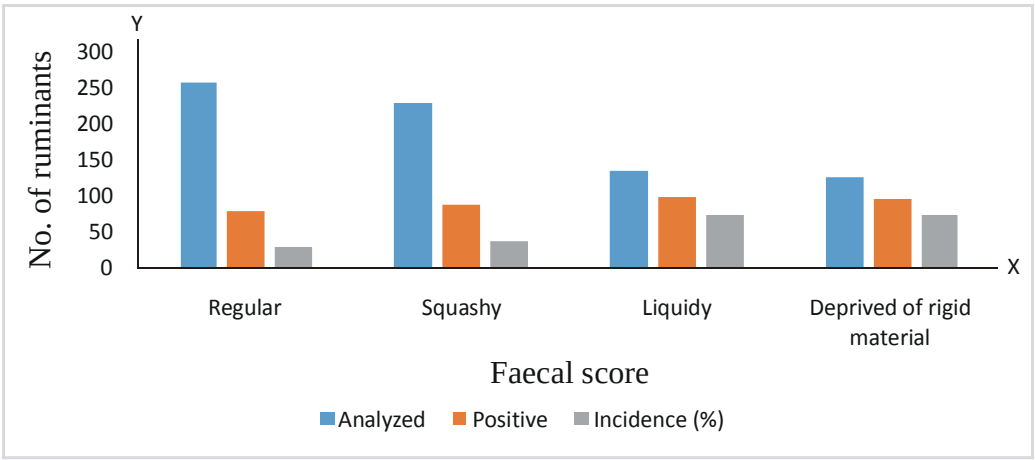

Fig. 6. Incidence of coccidiosis as affected by fecal score of small ruminants in Dera Ghazi Khan

Six *Eimeria* spp. were found in sheep in current research and incidence of every specie was *E.* ovinoidalis (56.78%), *E. ahsata* (47.23%), *E. parva* (35.67%), *E. intricate* (30.15%), *E. faurei* (26.63%), *E. pallida* (19.09%) (Fig. 7). *E. ninakohlyakimovae* (68.86%), *E. alijevi* (59.88%), *E. arloingi* (53.29%), *E. caprina* (46.70%), *E. hirci* (22.15%) were the 5 species identified in goats (Fig. 7 and 8).

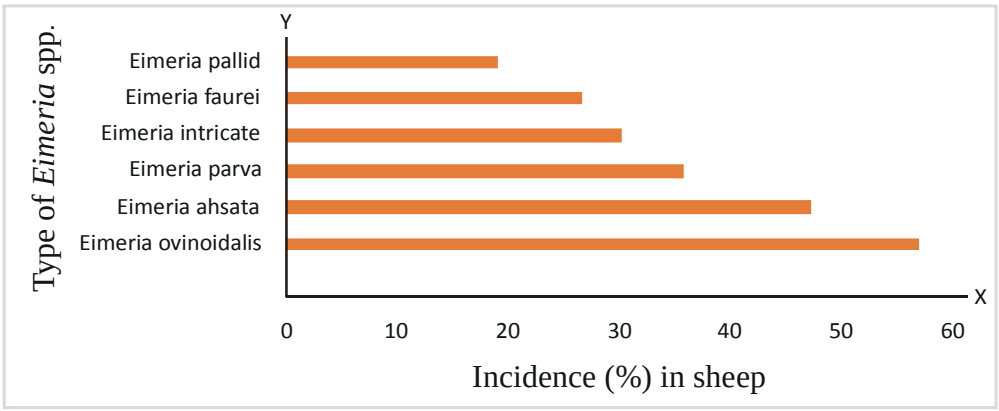

Fig. 7. Incidence of different *Eimeria* species recognized in Sheep in Dera Ghazi Khan

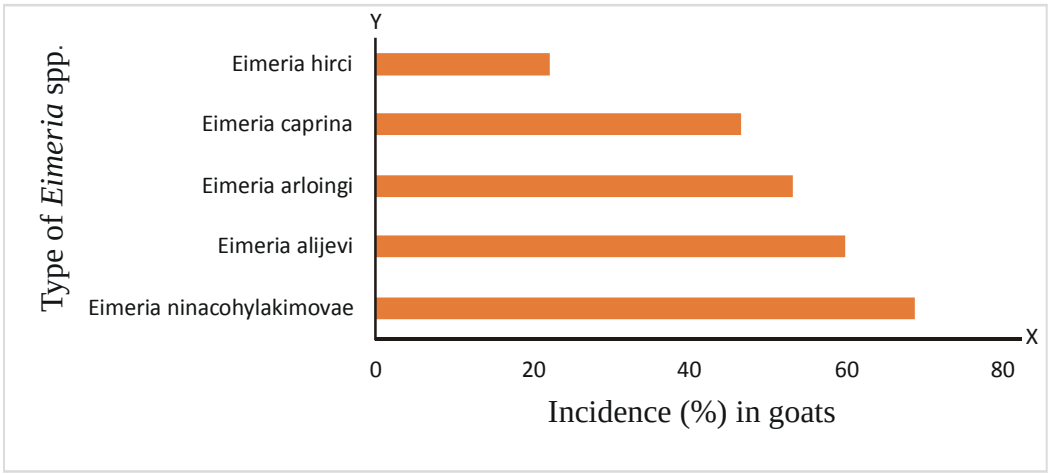

Fig. 8. Incidence of different *Eimeria* species recognized in goats in Dera Ghazi Khan

DISCUSSION

Goats and sheep were found infected with *Eimeria* spp. (Chartier and Paraud, 2012). Coccidial infection was found in 44.41% of goats and 52.92% of sheep in the current research. The observed incidence in sheep was almost same to the current Egyptian figure of 57.7% (Mohamaden et al., 2018), the 57.5% in Iraq (Al Saadoon and Al-Rubaie, 2018) and the 47.8% in Brazil (de Macedo et al., 2020). Nevertheless, the incidence of *Eimeria* spp. infection in goats was less compared to 66.9% documented in Ethopia (Kiltu et al., 2016), the 89.9% in Iran (Kheirandish et al., 2014) but more than the degree of infection documented in India (23%) (Das et al., 2017).

In present research, female goats and sheep had a higher rate of *Eimeria* spp. as compared to the males. This result is consistent to the prior findings (Rehman et al., 2011; Mohamaden et al., 2018), which stated that does and ewes are subjected to physiological pressure linked with gestation, kidding and nursing that render them more vulnerable to *Eimeria* spp. infection relative to males (Kahan and Greiner, 2013; Mohamaden et al., 2018). The incidence of coccidian oocysts in this analysis was lesser in mature goats and sheep relative to the ewes and infants that supports the prior reports (El-Shahawy, 2016). This is related to the increasing likelihood of accessing the source of Eimeria spp. infection as sheep and goats grow older, as well as the building of better tolerance or developed resistance to coccidian in mature goats and sheep compared to lambs and newborns (Wang et al., 2010).

The incidence of *Eimeria* infection in various goat and sheep races did not vary significantly. Same findings were documented by Biu et al. (2009) about breed vulnerability to *Eimeria*. In case of living environment greater incidence rate was noticed in non-cemented floor compared to cemented floor. The similar behaviour of incidence was documented by Rehman et al. (2011) who observed more incidence in non-cemented floor (48.5%) as compared to cemented floor. The difference could be reflected from the fact that urine accumulates in the non-cemented floor and raises the temperature; thus providing hot and moist atmosphere suitable for oocysts sporulation (Lawrence, 2011). *Eimeria* infection was remarkably more in stall feeding animals (71.65%) than in pasturing animals (33.33 %). Khan et al. (2011) also confirmed these findings as he documented 17.5 % incidence of *Eimeria* in pasturing and stall feeding sheep and 56.02 % in goats, accordingly.

An important strong association was observed between body state score and *Eimeria* infection in my research. This result is consistent with Khanet al. (2011) who stated that the sheep with poor body state score has greater infection rate as compared to the good score animal. This may be attributed to the weakened immune systems of poor score animals due to of underutrition and various parasitic infections which resulting in immuno-compromising. This state promotes increased risks of infection in poor state animals in comparison with good score animals (Radostitis et al., 2007).

In sheep having diarrhea, the rate of Eimerial infection increases prominently compared to the sheep with usual and soft excreta consistency. This result coincides with the findings of (Yakhchali, etal 2010). The prevalence of infection was maximum in autumn (51.5%), accompanied by summer (31.3%), whereas the minimum infection rate was in winter season (16%) (Alkhatam et al., 2020). It may be due to the reason that the weather is quite hot in summer and it could be a stressful element for the animals which tends more shedding of protozoa whereas autumn indicates more degree of infection because of the moisture that is more suitable for sporulation of oocysts (Taylor et al., 2003)

Six *Eimeria* spp. were identified in sheep in the current research and incidence of every specie was also reported by (Galip, 2004; Skirnisson, 2007; Yakhehali and Golami, 2008; Cai and Bai, 2009; Wag et al., 2010; Khan et al., 2011; Silva et al., 2011) and five

species reported in goats were also documented by (Abo-Shehada and Abo-Farieha, 2003; Agyei et al. 2004; Abdurrahman, 2007;Wag et al., 2010; Cavalcante et al., 2011; Rehman et al., 2011; Zhao et al., 2012).

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