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Original article

Risk factors for dystocia in primiparous and pluriparous beef cows at the Besuki Animal Health Center, Situbondo Regency, East Java, Indonesia

Nisaaturrohma Fajriyah[1], Soeharsono Soeharsono[2], Oky Setyo Widodo[3]

[1] Large Ruminants Professional Interest Group, Jalan Ir. Soekarno, Surabaya, Indonesia
[2] Division of Veterinary Anatomy, Faculty of Veterinary Medicine, Universitas Airlangga, Indonesia
[3] Laboratory of Theriogenology, Joint Graduate School of Veterinary Sciences, Yamaguchi University, Yamaguchi, Japan

[*] Corresponding author, e-mail: nisafajriyah1@gmail.com
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ABSTRACT

This study aims to determine the risk factors for dystocia in primiparous and pluriparous dams at the study site. Cases of dystocia, both maternal and fetal, were obtained as secondary data from records at the Situbondo Regency Animal Husbandry Service for year 2020 and 2021. Tracking on these secondary data was carried out to look for cows experienced dystocia and the owners' names and addresses for interviews using a questionnaire worksheet. Interviews were conducted in February - May 2022 to obtain data on the maternal breed, age, feeding, fetal sex, and exercise frequency during pregnancy of the cows. Dystocia in the working area of the Besuki Animal Health Center in Sitobondo Regency in 2020 and 2021 occured in 50 cows which included primiparous (26%) and pluriparous (74%) cows. Breed, age, feed, and sex of the calves were not significantly different ($p > 0.05$) between primiparous and pluriparous dams. However, the frequency of the exercises differed significantly ($p < 0.05$) between primiparous and pluriparous dams. It could be concluded that the dystocia of cows in the study area was dominated by pluriparous parturition with exercises factor as the main cause.

Keywords: age, breed, feed, primiparous, pluriparous

INTRODUCTION

Reproductive problems are common in dairy cows and can dramatically affect reproductive efficiency (Kebede *et al*., 2017). On beef cows farms in Indonesia, it impaired productivity (Agus and Widi, 2018). One of the reproductive problems is dystocia. Dystocia can cause a decrease in the number of calves due to calf death if proper treatment is not received (Misaka *et al*., 2022). Dystocia is a reproductive problem that affected production and reproduction, and economically increased expenses due to fetal and maternal mortality and handling costs by veterinarian (Kebede *et al*., 2017). Studies have associated dystocia with reduced milk production and cow fertility (Gaafar *et al*., 2011). The Cow-Calf Health and Productivity Audit (CHAPA) study showed that dystocia contributed 33% to fetal death during parturition, and losses for cows farmers due to dystocia reach 15.4% (Whittier *et al*., 2009). Dystocia followed by perinatal mortality is major animal health and welfare problem, as

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well as economic issues of cows' production in different parts of the world (Hohnholz *et al*., 2019). Even in veterinary-assisted dystocia, it can still cause 25% of calf mortality and 11% of maternal mortality (De Amicis *et al*., 2018).

Up to this study, there was no report on the prevalence of dystocia cases at the Besuki Animal Health Center, Situbondo Regency. Febrianila and co-workers (2018) reported the prevalence of dystocia cases in beef cows in Kunir District, Lumajang Regency in 2015-2016 of 11.6%. Factors that influenced the occurrence of dystocia in Kunir District, Lumajang regency was fetomaternal disproportion due to the use of superior bull frozen semen for artificial insemination, fetal maldisposition, and uterine inertia in older cows and higher parity (Febrianila et al., 2018). Dystocia could result in fetal death and caused postpartum maternal pathology. Cows with dystocia were more susceptible to metritis, retained placenta, left displaced abomasum, and an increased incidence of dystocia in subsequent calving (Kim *et al*., 2016).

Dystocia in cows is distinguished between primiparous and pluriparous. The risk factor for dystocia in primiparous cows was dominated by feto-pelvic disproportion, and in pluriparous cows it was dominated by malposition of the fetus. The determining factors for feto-pelvic disproportion was calf birth weight and maternal pelvic size (Mee *et al*., 2011). Therefore, this study aims to determine the risk factors for dystocia in primiparous and pluriparous cows based on the age, feed, and exercise of the cows during pregnancy, and the sex of the fetus. The present study was expected to be beneficial in preventing an increase in dystocia cases.

MATERIALS AND METHODS

This study was conducted in the working area of the Besuki District Animal Health Center, Situbondo Regency, East Java Province, Indonesia (Figure 1). The study area is located at 7°45'10.0044" S and 113°41'52.1844" E. Besuki District occupies an area of 26.08 Km2, bordering the Madura Strait in the north, with an altitude between 0 - 1,250 meters above sea level. The annual temperature of 24.7 - 27.9°C, with 3 - 4 humid months and 8 - 9 dry months (the peak of the dry season is between July). The average annual rainfall is 994 - 1,503 mm, with an average humidity of 76.10-90.92% (Besuki District Official Website, 2021).

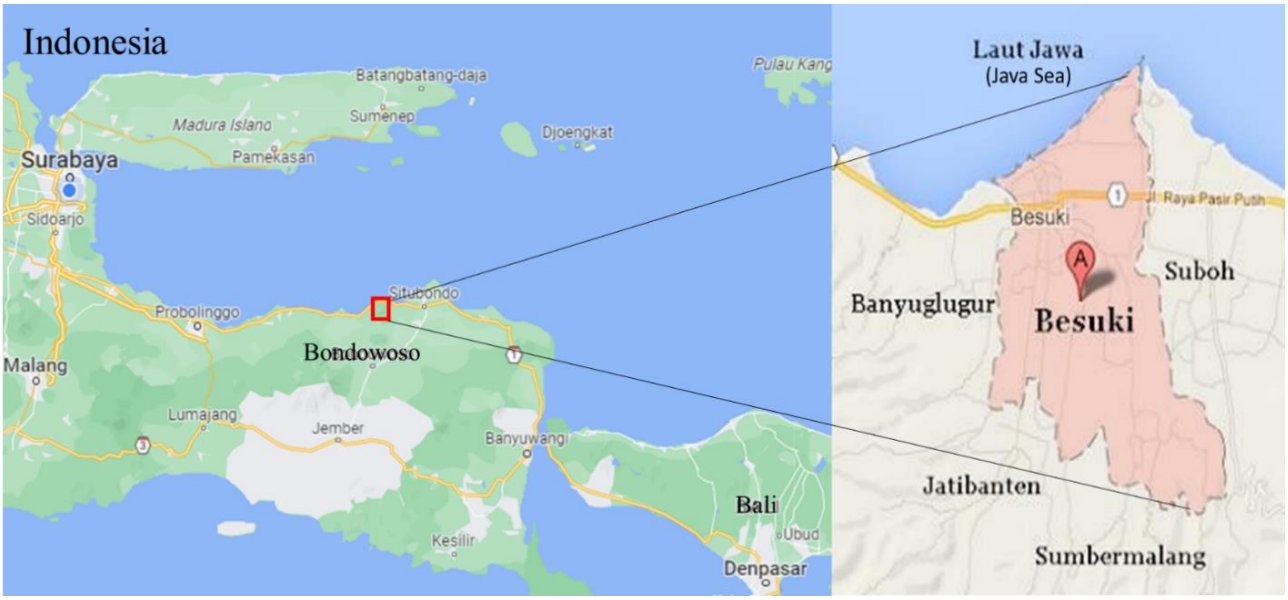

Figure 1 Map of the Besuki Animal Health Center working area in Sitobondo Regency (Google maps, 2022; KotaKita.com, 2014).

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This study used a survey method with reference to secondary and primary data. Cases of dystocia, both maternal and fetal were obtained from records at the Situbondo Regency Animal Husbandry Service in 2020 and 2021. The working areas of the Animal Health Center of Besuki District, Situbondo Regency includes the Besuki, Banyuglugur, Sumbermalang, and Jatibanteng districts. Data on dystocia cases obtained were separated between data on primiparous and pluriparous cows. Primiparous cows are cows in the first calving, and pluriparous cows are cows in the second or more calving (Wathes *et al*., 2007). Secondary data tracking was carried out to look for cows with dystocia, with the name and address of the owner of the cows to be interviewed using questionnaire worksheets. Interviews were conducted in February - May 2022 to obtain data on the breed and age of the dam, feeding, fetal sex, and exercises during pregnancy of cows with dystocia (Mee *et al*., 2011). Exercise in pregnant cows was categorized as often (three or more times a week), rarely (less than three times a week) and never. What is meant by exercise in this study was that pregnant cows were allowed to roam freely in the barn at 7.00-09.00 a.m. or 3.00-5.00 p.m.

Data analysis

The data are presented descriptively, and the causes of dystocia were analyzed using the Chi-square test at a significance level of 5%. Significant differences ($p < 0.05$) of them were followed by regression tree analyses. All Statistical analyses used Statistical Product and Service Solutions (SPSS, IBM) version 25 for Windows.

RESULTS

Dystocia in the working area of the Besuki Animal Health Center in Sitobondo regency in 2021 was 50 cases, of which 26% occurred in primiparous cows and 74% in pluriparous cows (Table 1). Breed, age, feed, and sex of the calf (Table 2) were not significantly different ($p > 0.05$) between primiparous and pluriparous dams. However, the exercise frequency differed significantly ($p < 0.05$) between primiparous and pluriparous dams, and between study areas (Figure 2).

Table 1 Dystocia in beef cows in the working area of the Besuki Animal Health Center, Situbondo regency based on primiparous and pluriparous dams

parturition	dystocia case
primiparous	26% (13/50)
pluriparous	74% (37/50)

Table 2 Dystocia of primiparous and pluriparous cows in the working area of the Besuki Animal Health Center, Situbondo regency, based on maternal breed, age, feeding, and fetal sex

description	parameters	primiparous	pluriparous	total
maternal breed	Limousine	18% (9/50)	30% (15/50)	48% (24/50)
	Ongole cross	-	4% (2/50)	4% (2/50)
	Simmental	8% (4/50)	40% (20/50)	48% (24/50)
maternal age	more than 6 years	26% (13/50)	50% (25/50)	76% (38/50)
	less than 6 years	-	24% (12/50)	24% (12/50)
maternal feeding	Elephant grass (Eg)	6% (3/50)	46% (23/50)	52% (26/50)
	concentrate (C)	12% (6/50)	18% (9/50)	30% (15/50)
	Eg + C	8% (4/50)	10% (5/50)	18% (9/50)
fetal sex	male	10% (5/50)	24% (12/50)	34% (17/50)
	female	16% (8/50)	50% (25/50)	66% (33/50)

Chi-square test showed there was no significance different ($p > 0.05$) of all parameters based on primiparous and pluriparous dams.

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In the frequently exercised dams, dystocia occurred higher in primiparous (52.6%) than in pluriparous (47.4%) dams. On the contrary, in dams that were rarely and never exercised, dystocia occurred higher in the pluriparous dam (90.3%) than in primiparous dams (9.7%). The dystocia case in the Besuki area related to frequent exercise was higher in pluriparous (80%) than in primiparous dams (20%). In other areas (Banyu Glugur, Sumbermalang, and Jatibanteng), cases of dystocia related to frequent exercise was higher in primiparous (88.9%) dams than in pluriparous dams (11.1%) (Figure 2).

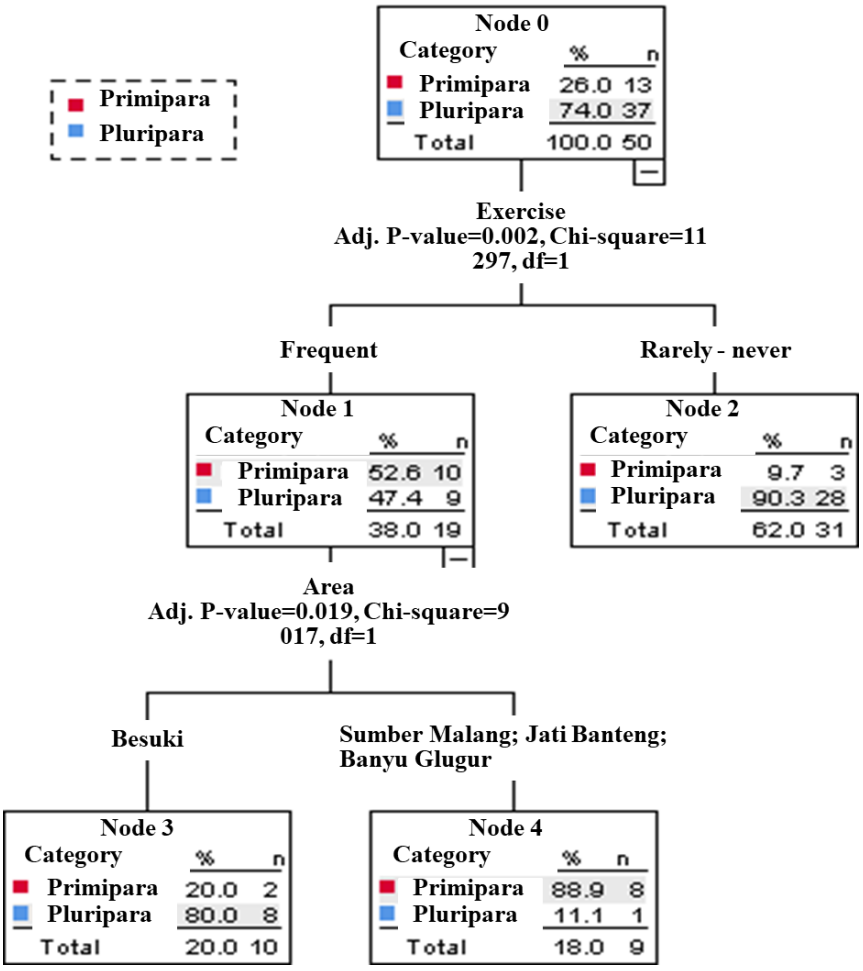

Figure 2 Regression tree analyses of the effect of exercise frequency on the incidence of dystocia cases.

DISCUSSION

The determination of dystocia risk factors based on dam breed and age, and breeding management by farmers (feeding and exercise of the dams during pregnancy) could be used to prevent future cases. In addition, the causes of dystocia cases in the working area of the Besuki Health Center, Situbondo Regency, could be used as a guide for farmers in other areas. Dystocia in this study was dominated and occurred in pluriparous than primiparous dams. Breed and feed of the dams during pregnancy, and calf sex were not related to the primiparous and pluriparous dams. Among these factors, the frequency of exercise affected the incidence of

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dystocia in primiparous and pluriparous dams. The incidence of dystocia was higher in the primiparous dam in Italy (De Amicis *et al*., 2018). The most common cause of dystocia in heifer cows, is fetopelvic disproportion, which may be caused by the size of the calf that is too large relative to the size of the maternal pelvis (Singh *et al*., 2019). First-parity dams had a higher probability of dystocia than subsequent parities (Purohit *et al*., 2012; Hohnholz *et al*., 2019). However, in this study, the incidence of dystocia was only 26% in primiparous dams compared to 74% in pluriparous dams. This might be due to the higher population of pluriparous than primiparous dams at the time of the study. Unfortunately, the data on pluriparous and primiparous dam populations at the study site was not available.

The incidence of dystocia in the Limousine and Simmental dams was higher (48% each) than in the Ongole cross (Peranakan Ongole, PO) dams (4%). Most farmers in the working area of the Animal Health Center preferred to rear the Simental and Limousin breeds compared to PO dams. Crossing beef cows has been practiced in Indonesia. Cross-breeding between POs and exotic breeds are increasingly carried out by smallholder farmer to increase productivity (Agustine *et al*., 2021). Most of the smallholder farmers keep breeding stock rather than fattening cows. They aim to own animals for a longer period of time to provide progeny for sale and a continuous supply of manure for crops (Agus and Widi, 2018). Farmers preferred to raise crossbreed cows compared to PO cows (Agustine *et al*, 2019), because the price of Simmental or Limousine cross cows are higher than PO cows (Pawere *et al*., 2012). Artificial insemination of local cows using frozen semen of Limousine and Simmental bulls is expected to obtain a higher average calf daily weight gain and higher income over calf feed costs at weaning, although it is more likely to experience dystocia (Paputungan *et al*. al., 2022).

Dam breeds had been reported to affect dystocia in male calves but not female calves (Abera *et al*. 2017). Birth weight varied among breeds, and differences were significant among sires within breeds (Purohit *et al*. 2011; Abera *et al*. 2017). Birth weight and gestation length were affected by the breed of sire and sire within a breed. Crossing European breeds has been associated with an increased risk of dystocia (Purohit *et al*. 2012). However, the dam breed (Limousine, Simmental, and PO) in this study had no effect on the dystocia of primiparaous and pluriparous cows. This might be due to the fact that the pelvic inlet sizes of the primiparous and pluriparous cows of all the cow breeds were not significantly different. The most common cause of dystocia in primiparous cows associated with cross-breeding using superior bull frozen semen was fetopelvic disproportion because the size of the calf was too large compared to the size of the dam's pelvis (Singh *et al*., 2019)

In general, the age of cows in farmer scale was related to parity, with older cows followed by higher parity (Khan *et al*., 2015). Dystocia of cows in the working area of the Besuki Animal Health Center, Situbondo Regency, was dominated by dams that were less than six years old (76%). This result was similar to the report of Febrianila and co-workers (2018) that the incidence of dystocia in the first, second, and third or more concecutive calving was 30-60%, 8-25%, and 2-8%. The percentage of dystocia in cows decreased significantly with age (Gaafar *et al*., 2011). Cows that are inseminated with superior bull frozen semen in the first or second estrus after puberty (sexually mature but not yet reaching mature body weight) tended to cause dystocia due to fetomaternal disproportion (Mustofa *et al*., 2019). Age at first calving was related to the incidence of dystocia. Heifers that calve for the first time at a younger age increased the incidence of dystocia (Atashi *et al*., 2021). However, the age of the dams (less or more than six years) in this study did not affect the incidence of dystocia in primiparaous and pluriparous cows. It might be because of the veterinarian's recommendation to farmers to mate their cows after reaching puberty and mature body size. In addition, it might also be because the range of age differences in this study (aged more or less than six years) was not enough to resulted differences of dystocia cases

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in primiparous and pluriparous cows.

The incidence of dystocia in beef cows was higher in pregnancies with female calver (66%) than male calves (34%). Dystocia was dominated by the oversized fetus (Singh *et al*., 2019). The gestation length for Bali cows is 250-285 days, with an average of 275.2 ± 8.2 days for male calves and 257.15 ± 6.00 days for female calves. Male calves were conceived 18.08 days longer than female ones (Mappanganro *et al*., 2022). Also, male fetuses have a higher birth weight of 2.3 to 3.2 kg than female fetuses (Febrianila *et al*., 2018). Male fetuses had a longer gestation period of about one to two days than female fetuses. In beef cows, the growth rate and production efficiency were higher in males than in females. In general, the birth weight of male calves was greater than that of female calves; this was because the androgen hormones possessed by males, would cause more nitrogen retention than female caves, resulting in greater growth. Therefore, male fetuses had greater prenatal growth and higher birth weights than female calves (Susanti *et al*., 2015). The percentage of difficulties in calving to male calves was higher than female calves for cows of all ages (Mee *et al*. 2011; Purohit *et al*. 2011). Pregnancies with male calves experienced dystocia more often than pregnancies with female calves because male calves were heavier at birth with larger body dimensions. Therefore, the risk of dystocia was higher in cows delivering male than those with female calves (Atashi *et al*., 2021). The incidence of dystocia caused by the fetal factor was higher than that caused by maternal factors in Italy (De Amicis *et al*., 2018). Increased birth weight was associated with an increased risk of dystocia (Hohnholz *et al*., 2019). However, the sex of the calves in this study did not affect the incidence of dystocia in primiparaous and pluriparous cows. This might be due to the insufficient sample size to show statistically significant differences. Small samples had limitation for detecting population differences. Conversely, large samples could detect small differences and reflected them as statistically significant population differences (Leppink *et al*., 2016).

Nutritional needs are one of the most important factors in triggering reproductive disorders in beef cows. Protein, minerals, and energy were needed for metabolic processes, synthesis of reproductive hormones, growth, lactation, and reproductive activity (Luthfi and Widyaningrum, 2017). The highest incidence of dystocia was observed in hypo-calcemic cows (Bahrami-Yekdangi *et al*., 2022). Farmers' awareness of proper feeding, considering the size of the sire and dam when using artificial insemination, needed to be increased to minimize the incidence of dystocia (Yohannes *et al*., 2018).

The condition of the land in the working area of the Besuki Animal Health Center is mostly dry land which is dominated by plantations. The main feed for cows is agricultural waste products which were assumed to be lacking in phosphorus (Ding *et al*., 2023). Several minerals, such as phosphorus, were needed at late gestation for the homeostasis of periparturient cows (Cohrs *et al*., 2018). Inadequate feeding during pregnancy could also cause dystocia; in this case, the dam lacked energy during contractions. Conversely, pregnant cows that were overfed could cause dystocia due to excessive accumulation of fat in the pelvic area and oversized fetuses (Febrianila *et al*., 2018). However, the feeding of dams during pregnancy in this study had no effect on dystocia in primiparaous and pluriparous cows. This might be due to the nutritional content (protein, minerals, and energy) in elephant grass or concentrates or their combination did not affect the normal physiology of pregnancy and calving. This result was similar to the report that there was no difference in calf birth weight due to differences in mid-pregnancy feeding. Likewise, birth weight did not affect the incidence of dystocia due to variations in feeding in the third trimester of pregnancy (Hickson *et al*., 2006).

Of the 50 cases of dystocia in this study, only 38% exercised, and the rest rarely or never exercised during pregnancy. This result followed the case of dystocia in beef cows in Kunir District, Lumajang Regency, which showed that

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the exercise factor influenced the occurrence of dystocia cases (Febrianila *et al*., 2018). Exercise would strengthen the myometrium and prevent uterine inertia at parturition (Mustofa *et al*., 2019). In Saesie Tsaeda–Emba district, Eastern Tigray, Ethiopia, dystocia was more often caused by maternal factors than fetal and other factors (Yohannes *et al*., 2018). Research on Iraqi cows reported dystocia caused by maternal factors of 37.15%, and fetal factors of 62.85%. Dystocia caused by parental factors consisted of primary uterine inertia, incomplete cervical dilatation, uterine torsion, and narrow pelvis, with respective percentages of 22.9, 20, 14.3, and 5.7%. Meanwhile, dystocia caused by fetal factors consisted of fetal maldisposition of 17.15%, fetal monsters of 11.42%, and fetal emphysema of 8.58% (Rahawy, 2019).

Exercise could support the cow's stamina and longer life expectancy. Lack of exercise, such as lack of movement and walking around the barn every day during pregnancy, could also be a factor in causing dystocia. Exercise during pregnancy could affect muscle tone that supported labour. Therefore, rearing cows in a shed without exercise could affect the incidence of dystocia (Funnell and Hilton, 2016). Physical activity, at least in late-gestation cows, resulted in higher cortisol levels on the day of calving and facilitated the calving process (Black and Krawczel, 2019). In addition, outdoor exercises of pregnant cows allowed sunlight exposure. Sunlight as a signal received by the hypothalamus is related to the secretion of Gonadotropin-Releasing Hormone (GnRH), which played a role in stimulating the pituitary to release Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH) for regular reproductive cycles (Marques *et al*., 2022).

CONCLUSION

Dystocia of cows in the working area of the Besuki Health Center in Situbondo Regency was dominated by pluriparous parturition with exercise factor as the primary cause.

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AUTHORS' CONTRIBUTIONS

Nisaaturrohma Fajriyah (NF), Soeharsono Soeharsono (SS), Oky Setyo Widodo (OKW). NF: conceived the idea, designed the study and collected data. NF and SS: analyze data and drafted the manuscript. OKW: critically review, proofread and revise. All of the authors approved the final draft.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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