# SEO-PREVALENCE WITH RISK FACTORS FOR PESTE DES PETITS RUMINANTS (PPR) IN SHEEP AND GOATS USING COMPETITIVE ELISA IN MOSUL, IRAQ.

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## ABSTRACT

The prevalence as well as the risk factors of PPR in sheep and goat herds from various regions of Mosul governorate, Iraq employing competitive ELISA was investigated. In total, 384 serum samples (276 from sheep and 108 from goats) which were obtained from the north, east, south and west districts of the Mosul governorate, . From the total, 183 had vaccination history, 22 were un-vaccinated animals and 179 had uncertain history of vaccination against PPR The results showed that 65 (58.03%), three (15.79%) and 63 (43.45%) were in vaccinated group, unvaccinated group, and group with uncertain history of vaccination respectively, were positive for PPRV antibodies. Overall percentages of prevalence were 47.46%, 49.07% for sheep and goats respectively. A significant difference ($P < 0.05$) was found the prevalence between the species of animals was reported to be significantly ($p<0.05$) different. Animals aged one to two years exhibited significantly (68.42%) elevated occurrence compared to other ages. Animals live in eastern districts of Mosul governorate has greater significantly ($p<0.05$) prevalence of infection (77.5%) compared to animals from other districts, and vaccinated animals had significantly ($p<0.05$) greater prevalence (54.64%). In conclusion,it can be stated that PPR occurs in small

ruminants in Mosul city, Iraq. The small ruminant population in the area have not higher protection because of the use of an exotic strain for vaccination in the PPR program. Certain risk factors such as age, geographic area, and vaccination program can play important roles in the prevalence of the disease in Mosul governorate.

## INTRODUCTION

Peste des Petitis Ruminants PPR is described as "a contagious sheep and goat viral disease characterized by fever, necrotic stomatitis, gastroenteritis, pneumonia, and elevated morbidity and mortality rates" (1). Peste des Petitis Ruminants PPR triggers aborted pregnancies in animals, increases neonatal deaths, and magnifies negative economic outcomes (2). The typical targets are sheep and goats, in addition to the most frequent laboratory infection of cattle and other wild ruminants (3). Infection rates are usually elevated (above 50 %) in enzootic areas and could be up to 90 % throughout an epidemic (4). In goats case fatality rates are even higher(55-85 %), compared to sheep (less than 10 %) (5). The PPR causative agent is of the Paramyxoviridae family, the Mononegavirales genus Morbillivirus. The PPR virus appears as a single serotype but is separated into four different lines (I-IV) on the basis of the fusion (F) protein at the genetic level (6). The virus exists in the secretions of the diseased ruminants, the main source of contamination is direct contact with animals, which leads to inhaling the droplets that contaminate the water, feed, and bedding from the infected ruminants. However, outside the body of a host species, the infection can only live for a relatively short time (7). Currently, no medication exists for effectively treating PPR. To avoid secondary bacterial infection, management of the disease is limited to the use of antibacterial drugs. It is also critical that the animals should be vaccinated as the key control mechanism in infectious regions with the commercially available attenuated vaccine (6). The prevalence of PPR is global, especially in Asia, Africa and the MENA (Middle East and North African) countries (8,9,10), where the insufficiency of veterinary facilities and inadequacy of resources hamper the management, much less the eradication of the disease. The area mentioned was the location where the Iraqi Ministry of Agriculture confirmed officially the first outbreak of PPR in Iraq in September 1998 (11). Another outbreak occurred in 2000 in which the virus caused high morbidity and low mortality rates among small ruminants (12). Recently, in 2010 a devastating outbreak occurred in Erbil province in Kurdistan among wild goats (Capra aegagrus) and killed 750 of

the animals (13) . Another outbreak of PPR in sheep was in Sulaimani during 2012-2013. (14).

The aims of Current study was to investigate and verify the prevalence of PPR using competitive ELISA test, and to determine the main risk factors in sheep, and goats small ruminants in different vaccinated states, in Mosul governorate Iraq.

## MATERIALS AND METHODS

### Experimental design and samples collection

A cross-sectional analysis was carried out in the Mosul governorate of Iraq, located at 34° north to 36.°21 north latitude and 10° east to 43.09° east longitude. Which shares borders with the Republic of Syria to the west and Duhok province in the north and Erbil province to the east. The 384 sample size was according to a 50% occurrence rate (12), using the formula for known populations (15). The target serum samples were obtained from a total of 276 sheep and 108 goats in various districts of Mosul, in the north, east, south, and west. A total of 183 samples was sourced from small ruminants with vaccination history, while 22 came from non-vaccinated ruminants, and 179 from animals with an uncertain history of vaccination. The samples donors were of varying ages less than one year to more than four years old and of both sexes and samples were obtained throughout the year 2013. Following collection, samples were kept at - 20$^{o}$C prior to being examined.

### COMPETITIVE ELISA (cELISA).

Competitive ELISA test was applies according to manufacture instructions of the Vet Creative Diagnostics, Montpelier, France, Using the ID Screen® PPR Competition.

### Statistical analysis

The prevalence rate was statistically estimated through Excel program V.10 for windows. Using student t-test Statistical analyses was conducted using SPSS software version 21 (Statistical Package for Social Sciences Inc., Chicago, IL, USA). Risk factors analysis was performed employing computed 2 x 2 tables in Epi-InfoTM 7 software (V. 7) (16).

## RESULTS

Results of the current study indicated that the overall prevalence of PPR was 47.46%, with 47.46 % and 49.07 % for sheep and goats respectively, and indicative of more

significant (P < 0.05) prevalence in goats in comparison with sheep. Among the sheep, 112 sera were from sheep with vaccination history, 19 were from those without vaccination history, and 145 were from those with uncertain vaccination status.

Of these, 65 (58.03%), three (15.79%) and 63 (43.45%), proved positive for PPRV antibodies using c-ELISA (Table 1). Of the 108 goats tested for the existence of antibodies, 71 had vaccination history, three goats were without vaccination and 34 had uncertain vaccination history. From them, 35 (49.29%), one (33.34%) and 17(50%) were found to have PPRV antibodies using c-ELISA (Table 1). PPRV antibodies occurred in small ruminants with varying vaccination histories. Of these, 183 (54.64%) 22 (18.18%) and 179 (44.69%) were provided by small ruminants which were vaccinated, unvaccinated and of uncertain vaccination history, respectively (Table 1).

**Table 1: The prevalence of Anti-** PPRV **IgG antibody in sheep and goats**

| Type of animal | No. of animals | Vaccination (No. of positive, %) | not vaccinated (No. of positive, %) | Uncertain vaccination (No. of positive, %) | Overall % prevalence |
|---|---|---|---|---|---|
| Sheep | 276 | 112 (65, 58.03%)[a] | 19 (3, 15.79%)[a] | 145 (63, 43.45%)[a] | 47.46[a] |
| Goats | 108 | 71 (35, 49.29%)[b] | 3 (1, 33.34%)[b] | 34 (17, 50%)[b] | 49.07[a] |
| Total No. | 384 | 183 (100, 54.64%) | 22 (4, 18.18%) | 179 (80, 44.69%) | 47.91 |

a,b, values in different superscripts within column were significantly different at ($p<0.05$)

**Risk factors analysis**

Statistical analysis was performed employing computed 2 x 2 tables in Epi-InfoTM.

Four variables were found for sheep and goats with ($P < 0.05$). The models revealed Districts of the study, species of animal, age of animals and history of vaccination against PPR as risk factors for PPR prevalence in small ruminants

The occurrence of PPR in the Eastern district was significantly greater compared to the other Districts under study ($P < 0.05$) and have relative risk (R.R) of 2.1 times, Confidence interval (C.I) of 3.06-11.4 in comparison with other Districts of the study. The occurrence of PPR was elevated in goats compared to sheep but had the same Relative risk in the infectivity of animals. This study revealed that the occurrence of PPR was substantially higher in sheep and goats aged 1-2 years, with Relative risk of 3.9 times, Confidence interval at 4.10-26.7 in comparison with other age ranges. This investigation determined that 54.64% of the animals with vaccination history had protection against PPRV of 3 times, Confidence interval of 1.22-7.36, compared to other groups with uncertain vaccination history or were unvaccinated against PPRV (Table 2).

**Table 2**: Relative risk factors of sheep and goats related to the occurrence rate of the PPRV

| **Factors** | **Number tested** | **Number positive (%)** | **RR** | **95% CI** | **P value** |
|---|---|---|---|---|---|
| **District** | | | | | |
| North district | 106 | 39(36, 79%) [a] | 1 | | |
| East district | 80 | 62(77, 5%) [b] | 2.1 | 3.06-11.4 | 0.0000 |

| | | | | | |
|---|---|---|---|---|---|
| South district | 94 | 65(69, 14%) [b] | 1.8 | 2.18-6.94 | 0.0000 |
| West district | 104 | 67(64, 42%) [b] | 1.7 | 1.77-5.46 | 0.0000 |
| **Species** | | | | | |
| Sheep | 276 | 131(47.46 %) [a] | 1 | | |
| Goats | 108 | 53(49.07%) [a] | 1 | 0.68-1.66 | 0.77 |
| **Age** | | | | | |
| < 1year | 35 | 6(17.14%) [a] | 1 | | |
| 1-2 years | 171 | 117(68.42%) [b] | 3.9 | 4.10-26.7 | 0.0000 |
| 2-3 years | 113 | 57(50.44%) [b] | 2.9 | 1.89-12.7 | 0.0004 |
| 3-4 years | 60 | 22(36.66%) [a] | 2.1 | 1.00-7.79 | 0.04 |
| > 4 years | 5 | 0 | | | |
| **History of vaccination** | | | | | |
| Not vaccinated | 22 | 4 (18.18%) [a] | 1 | | |
| Vaccinated | 183 | 100 (54.64%) [b] | 3 | 1.22-7.36 | 0.001 |
| Uncertain vaccination history | 179 | 80 (44.69%) [a] | 2.4 | 0.99-6.05 | 0.017 |
| **Total** | 384 | | | | |

a,b, values in different superscripts with in column were significantly different at ($p<0.05$)

## DISCUSSION

Peste des Petitis Ruminants PPR is described as "a highly contagious viral disease affecting sheep and goats." For reasons of significant economic implications of PPR in Iraq, it is critical to analyze the prevalence and risk factor data of PPR. It is essential to be concerned about the PPR epidemiology in efforts to effectively control, manage and eliminate the disease. This current investigation was carried out to determine and generate epidemiological history on the prevalence of PPR in the Mosul region, Iraq.

In Current study, the occurrence of PPRV antibodies in sheep was 47.46 % and 49.07% in goats. It appears to be higher than or similar to recorded prevalence in adjacent countries. These outcomes are in agreement with the findings of earlier epidemiological investigations (8, 9). In the Kingdom of Saudi Arabia (KSA), employing a microtiter neutralization assay the occurrence of PPR in sheep and goats was 3.1% and 0.6%, respectively (17). In Syria, the prevalence of PPR in sheep was revealed to be 96%, a rate significantly greater compared to Jordan (60% and 74% in sheep and goats respectively) (18, 19). In Turkey, the PPR

occurrence rate ranged from 0.87%–82.6%, and was higher in sheep (29.2%) compared to goats (20%) (9). PPRV has been known to have been in circulation for several years since ,it has spread in Iran countrywide over time and caused substantial economic losses.(20,21) Cumulatively, all these reported outcomes suggest the significant presence of PPR in the region and give rise to the need to initiate a surveillance system to monitor and manage this disease. The current investigation has confirmed that goats have higher PPR antibodies occurrence that sheep, which appears to be in agreement with the findings of other epidemiological investigations of PPR prevalence. (22, 19). However there were other contrasting findings (9, 23) which reported the occurrence of antibodies in sheep to be greater compared to goats. Apparently, goats exhibit more acute clinical manifestations compared to sheep under similar environmental circumstances. This is verified by the greater occurrence of PPRV antibodies in sheep compared to goats, thus rendering the former more resistant to PPR disease. (24, 25).

The current research confirmed that 54.64% of the vaccinated small ruminants had protection against PPRV, in probable agreement with (26) in Uganda. This is comparatively low relative to the lowest rate of 75-80% herd immunity necessary for controlling Rinderpest (27). This squat level of PPRV prevalence reported in this study was contrary to expectations as the PPR vaccine normally offers immunity against the disease for up to three years (28). In Iraq, vaccination is performed as a part of control action in certain endemic areas. However, the PPR vaccine used has its basis in Nig75/1, which is in lineage II, whereas the circulating field isolates in Iraq according to the phylogenetic tree and sequence analysis are grouped in lineage IV (14). As such, it is better to use a domestic strain for vaccination as has been practiced in other countries.

In the case of the non-vaccinated goats and sheep, 18.18% possessed antibodies to PPRV, the implication being that those animals may have been subjected to exposure to the field virus or were in contact with animals shedding the vaccine virus. The prevalence of non-vaccinated animals as determined by this research may continue the spread of the PPR virus among vulnerable small ruminants (29). As for the rate of prevalence among uncertain vaccinated small ruminants, there is a possibility that some of them received vaccination but the herdsmen failed to confirm such status. Besides, the sale of animals to/from one region that has vaccinated animals to a region with unvaccinated herds without the knowledge of the owner and *vice versa* also occurs. Other reasons that are also responsible for disseminating an outbreak comprise common shared-grazing and livestock keepers

going for cheap (usually sick) animals for sale as slaughtered mean, usually in rural communities .(24,4)

The occurrence of PPR in the Eastern district was significantly greater compared to other studied quarters where Iraq has extensively long borders with Kurdistan, where the PPRV is endemic and has recorded numerous outbreaks (30, 14, 15). Furthermore, the movement of the animals, both legal and illegal, inadequate veterinary levels, and a limited PPR control program that is not satisfactorily implemented because of the migration activities of the majority of these ruminants also aggravate the already high prevalence of the disease in Kurdistan.

This current investigation has reported the occurrence of PPR was substantially higher in sheep and goats aged 1-2 years, and agrees with (31, 32) who found that this age was likely to be facing this disease. Besides, the current research reported that 54.64% of the vaccinated sheep and goats had protection against the disease of 3 times more than other groups of uncertain and non-vaccinated ruminants. Vaccination is performed as a part of control action in certain endemic areas of Iraq, and this enhances the success of using vaccines in controlling PPR, even though the vaccine strain used for vaccination is not local.

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**نسبة انتشار وعوامل الخطورة لطاعون المجترات الصغيرة (PPR) في الأغنام والماعز باستخدام اختبار الاليزا التنافسي في الموصل العراق.**

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## الخلاصة

صممت هذه الدراسة لمعرفة مدى انتشار مرض طاعون المجترات الصغيرة لدراسة مدى انتشار المرض ودراسة عوامل الخطورة في قطعان الأغنام والماعز في مناطق مختلفة من محافظة الموصل وباستخدام تقنية اختبار اللاليزا التنافسي c ELISA. اشتملت الدراسة جمع ٣٨٤ عينة مصل دم (٢٧٦ من الأغنام و١٠٨ من الماعز) تم الحصول عليها من مناطق شمال وشرق وجنوب وغرب محافظة الموصل. من اجمالي هذه العينات كانت ١٨٣ منها لحيوانات كانت ملقحة ضد طاعون المجترات الصغيرة و٢٢ منها كانت غير ملقحة و١٧٩ منها كانت غير مؤكد تاريخ تلقيحه ضد المرض وتراوحت اعمار الحيوانات من اقل من سنة الى أكبر من أربعة سنوات ومن كلا الجنسين. وأوضحت النتائج ان ٦٥ (58.03%) و٣(15.79%) و٦٣ (43.45%) كانت موجبة تمتلك اجسام مضادة اتجاه فيروس طاعون المجترات الصغيرة في مجاميع الحيوانات الملقحة والغير الملقحة وغير مؤكدة التلقيح بينما كانت النسبة الكلية لتواجد الاجسام المضادة 47.46% و 49.07% في الأغنام والماعز على التوالي . لوحظ من خلال الدراسة وجود اختلاف معنوي عند مستوى معنوية (P <0.05) بين إصابة الأغنام والماعز وعند دراسة عوامل الخطورة للمرض تبين ان الحيوانات ذي عمر سنة الى عمر سنتين كانت اكثر عرضه الإصابة وبنسة إصابة بلغت (68.42%)عند مقارنتها مع باقي الاعمار وكانت المناطق شرق المحافظة اكثر عرضة الإصابة من باقي المناطق وبنسبة (77.5%) عند مقارنتها مع باقي مناطق ،وكانت الحيوانات الملقحة تمتلك نسبة إصابة (54.64%) وهي اكثرمن باقي المجاميع .استنتج من هذه الدراسة ان طاعون المجترات الصغيرة متوطن في محافظة الموصل ،العراق وان المجترات الصغيرة (الأغنام والماعز ) وان هذه الحيوانات لا تتمتع بحماية كبيرة اتجاه المرض كون السلالة المستخدمة في التلقيح سلالة غير محلية وكان لعوامل الخطورة المتمثلة بالعمر والمنطقة الجغرافية وحالة التلقيح دورا في انتشار المرض في محافظة الموصل .


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