

42 **CLINICAL SIGNS:**

43 Infected animals typically display a range of clinical signs associated with Peste des Petits Ruminants
44 (PPR), including high fever as an early and consistent indicator, along with runny nasal and ocular
45 discharges (11). Respiratory symptoms like coughing, sneezing, and labored breathing arise due to
46 respiratory tract inflammation, often accompanied by conjunctivitis marked by red, swollen, and teary
47 eyes. Lesions in the mouth and on gums cause discomfort, hampering eating and drinking, while
48 gastrointestinal effects encompass diarrhea, reduced feed intake, weight loss, and dehydration. Although
49 less common, skin lesions like redness, swelling, or blisters can occur. Behavioral shifts like depression,
50 isolation, and decreased ~~movement activity might manifest, and in pregnant animals, PPR can lead to~~
51 ~~abortion or stillbirth, contributing to reproductive losses.~~

52 Post-mortem examinations of animals affected by Peste des Petits Ruminants (PPR) often uncover
53 distinctive lesions indicative of the disease, encompassing inflammation, ulceration, and hemorrhages in
54 the gastrointestinal tract particularly the stomach and intestines and Zebra markings are a significant
55 diagnostic feature of PPR and are typically seen in the posterior part of colon and rectum as
56 discontinuous streaks of congestion, particularly the jejunum (2). Additionally, respiratory tract
57 involvement becomes evident through inflammation and congestion in the lungs and trachea, sometimes
58 leading to lung consolidation and pleural effusion. Lymphoid tissues, central to PPR's impact, exhibit
59 enlargement and congestion in the lymph nodes, spleen, and tonsils. Oral lesions manifest as erosions
60 and ulcerations on the tongue, gums, and mucous membranes. Depending on disease severity, other
61 observations might include organ congestion, such as in the liver and kidneys, and sporadically, skin
62 lesions like blisters or erosions. These post-mortem findings play a crucial role in confirming PPR
63 diagnoses and differentiating the disease from similar conditions in small ruminants.

64 **The economic impact** of Peste des Petits Ruminants (PPR) is substantial, exerting far-reaching
65 consequences on livestock and communities. When goats are infected with PPR, their productivity takes
66 a hit on multiple fronts. Reproductive capabilities are impaired, causing a decrease in fertility rates and
67 potentially leading to a rise in abortions and stillbirths. Additionally, growth rates among infected animals
68 diminish, resulting in delayed maturation and reduced body weight gain. The combined effect of mortality
69 and decreased productivity can result in significant economic losses, affecting not only individual goat
70 herders but also entire communities that rely on these animals for their livelihoods and sustenance (5).

71 **The geographic distribution** of PPR is wide-ranging, primarily affecting regions in Africa, Asia, and
72 the Middle East (3). This disease is particularly prevalent in areas with substantial populations of goats
73 and sheep, given that these species are highly susceptible to PPR. In these regions, where small
74 ruminants are integral to the local economy and social fabric, outbreaks of PPR can lead to cascading
75 economic and social challenges. The disease's impact extends beyond the immediate loss of animals to
76 encompass disruptions in the supply of meat, and other byproducts and can even hamper access to
77 resources such as leather and wool. This underscores the urgency of effective control measures to
78 mitigate the disease's economic toll and preserve the livelihoods of those reliant on small ruminant
79 husbandry.

80 **Prevention and control** strategies for Peste des Petits Ruminants (PPR) encompass vaccination,
81 considered the primary and most effective method, with various vaccines employed in endemic areas to
82 safeguard vulnerable animals. Complementary biosecurity measures, including isolating infected animals,
83 imposing movement limitations, and upholding hygiene standards, play a vital role in limiting disease
84 transmission. Additionally, raising awareness among farmers and herders about the significance of
85 vaccination and implementing biosecurity practices is crucial for comprehensive disease management.

86 **BACKGROUND:**

87 One of the seven provinces of Nepal established by the constitution is Bagmati Province. It is the second-
88 most populous and fifth-largest province in terms of area in Nepal. The province, which has Hetauda as
89 its provincial seat and is also where Kathmandu, the nation's capital, is located, is largely hilly and
90 mountainous and is home to high peaks including Gaurishankar, Langtang, Jugal, and Ganesh. Bagmati
91 Province, which makes up around 13.79% of Nepal's total area and has an area of 20,300 km², contains
92 13 districts and has a population of 60,440,222.



93

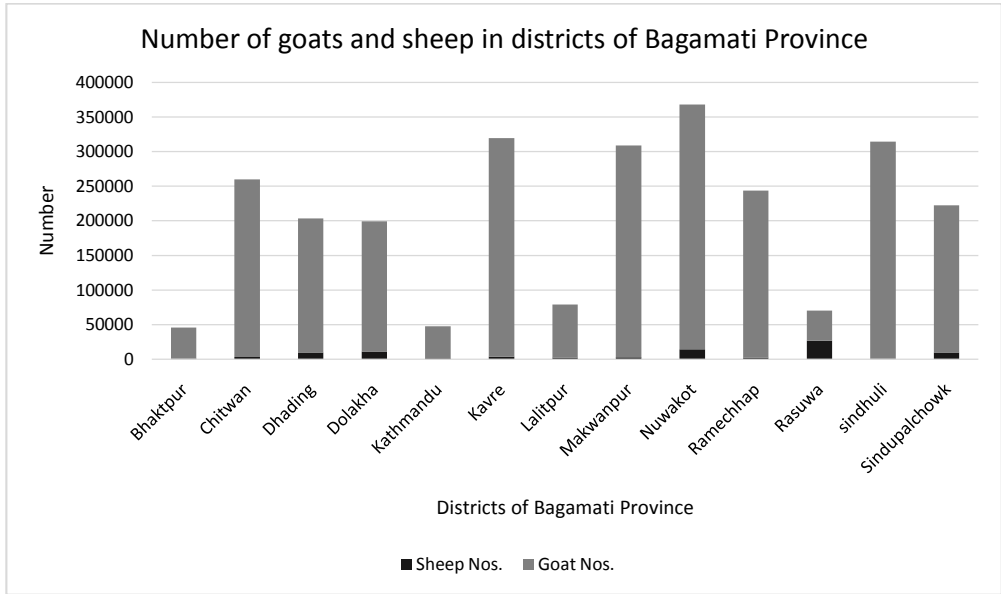
94 **Figure 1: Districts of Bagmati Province**

95 Source: NepalNews, 2022 (<https://www.nepalnews.com>)

96 There have been several commercial goat farms as well as conventional farms that raise both native and
97 foreign varieties of goats. Following figures 2 and 3 will illustrate the total number of goat and sheep in 13
98 districts of Bagmati Province and the meat production status of Bagmati Province among 7 provinces
99 of Nepal. Bagmati Province have 89,014 sheep and 2,593,899 Goats in Number and total meat from
100 sheep and goats of this province are 14,096 MT in a year 2021/22 (Statistical-Information-on-Nepalese-
101 Agriculture-2078-79-2021-22)

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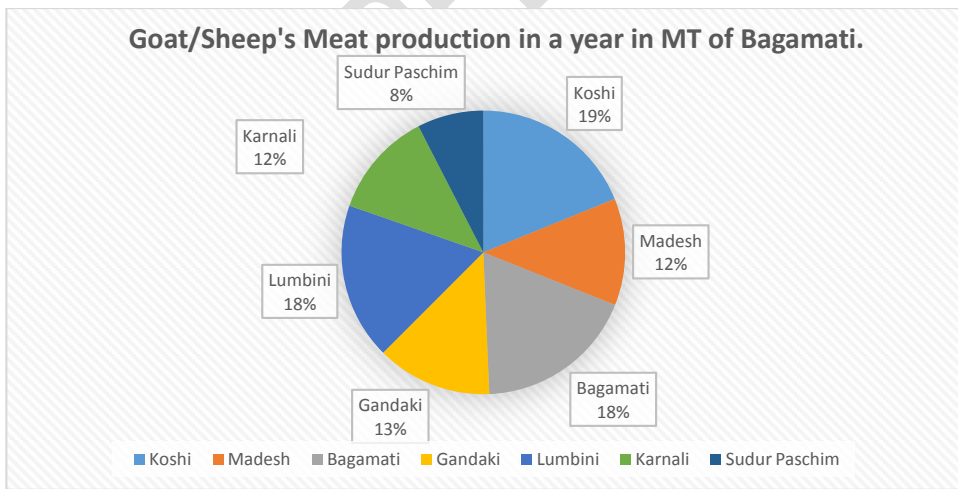


102

103 **Figure 2:**Total number of goats and sheeps in year 2021/22 of Bagamati Province

104 Source: (Statistical-Information-on-Nepalese-Agriculture-2078-79-2021-22)

105



106

107 **Figure 3:**Meat production from goat and Sheep in Year 2021/22 of Bagamati Province.

108 Source: (Statistical-Information-on-Nepalese-Agriculture-2078-79-2021-22)

109 PPR first appeared in the African country of Ivory Coast in 1942(18). This disease, which was initially
 110 confined to the continent of Africa, has now spread to many countries around the world. This disease has
 111 appeared first in 1995 (1) and had speeded in all districts of Nepal. When this disease appears in old
 112 places, the death rate is low, but if it spreads to new places, the death rate is high. The national PPR
 113 disease control program is currently being implemented throughout the country to control this disease,
 114 which causes great economic and social damage to farmers. In order to ensure the leading and
 115 significant role of Bagmati Province in eradicating PPR disease from the country by 2030 by
 116 implementing the same program effectively in all the districts within the Bagmati Province district, the
 117 Bagmati Province Government conducted a weekly vaccination program against PPR disease throughout
 118 the province in Fiscal Years 2021/22 and 2022/23.

119 In view of the fact that the World Animal Health Organization (Office International des Epizooties, OIE)
 120 and the United Nations Food and Agriculture Organization (Food and Agriculture Organization of the
 121 United Nations, FAO) have moved forward the strategy to eliminate PPR by 2030, and through the
 122 Animal Health Program Implementation Procedure, 2075 Chapter 3, the implementation of the PPR
 123 disease control program, a clear action plan has been created to effectively control this disease, and a
 124 PPR vaccination campaign is being conducted.

125 PPR disease causes many sheep and goats to die each year in Nepal, costing farmers a fortune. This
 126 makes it imperative to take strong measures to control this PPR disease, and the vaccine program may
 127 be a key first step, given the risk that farmers and suppliers who depend on sheep and goat farming may
 128 leave the industry.

129 **OBJECTIVES OF THE PROGRAM:**

- 130
- 131 • To conduct a vaccination program against PPR at the same time throughout the provincial districts
 - 132 • Facilitating, systematic and effective immunization programs.
 - 133 • To eliminate PPR by 2030 from Nepal.
- 134

135 **IMMUNIZATION PROGRAM CONDUCTED IN FY 2021/22 AND FY 2021/22**

- 136 3.1 Campaign Operation Date for Fiscal Year 2022: 2022/02/08 to 2022/02/14
 137 3.2 Campaign Operation Date for Fiscal Year 2022/23: 2023/02/13 to 2023/02/19
 138

139 **List 1 :Action plan model for Campaign**

Date	Job description	Responsible body
15 days before campaign	Publish notification for appointment of vaccinator. To hold a coordination meeting regarding the vaccination campaign with the Goat Traders Federation.	<ul style="list-style-type: none"> ▪ Related Veterinary Hospital and Livestock Services Expert Center in coordination with the concerned local level ▪ Ministry of Agriculture and Livestock Development, Bagmati Province
10 days before campaign	<ul style="list-style-type: none"> ▪ To appoint the vaccinator in the area of work. ▪ Designate the vaccination center as per requirement and request the related ward office for assistance along with the information. 	<ul style="list-style-type: none"> ▪ Related Veterinary Hospital and Livestock Services Expert Center in coordination with the concerned local level

	<ul style="list-style-type: none"> ▪ Farmers raising more than 20 sheep and goats can be identified and vaccinated at the same place. ▪ Production and printing of PPR vaccination cards, campaign logos, jingles, pamphlets and brochures etc. 	
7 days before campaign	<ul style="list-style-type: none"> ▪ Spreading propaganda through various media including radio FM newspapers. ▪ Storing vaccines and purchasing the necessary materials for vaccination and providing them to the vaccination center. ▪ Identify the areas with high risk of disease and determine the first priority location for vaccination. ▪ Making the necessary arrangement for insufficient vaccine quantity ▪ To inform the relevant local level and security agencies about the vaccination campaign. 	<ul style="list-style-type: none"> ▪ Veterinary hospital and local government ▪ Directorate of Livestock and Fisheries Development and Ministry of Agriculture and Livestock development ▪ Veterinary hospital
One day before campaign	<ul style="list-style-type: none"> ▪ Press briefing regarding vaccination campaign 	<ul style="list-style-type: none"> ▪ Ministry of Agriculture and Livestock Development, Bagmati Province
1 st day of campaign	<ul style="list-style-type: none"> ▪ Inaugurate the vaccination campaign. ▪ 	<ul style="list-style-type: none"> ▪ Ministry of Agriculture and Livestock Development, Bagmati Province
2 nd to 7 th day	<ul style="list-style-type: none"> ▪ Expert centers should collect vaccination data from the relevant local animal service branch or vaccination center and send it to the Directorate of Livestock and Fisheries Development. 	<ul style="list-style-type: none"> ▪ Veterinary Hospital
After vaccination campaign	<ul style="list-style-type: none"> ▪ In order to monitor the efficacy of the vaccine, the relevant laboratory will collect the serum and provide the preliminary test report to the Directorate of Livestock and Fisheries Development located in the province and the Directorate will inform the relevant local level through the Veterinary Hospital and Animal Services Expert Center. ▪ Monitoring and follow-up of vaccination work. 	<ul style="list-style-type: none"> ▪ Directorate of Livestock and Fisheries Development, Bagmati Province, related expert centers and Central Livestock Disease Research Laboratory, Tripureshwar, Kathmandu ▪ Directorate of Livestock and Fisheries Development and Ministry of Agriculture and Livestock development

140 Source: PPR control action plan, 2021 and 2022

141 **Financial Management:** The available vaccines were provided by the federal government, and the
142 Department of Livestock Services has allocated budget for logistics support through the Federal State
143 Program. The remaining needed budget was supplied by the provincial government to the Veterinary
144 Hospital and Livestock Expert Services Center, which is located in 8 districts and has working areas in 13
145 districts of Bagmati Province. Seromonitoring was performed by the Central Veterinary Laboratory,
146 Tripureswor. Besides vaccines and seromonitoring, the total budget allocated was approximately 91,500
147 USD in one year.

148 VACCINE COVERAGE REPORT

149 Vaccine coverage in the Year 2021/22.

S.N.	District	Vaccine available in 2021/22	Vaccinated number in 2021/22	Progress report	Remarks
1	Bhaktpur	30000	6181	21	
2	Chitwan	127000	71418	56	
3	Dhading	107000	83270	78	
4	Dolakha	96000	94998	99	
5	Kathmandu	36000	31557	88	
6	Kavre	165000	99182	60	
7	Lalitpur	56000	27587	49	
8	Makwanpur	176000	166423	95	
9	Nuwakot	220000	120019	55	
10	Ramechhap	102000	44610	44	
11	Rasuwa	29000	23165	80	
12	sindhuli	30000	45825	153	Local governments also work together.
13	Sindupalchowk	16000	15952	100	
	Total	1190000	830187	70	

150 **Table 1:** Vaccination coverage of one week campaign against PPR in year 2021/22 of Bagmati Province

151 Vaccine coverage in the Year 2022/23.

S.N.	District	Vaccine available in 2022/23	Vaccinated number in 2022/23	Progress report	Remarks
1	Bhaktpur	32000	4153	13	
2	Chitwan	135000	86802	64	
3	Dhading	114000	97407	85	
4	Dolakha	102000	84176	83	
5	Kathmandu	38000	40143	106	Local governments also work together.
6	Kavre	176000	132270	75	

7	Lalitpur	60000	44513	74	
8	Makwanpur	188000	159007	85	
9	Nuwakot	235000	145281	62	
10	Ramechhap	109000	106202	97	
11	Rasuwa	31000	30440	98	
12	sindhuli	32000	30400	95	
13	Sindupalchowk	17000	19135	113	Local governments also work together.
	Total	1269000	979929	77	

152 **Table 2:** Vaccination coverage of one week campaign against PPR in year 2022/23 of Bagmati Province

153 Though vaccine coverage had not been completed at the time of the campaign and there had been a
 154 continual procedure till the remaining vaccine was done, we only considered the one-week campaign.

155 **PROBLEMS ENCOUNTERED IN CONDUCTING THE VACCINATION CAMPAIGN**

156 Conducting an effective vaccination program is a difficult task, especially during a global epidemic like
 157 COVID-19. The challenges experienced can vary depending on the geography, the resources available,
 158 and the level of coordination amongst various parties. Let us expand on the points raised:

- 159 • **Inadequate Vaccine Supply:** Providing a constant and sufficient supply of vaccines is one of the
 160 most difficult difficulties in immunization programs. When there is a vaccine scarcity, it can cause
 161 delays in the immunization process and frustration among the people. Manufacturing constraints,
 162 distribution challenges, strong global demand, or supply chain interruptions could all contribute to
 163 this.
- 164 • **Geographic Difficulties:** Some places may have geographical difficulties, such as distant areas,
 165 rough terrain, or areas with little infrastructure. These variables can make it difficult to distribute
 166 vaccinations and deploy immunization teams efficiently. This can cause delays in reaching all
 167 communities, particularly those in difficult-to-reach areas.
- 168 • **Inadequate Vaccinators:** A successful campaign requires adequate staffing of vaccination
 169 centers and teams. If there are fewer vaccinators than there is demand for immunization,
 170 vaccination rates may slow. Time and money are required to train and mobilize a sufficient
 171 number of technician experts to deliver vaccines.
- 172 • **Limited Publicity:** Effective communication is required to inform the public about the importance
 173 of vaccination, the vaccination process, and the advantages of vaccination. There may be
 174 skepticism or disinformation flowing among the population if there is a lack of publicity and clear
 175 information regarding the campaign. This may reduce people's willingness to have their pets
 176 vaccinated.
- 177 • **COVID-19 Nationwide Transmission:** The extensive transmission of COVID-19 inside a country
 178 can make a vaccination program difficult.

180 Addressing these issues would necessitate a multifaceted approach combining government agencies,
 181 non-governmental organizations, and foreign partners. Some potential strategies include:

- 182 • **Increasing Vaccine Production:** Collaborating with vaccine manufacturers to increase production
 183 and maintain a consistent supply of vaccines.
- 184 • **Infrastructure Improvement:** investing in infrastructure to facilitate vaccine distribution to remote
 185 and hard-to-reach areas

- 186 • Vaccinator Training: Fast-track the training and deployment of veterinary technician to serve as
 187 vaccinators.
 188 • Communication efforts: Starting information and awareness efforts to educate the public about
 189 the importance of vaccination and the details of the campaign.
 190 • Adapting to Conditions: Flexibility in campaign planning to adapt to changing COVID-19
 191 transmission rates and related restrictions

192 Successfully conducting a vaccination campaign requires a well-coordinated effort that addresses the
 193 unique challenges posed by the pandemic and the specific circumstances of each region.

194 **EFFICACY OF VACCINATION**

195 Seromonitoring was performed with collaboration of Central Veterinary Laboratory, Tripureshwar and
 196 they have provided the following report.

S.N.	District	Seroconversion percentage 2021/22	Seroconversion percentage 2022/22
1	Bhaktpur		
2	Chitwan	92.66	59
3	Dhading	83.66	54.93
4	Dolakha	85.37	
5	Kathmandu	85.9	
6	Kavre	61.5	
7	Lalitpur		74.29
8	Makwanpur	87.37	71
9	Nuwakot	92	
10	Ramechhap	88.83	
11	Rasuwa	52.53	
12	Sindhuli	43.59	

197
 198 Table 3: Report provided by central veterinary laboratory to Bagmati province on Seromonitoring of
 199 PPR.



201 **Figure 4: District-wise distribution of PPR in Nepal**

202 *Source: (1) and Situation analysis of Peste des Petits Ruminants (PPR) for past 10 (2008–2017) years in*
203 *Nepal, Veterinary Epidemiology Section, Animal Disease Investigation and Control Division,*
204 *Tripureshwor, Kathmandu*

205 In an annual report of Central veterinary laboratory of Nepal a serum sample of 29 goats from district
206 Kathmandu, Dhading and Chitwan were tested against PPR through ELISA 96.5% sample were found
207 to be positive against PPR in Fiscal Year 2019/20. In the year 2021/22, after the vaccination campaign
208 was conducted in all the districts of Bagmati Province, there has been only 2 outbreak notification of PPR
209 disease infection in this province till 14th of March, 2023 which in the sense, proving the weekly campaign
210 vaccination against PPR to be successful.

211 **CONCLUSION:**

212 In conclusion, the one-week vaccination campaign has been a resounding success, effectively reaching a
213 substantial portion of the target population. The collaborative efforts of federal government, Ministry of
214 Agriculture and Livestock development, Bagmati Province, Directorate of Livestock and Fisheries
215 Development, Veterinary Hospital and Livestock Services expert center and related local government
216 have led to a significant increase in vaccine uptake. The campaign's strategic planning, efficient
217 execution, and accessibility have played pivotal roles in achieving widespread immunization coverage
218 within a short timeframe. As a result, the community is now better protected against infectious disease
219 PPR, laying a foundation for improved animal health outcomes in the future. Continued momentum in
220 such campaigns is crucial to ensuring the longevity of this positive impact and fostering a healthier and
221 more quality products of sheep and goat. Furthermore, Bagmati Province Government, Ministry of
222 Agriculture and Livestock Development, which conducts the vaccination program against the infectious
223 disease PPR in sheep and goats as a campaign every year, it is seen that the vaccination program
224 against PPR has been effective.

225

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