

Study on Helminthes and Liver Lesions of Sheep and Goats at Addis Ababa Abattoir

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Abstract: Cross sectional study was conducted on indigenous sheep and goats slaughtered at Addis Ababa Abattoir. A total of 427 animals were sampled to determine the prevalence of helminthes parasites by coprology and postmortem examination of the same animals with emphasis on liver lesion and fasciolosis. Simple direct smear and sedimentation technique were used to examine the eggs of gastrointestinal parasites and *Fasciola*. The liver of the target animal was thoroughly inspected by visualization, palpation and incision for the identification and exposing of pathological lesion and parasites. The overall prevalence of helminthes parasites of small ruminants was 21.1% (goats) and 39.5% (sheep). There was statistically significant ($p < 0.05$) difference in the overall prevalence of the parasites where higher prevalence was recorded in sheep than in goats. Of a total of 427 animals sampled, 163 (38.2%) livers were condemned due to sever pathological lesions. In general 8.8% of liver from goats and 29.3% of liver of sheep had one or more different types of lesion. The major lesions of liver on both animal species encountered during postmortem examination were white spot (4.4%), calcification (3.5%), discoloration (2.6%) and narcotization (2.3%). The study has indicated that helminthes parasites are highly prevalent in the study area which insists further epidemiological study to assess the significant effect of risk factor on the prevalence of gastrointestinal parasites.

Key words: Addis Ababa Abattoir, fasciolosis, liver lesion, prevalence, sheep and goats, helminthes parasites, sheep, pathological lesion, postmortem, sedimentation technique

INTRODUCTION

Sheep and goats are mainly found in arid and semi-arid areas of sub-Saharan Africa. They play a vital role in rural economies through the provision of meat, milk, household income, manure and skin. Compared to cattle and camels, sheep and goats contribute a larger proportion of readily available meat in the diets of pastoralists. They have been estimated to provide up to 30% of the meat and 15% of the milk supplies in sub-Saharan Africa where thrive in a wide range of ecological regions often in conditions too harsh for the beneficial rearing of cattle. Small ruminants have also been reported to survive better under drought conditions than cattle due to their low body mass and low metabolic requirements which in turn minimize their water requirements and maintenance needed in arid and semi-arid areas. The frequent droughts and large tsetse infected areas in sub-Saharan Africa requires more small ruminants in order to supplement cattle production.

Ethiopia owns the largest livestock population in Africa with an estimated population of 50.8 million cattle, 25.01 million sheep and 21.9 million goats (CSA, 2010). Despite this huge resource, Ethiopian livestock productivity remains below adequate. The major constraints contributing to low productivity include the low genetic potential of the animal, poor nutrition and prevailing diseases like parasitosis. Stomach and intestinal worms occur in all species of animals. Young and malnourished animals of both sexes and lactating animals are most suitable to these parasites. Stomach worms affect specially camels, goats and sheep. Different types of worms are transmitted when an animal eats grass or drinks water contaminated with larva or eggs. The problem is especially common in the rainy season (IIRR, 1996). Fasciolosis, also is an economically important disease of domestic livestock mainly in sheep and cattle (Abebe, 1995). The disease is caused by trematodes of genus *Fasciola* commonly referred as liver flukes (Lemma *et al.*, 1985; Jones *et al.*, 1997; Bowman, 2003).

Species of liver fluke include *Fasciola hepatica* and *Fasciola gigantica* with the former being more prevalent in cattle and the latter in sheep and goats (Blood *et al.*, 1980). Fasciolosis has a worldwide distribution but *Fasciola hepatica* is predominantly found in temperate zones while *Fasciola gigantica* is also found in most continents primarily in tropical (FAO, 2009). These both species of *Fasciola* affects the organ liver. Liver is an important organ for all animals to carry out different activities and functions for animals and a source of protein and valuable commodity for poor communities. Postmortem inspections, screening and sorting livers is important to separate the normal liver from abnormal (Assefa, 2005). In Ethiopia, many studies have been undertaken to identify the major disease condition encountered during ante mortem and postmortem examination.

The study conducted by Mezgebu (2003) at Nazreth and Gondar abattoirs revealed that liver where highly rejected organ by postmortem inspection mainly due to fasciolosis. The adult flukes are found in the bile ducts and the immature flukes in the liver parenchyma. *Fasciola gigantica* (giant liver fluke) is similar shape to *Fasciola hepatica* but larger with less clearly defined shoulders. It causes economic loss in sheep and cattle of Africa mainly through liver condemnation. Ovine Fasciolosis in Ethiopia is very frequent and causes a significant economic loss either in production loss or decrease productivity and loss of body condition (Jibat, 2006; Abunna *et al.*, 2010; Abebe *et al.*, 2010). Acute Fasciolosis is common in sheep and goats while the chronic form is found mostly in cattle. While in acute Fasciolosis, the animal usually show signs of anorexia, dullness, diarrhea, muscular atrophy, subcutaneous edema and impaired immune systems (Boray, 1969; Blood *et al.*, 1980) Hepatic Fasciolosis is often characterized by a swollen liver (Dawes and Hughes, 1970). The incidence of Fasciolosis varies with the seasons (Suarez and Buseti, 1995) and depends on the level of agricultural activity, nutritional deficiency, pasture management, micro and macro environments of the area, presence of intermediate host (water snail) and vectors in the area, as well as the immunological status of the host (Onyali *et al.*, 1990). However, this important disease was usually overlooked not addressed and assessed all over the country. There was statistically significant ($p = 0.000$) difference in proportion of liver condemned due to liver lesion in sheep and goats in this study. Therefore, the objectives of this study were to determine the overall prevalence of helminthes of small ruminants with emphasis on Fasciolosis and assess the different pathological condition of liver and degree of liver condemned.

MATERIALS AND METHODS

Study area: The study was conducted in Addis Ababa administrative region which is the capital city of federal democratic republic of Ethiopia. Addis Ababa lies at an altitude of 2000-2560 m.a.s.l. It receives a mean annual rainfall of 1800 mm in bimodal pattern. The long rainy season extends from June to September followed by a dry season ranging from October to February. The short rainy season lasts from March to May. The average minimum and maximum temperature are 10.7 and 23.6° C, respectively with mean relative humidity of 61.3% (CSA, 2010). Animals slaughtered at Addis Ababa abattoir are originated from different parts of Ethiopia, since Addis Ababa livestock markets are terminal markets. Due to this fact the origin of slaughtered animals are from different parts of the country including central highlands of Ethiopia (N. Shoa, E. Shoa, W. Shoa, S. Shoa), Arsi, Bale, Afar, Wolaita, etc. This abattoir has slaughtering capacity about 700 cattle, 300 sheep and goats, 60 swines and 20 camels daily to satisfy the demands of highly growing customers in the capital.

Study population: The study animals comprised of both sexes of indigenous sheep and goats originated from different agro ecological zones of Ethiopia for slaughter at Addis Ababa abattoir enterprise. Animals originated from different parts of the country and it was very difficult to trace back their exact location. But, according to the information obtained from the abattoir officials and marketing places, the origins of the animals were recorded.

Study design and sampling methodology

Study type: Cross sectional type of study was conducted from November, 2011 to March, 2012 to determine the prevalence of helminthes parasites by coprology and postmortem examination of the same animals with emphasis on liver lesion and fasciolosis. The animals were randomly selected for sheep and goats presented for slaughter at Addis Ababa abattoir. The sample of individuals from a population was taken from the abattoir.

Sample size determination: The sample size was determined according to (Thrusfield, 1995):

$$N = T^2 * P \exp(1) - P \exp / d^2$$

Where:

N = Sample size to be determined

T² = Value at a given confidence interval

Pexp = Expected prevalence of Fasciolosis in the study area

d = Desired absolute precision

For this study, since the approximate previous prevalence value is not known an expected prevalence value of 50% (0.5) with a desired absolute precision (d) of 5% (0.05) was used to conduct the study. The sample size was calculated according to the above given expected prevalence value of Fasciola and it is 384. However in order to increase precision a total of 427 animals were sampled.

Sampling method: A simple random sampling method was employed on the selection of sampling units at the abattoir and sample units were clustered by species, breed, age, sex, origin and body condition. The study animals were randomly selected and the data liver species, breed, origin, sex age and boy condition of each study animal was recorded during abattoir survey. The age of each study animal was estimated based on the dentition formula described by Gatenby (1991).

Study methodology: To investigate the prevalence rate and loss due to liver lesion 2 techniques (coprology and liver inspection) were applied. The presence and absence of the parasite was detected before and after slaughter of these selected animals.

Ante mortem inspection: An ante mortem inspection was made on individual animals for assessment of animal origin, body condition and also to collect fecal sample. During every visit each animal was identified based on enumerated marks on its body tagged before slaughter and assessment of body condition was carried out using a modified method described by Asmamaw (2010) as animals with poor body condition scored as 1; medium as 2 and for good as 3.

Laboratory examination: Laboratory examination was conducted using standard laboratory examination procedures (Urquhart *et al.*, 1996). Fresh fecal samples were collected directly from the rectum using disposable plastic glove and transported the sample to Shola Zonal veterinary diagnostic laboratory by placing it in ice box. Samples were preserved with 10% formalin solution. Simple direct smear and sedimentation technique were used to examine the eggs of gastrointestinal parasites and Fasciola. To conduct sedimentation the following procedure was followed: 3 g of feces were crushed using pestle and mortar; 40 mL of water was added and then let to sediment. The supernatant was discarded and the sediment parts was put on petridish and observe under a microscope of 10 x magnification power and identified the eggs of Fasciola from other nematodes and trematodes egg using identifying keys (Chanie and Begashaw, 2011).

Postmortem examination: During meat inspection, the previously identified animals and their livers were carefully followed and examined. During the postmortem inspection, the liver was thoroughly inspected by visualization, palpation and incision for the identification and exposing of pathological lesion and parasites. Using this procedure a total of 427 liver was inspected according to the guide line on meat inspection for developing countries prepared by FAO (2009). Identification of species involved, also was carried out using the size parameters described by Soulsby (1982).

Data analysis: Daily data were recorded and stored in excel Microsoft spread sheet and it was analyzed using SPSS (Statistical Package for Social Science) version 15. Prevalence of the disease was determined by dividing the number of animals positive for total number of animals examined. Association of different risk factors, like, sex, age, body condition and origin of the animals was assessed using χ^2 test. Total 95% confidence interval and 5% precision was set for level of significance.

RESULTS

The overall prevalence of helminthes parasites of small ruminants was 21.1 and 39.5%, respectively in goats and sheep. There was significant ($p < 0.05$) difference in the overall prevalence of the parasites where higher prevalence was recorded in sheep than in goats. Likewise, the overall prevalence of Fasciolosis was 12.6%. Similarly, higher prevalence of Fasciola egg was detected in sheep than in goats (Fig. 1). The study also indicated that more than half (56.1) of the liver inspected from sheep were unfit for consumption where as significantly less liver in goats (18.6%) were unfit for consumption due to different gross pathological conditions.

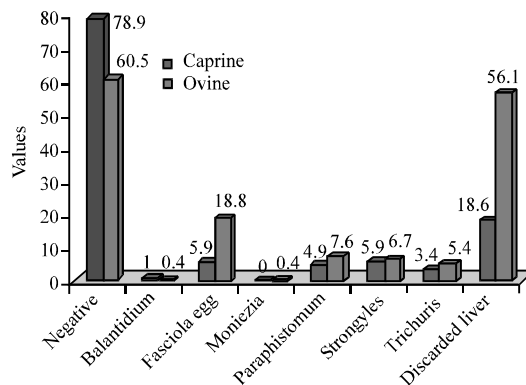


Fig. 1: Coprological prevalence of helminth parasites and proportion of liver discarded in sheep and goat

Table 1: Most common gross pathological conditions observed at postmortem examination

Species	Liver lesion										
	Adhesion	Calcification	Cirrhosis	Discoloration	Hard nodules	Hemorrhage	Hydatid cyst	Necrotization	Pus	Taeniolis cyst	White spot
Caprine	0	2 (1)	2 (1)	3 (1.5)	0	0	0	6 (2.9)	2(1)	1 (0.50)	2(1)
Ovine	1 (0.4)	13 (5.8)	3(1.3)	8(3.6)	3 (1.3)	1(0.4)	6 (2.7)	4(1.8)	3(1.3)	4(1.8)	17(7.6)
Total	1 (0.2)	15 (3.5)	5 (1.2)	11 (2.6)	3 (0.7)	1 (0.2)	6 (1.4)	10 (2.3)	5 (1.2)	5 (1.2)	19(4.4)

Table 2: prevalence of helminthes in sheep and goats based on their origin

Origin	Coprology result (%)							Total
	Negative	Balantidium	Fasciola	Moniezia	Paraphistomum	Strongyle	Trichuris	
Afar	2 (66.7)	0	0	0	0	0	1 (33.3)	3
Arsi	40 (88.9)	0	2 (4.4)	0	0	1(2.2)	2 (4.4)	45
Bale	8 (66.7)	0	2 (16.7)	0	0	2 (16.7)	0	12
E. Shoa	3 (50)	0	2 (33.3)	0	0	0	1 (16.7)	6
Harar	54 (71.1)	1 (1.3)	6 (7.9)	0	7 (9.2)	4 (5.3)	4 (5.3)	76
Jimma	2 (100)	0	0	0	0	0	0	2
N. Shoa	19 (67.9)	0	8 (28.6)	0	0	0	1 (3.6)	28
Somali region	4 (66.7)	0	0	0	1 (16.7)	1 (16.7)	0	6
W. Shoa	160 (66.9)	2 (0.8)	31(13)	1(0.4)	17(7.1)	18 (7.5)	10 (4.2)	239
Wolaita	4 (40)	0	3 (30)	0	2 (20)	1 (10)	0	10
Total	296 (69.3)	3 (0.7)	54 (12.6)	1 (0.2)	27 (6.3)	27(6.3)	19 (4.4)	427

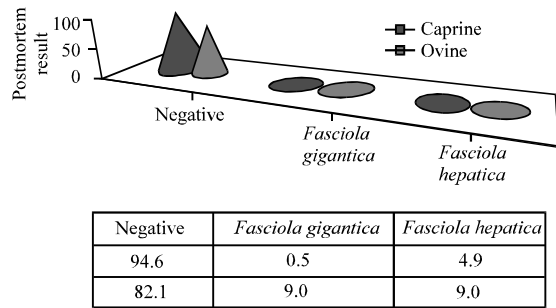


Fig. 2: Prevalence of Fasciola species based on postmortem in sheep and goat

Of a total of 427 animals slaughtered at Addis Ababa abattoir were thoroughly examined. Of these 163 (38.2%) livers were condemned due to sever pathological lesions. In general 8.8% of liver from goats and 29.3% of liver of sheep had one or more different types of lesion. The major lesions of liver on both animal species encountered during postmortem examination were white spot (4.4%), calcification (3.5%), discoloration (2.6%), necrotization (2.3%), etc. from their ascending to descending prevalence Table 1.

The overall prevalence of Fasciolosis in postmortem examination in sheep and goat was 5.4 and 19.9, respectively. *Fasciola hepatica* was the most commonly encountered species in goats whereas in sheep both species were detected (Fig. 2).

There was no significant ($p = 0.628$) difference in prevalence of helminthes across animal coming from different place of Ethiopia (Table 2).

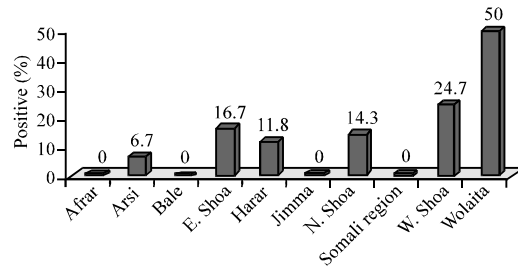


Fig. 3: Proportion of liver condemned due to liver lesion based on origin of the animals

There was significant ($p = 0.000$) difference in proportion of liver condemned due to liver lesion in sheep and goats originating from different parts of Ethiopia. Significantly higher proportion of liver was unfit for consumption from small ruminants originating from West Shoa and Wolaita than from Afar, Bale, Jimma and Somali region (Fig. 3). However, there was no significant difference in prevalence of Fasciola species detected during postmortem examination in small ruminants originating from different parts of the country. No difference ($p>0.05$) in prevalence of species of Fasciola detected from animals originating from different part of the country.

There was no significant ($p>0.05$) difference in prevalence of helminthes, Fasciola species, number of organ condemned between sex group of the examined animals though the prevalence with respect to age has indicated that it was high in adults than young. Whereas significantly higher prevalence of liver lesion was detected in older than younger animals. Moreover,

Table 3: Postmortem lesion on liver of Goats and sheep based on origin of the animals

Origin	Liver lesion											Total
	Adhesion nodules	Calcification cyst	Cirrhosis cyst	Discoloration spot	Hard	Hemorrhage	Hydatid	Necrotization	Pus	Taenicolis	White	
Afar	0	0	0	0	0	0	0	0	0	0	0	3
Arsi	0	1 (2.2)	0	0	0	0	0	0	0	0	2 (4.4)	45
Bale	0	0	0	0	0	0	0	0	0	0	0	12
E. Shoa	0	0	0	0	1 (16.7)	0	0	0	0	0	0	6
Harar	1 (1.3)	1(1.3)	0	1 (1.3)	0	0	0	0	2 (2.6)	2 (2.6)	2 (2.6)	76
Jimma	0	0	0	0	0	0	0	0	0	0	0	2
N. Shoa region	0	0	1 (3.6)	1 (3.6)	0	0	0	1(3.6)	0	1(3.6)	0	28
Somali	0	0	0	0	0	0	0	0	0	0	0	6
W. Shoa	0	11(4.6)	4(1.7)	7(2.9)	2 (0.8)	1 (0.4)	6 (2.5)	9 (3.8)	3 (1.3)	1 (0.4)	15 (6.3)	239
Wolaita	0	2 (20)	0	2(20)	0	0	0	0	0	1 (10)	0	10
Total	1 (0.2)	15 (3.5)	5 (1.2)	11 (2.6)	3 (0.7)	1 (0.2)	6 (1.4)	10 (2.3)	5 (1.2)	5 (1.2)	19 (4.4)	427

significantly higher prevalence of Fasciolosis was observed in old animals (50) than in younger ones (4). The 54 (12.6%) were positive for Fasciola eggs (Table 3).

On the other hand, assessment of effect of body weight indicated that there was no significant ($p>0.05$) difference in overall prevalence of gastrointestinal parasite between animals of different body conditions, neither is difference in the species of parasites detected in animals of poor, moderate and good body conditions.

DISCUSSION

Gastrointestinal parasitosis is 1 of the leading diseases of small ruminants. The current study indicated that gastrointestinal parasite and Fasciolosis are widely prevalent in sheep and goats originating from different parts of the country.

The prevalence of helminthes indicated by fecal examination in the present study was 39.5% sheep and 21.1% goats. This prevalence was lower than that reported by Tefera *et al.* (2011) which is 91.32% in sheep and 93.29% in goats in and around Bedelle. The coprological examination indicated highest prevalence of Fasciola in sheep than in goats. Comparable prevalence was also recorded by Zeryehun (2012) from South East Ethiopia. The overall prevalence of helminthes was significantly higher in sheep than in goats. This situation could be due to the fact that goats are browsers in nature and do not usually grazing and there is less chance of acquiring the infection by picking the larvae along with the grass (Ayana, 1996). In cases of absence of browsing feed, the nature of grazing also varies between these species of animals. Goats are not deep grazers up to the ground as compare to the case in sheep. When researchers compare the prevalence of Fasciola by coprology and during postmortem examination, it was significantly higher in sheep than in goats in which the same contributing factors may hold true. Regardless of

the number of animals came from an area the parasitic infection varies with a significant difference. This could be due to difference in altitude, seasonal variation and the way of application to control the parasite, observations of Kifle and Hiko (2011) indicated that in Ethiopia, *Fasciola hepatica* is widely spread disease in area with an altitude above 1800-2000 m. a.s.l., whereas *Fasciola gigantica* appears to be the most common species in area below 1200 m.a.s.l. and both species coexist in area with altitude ranging between 1200-1800 m.a.s.l. In the study, as mentioned earlier the a estimation of financial loss from liver condemnation as a result of fasciolosis in small ruminants slaughtered in Addis Ababa Abattoir is significantly high.

The difference in prevalence of the helminthes could be attributed to the difference in geographical origin of the animals and the time of sampling. Regardless of the number of animals came from an area the parasitic infection varies with a significant difference. This could be due to difference in altitude, seasonal variation and the way of application to control the parasite. The prevalence of helminthes parasite is higher in animals from wet and humid area which create favorable condition for survival of the larvae in the environment (Ayana, 1996; Tefera *et al.*, 2011).

Likewise in the present study, a prevalence of 6.3% Strongyloid eggs, 4.4% Trichuris eggs and 0.2% Monezia eggs were recorded for both sheep and goats. This indicates lower prevalence from Tefera *et al.* (2011) that recorded as 6.3 Stongyloids, 46.1 Trichris, 24.8% Monezia while the prevalence of 71.93, 46.67 and 78.95% Strongyloid egg; 3.51, 5 and 1.75% Paraphistomum; 5.26, 1.67 and 3.51% Monezia and 3.55, 5 and 7.02% Trichris were recorded in Arbaminch, Borana and Jinka, respectively (Dugassa, 2010). From parasitic disease of ruminants, the disease Fasciolosis accounts to be a great constraint of animal health and causes significant economic loss in Ethiopia. The current overall prevalence of fasciolosis in small ruminants (12.6%) is higher than

reports of Jibat (2006) (5%), Asmamaw (2010) (3.76%) both record in HELMEX, Kifle and Hiko (2011) (3.2%) in Modjo and Dugassa (2010) (1.61%) in HELMEX but lower than the prevalence 27.2 and 21.42 reports of Ayana (1996) in Assela (Arsi) and Abate (2008) in HELMEX, respectively. The prevalence indicated by fecal examination in the present study (12.6%) was also higher than 1.75, 5 and 5.26% recorded from Arbaminch, Borena and Jinka, respectively by Dugassa (2010). From the total number of 427 livers of ruminants, 56.1 and 18.6% livers of sheep and goats were rejected, respectively. This study is in agreed 57.6 sheep and 6.8% goats recorded by Mezgebu (2003) in Gondar abattoir but <43.8% goats recorded by Jibat (2006) in HELMEX. The present study was in consent with the prevalence recorded by Kifle and Hiko (2011) in and around Bedelle that indicated the same prevalence of *Fasciola gigantica* and *Fasciola hepatica* (0.4) for goats and 2.8% *Fasciola gigantica*, 3.4% *Fasciola hepatica* for sheep.

Similarly, the postmortem examination discovered 5.9% caprine and 18.8% ovine infected with *Fasciola* was higher than in caprine and ovine recorded by Jibat (2006) and Dugassa (2010) in HELMEX. But, it is lower than the prevalence recorded by Abate (2008) in HELMEX. This higher or lower prevalence estimates may be due to differences in sample size, laboratory methodology and seasonal variation. Statistical analysis has also indicated that there was a significant difference in prevalence of *Fasciola* between the 2 species of animals ($p < 0.05$) with more prevalent in sheep than in goats. This could be due to the fact that the difference in feeding behavior of the two species.

The present prevalence shows with a slightly greater prevalence in adults (12.9%) than in young (10.3%) for both species of animals. This indicates higher prevalence from the previous study (4.5%) adults and (1.25%) young reported by Kifle and Hiko (2011). This might be due to the length of time start to grazing where metacercaria is harvesting along with grass. Of the two species, *Fasciola hepatica* has high prevalence in goats (4%) but shows the same figure with *Fasciola gigantica* in sheep (9%). This contradicts with the previous prevalence reported by Kifle and Hiko (2011) that indicates higher prevalence of *Fasciola hepatica* in sheep (3.4%) but the prevalence of both species of *Fasciola* indicates the same prevalence in goats (0.4%). This could be associated with agro ecology of animal origin which favors intermediate snail host (Tefera *et al.*, 2011).

CONCLUSION

On fecal examination a significant difference was observed on the prevalence of *Fasciola* egg recorded in different agro ecological areas. Higher prevalence was

recorded in Wolaita, West and East Shoa as compared to the case in Jimma, Afar and Somlai region.

The overall prevalence of liver lesion in sheep and goats examined for pathological lesions of liver 163 (38.2%) livers were condemned due to severe pathological lesions. The liver lesions recorded during postmortem examination are necrotization, discoloration white spot, abscessation, cirrhosis, calcification and taenicolis cyst. This indicates lower prevalence from the previous liver lesions abscessation, calcification, cirrhosis and taenicolis as studied by Jibat (2006) and Dugassa (2010). There is significant loss due to discarding of liver in association to lesions observed during postmortem examination.

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