Global Veterinaria 18 (4): 250-255, 2017
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2017.250.255

Hemato-Biochemical Profile in Cattle with Rumen Impaction

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Abstract: The aim of this study was to investigate the prevalence of rumen impaction, hematological changes, biochemical parameters and ruminal pH change caused by indigestible foreign bodies (Plastic) in cattle. About 212 cows were examined immediately after slaughtering to determine the presence or absence of the foreign bodies in their rumen-reticulum. Both blood samples and rumen fluid were collected from all animals with or without foreign bodies in rumen-reticulum. Of the sixty (28.30%) head had indigestible foreign body (plastics materials), 44 (73.34 %) were males and 16 (26.66%) were females. Biochemical analysis revealed a significant increase in the concentration of glucose ($P < 0.01$), total proteins ($P < 0.05$), urea ($P < 0.05$), aspartate aminotransferase (AST) ($P < 0.05$), alanine transaminase (ALT) ($P<0.05$), with no significant difference in the level of the cholesterol ($P> 0.05$). Hematological analysis revealed a significant decrease of the concentration of packed cell volume (PCV) and White blood cell count (WBC) ($P < 0.05$), but no significant difference in the erythrocyte count (RBC) level of hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) ($P> 0.05$). Also, ruminal fluid pH measurement revealed no significant difference between rumen with indigestible foreign bodies and rumen without indigestible foreign bodies. The present study revealed that hemato-biochemical parameters should be taken into consideration in the diagnosis of cattle rumen impaction.

Key words: Blood Hemato-Biochemical Profile · Non-Biodegradable Material · Rumen Impaction · Rumenal Fluid pH

INTRODUCTION

Plastic is made from non-renewable, heavy pollutant petroleum products (Crude oil, natural gas and coal) [1]. Since it is a non-biodegradable material, it has been accumulating in the environment for decades and pose risk to animal health and the environment [2].

Plastics are the most common waste materials in the municipality, it represents the largest part of municipal wastes and it is not sent to landfill or incinerated. Plastic waste is harmful to ruminants because it can eventually lead to the dead of the animal as a result of indigestion [3]. This may possibly be one of the major health problem affecting cattle in Algeria. Cattle are more susceptible to ruminal impaction than other small ruminants because they do not use their lips for prehension [4-6]. Due to lack of oral discrimination cattle may ingest foreign particles that would otherwise be rejected by other species [7,8]. Nutritional deficiency and bad feeding management practices could lead to the ingestion of foreign particles and this might eventually affect different organs of the animal mainly the rumen and reticulum [9]. When ingested, these foreign particles stay in the rumen of the cattle, compromising ruminal space and interfering with normal physiological functions of the rumen thereby leading to loss of weight and eventually the dead of the animal [10,11]. Ruminal impaction as a result of indigestible foreign bodies especial plastics also leads to ruminal distension and passing of scanty or no feces [12] high mortality rates and also premature slaughter of sick cattle [13].

As the grazing land is becoming more and more polluted with these indigestible foreign bodies (plastic) we can predict that this will be a growing problem for grazing animals in Algeria. This study was designed to draw attention to the role of the environmental pollution on the prevalence of foreign bodies ingested by cattle in

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Batna city and serve as an eye opener for the government to enable it formulates policies on an effective and efficient waste disposal system. The purpose of this study aimed to investigate the number of cattle with rumen impaction as a result of indigestible foreign bodies slaughtered in Batna municipal abattoir and consider some blood hemato-biochemical parameters and rumenal fluid pH.

MATERIALS AND METHODS

Study Area: The study was carried out in Batna City, northeastern Algeria between August 2015 and January 2017. Batna is located between the north and south of the Atlas Mountains and this means that the mountains rise on either side to form a sort of naturally protective passage over the province. The climate tends to vary quite widely, with extreme heat during the summer with snow and cold during winter. The latitude and longitude of Batna City are 7°-4° N and 35°-36° E, respectively. The average altitude of the city is 1,048 meters above sea level with a temperature range of 4° to 35° C. According to the management of agricultural services Batna has livestock population of about 48357 cattle, 263575 goats, 674300 sheep and 110 Camel.

Animals: The study was conducted on 212 cattle apparently healthy. The animals were selected by systematic random sampling. The origin of animals slaughtered at Batna Municipal Abattoir is mostly from Batna and other surrounding municipalities. Cattle presented for slaughter were identified by sex, age and race. Age was determined basing on dental eruption [14]. After slaughtering the animals, the rumen and reticulum were examined in the evisceration stage, they were opened and any foreign bodies were washed with water to remove adhering feed material and identified. The plastics and/or other foreign bodies collected from each animal were separated into different types and weighted. Plastic objects were further stored into loose compact masses or metals.

Sample Collection and Analysis: Before slaughtering the animal, blood samples were collected from the jugular vein into dry and heparinized tubes for measuring glucose, total proteins, urea, aspartate aminotransferase (AST), alanine transaminase (ALT), cholesterol, packed cell volume (PCV), white blood cell count (WBC), erythrocyte count (RBC), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) by COBAS INTEGRA® 400 plus analyzer and Medonic M-Series hematology analyzers.

Measurement of pH: Rumen fluid was collected randomly from all animals with or without foreign bodies in reticulo-rumen through the Ryles stomach tube. The ruminal fluid pH was measured immediately after sampling (Digital pH meter (Ph 225, WTW).

Statistical Analysis: The data obtained is presented as mean and standard error (Mean±S.E.) and statistically analyzed using MYSTAT12. Student's t-test was used to analyze the significance of difference between the control and animals with rumen impaction. Significance level was set at $P = 0.01$ and $P = 0.05$.

RESULTS

Prevalence of Rumen Impaction: From the 60 (28.30%) cases out of 212 animal slaughtered suffered from rumen impaction, 44 (73.34 %) were males and 16 (26.66%) were females (Table 1).

Biochemical Analyzes: The results obtained from blood biochemical analysis (Table 2), showed that impacted animals had significantly ($p < 0.01$) high glucose (92.3±27.2mg/dl) compared to the control non impacted group (75.2±20.5 mg/dl). Total proteins of impacted animals (7.8.89±1.437 g/dl) was significantly ($p < 0.05$) high compared to the control group (7.127±1.503g /dl). Similarly, urea (5.24±1.25mg/dl) significantly ($P < 0.05$) increased in cattle with rumen impaction compared to the control animals (4.51±1.44mg/dl). As well as, AST (109.38±34.94 U/L) and ALT (28.03±6.21U/L) levels significantly ($P < 0.05$) increased in cattle with the rumen impaction compared to the control animals (93.76±25.44 U/L; 25.23±5.40U/L). There was no significant difference in the cholesterol level ($p>0.05$).

Hematological Analyzes: Hematological profile demonstrated non-significant changes in the RBC, Hb, MCV, MCHC and MCH values in cattle with rumen impaction compared to the control group (Table 3). Whereas, there was significant ($P < 0.05$) decrease in mean values of PCV (32.66 ± 6.01) in cattle with rumen impaction compared to the control group (36.64 ± 6.93) and a significant ($P < 0.05$) increase in WBC (21.60 ± 15.69) in cattle with rumen impaction compared to the control group (15.07 ± 7.10).

Ruminal fluid pH: The mean ruminal fluid pH of impacted animals (6.64 ± 0.64) was nearly similar to control animals (6.56±0.47;p<0.05; Table 4).

Table 1: Sex distribution of rumen impaction in cattle slaughtered at Batna municipal slaughterhouse

Animals	Examined animals	Prevalence (%)	Positive animals with rumen impaction	Prevalence (%)
Male	175	82.55 %	44	73.34 %
Female	37	17.45 %	16	26.66 %
Total	212	100 %	60	28.30 %

Table 2: Biochemical parameters of apparently healthy cattle and those with rumen impaction

Parameters	Rumen impaction (n=30)	Control group (n=40)
Glucose(mg/dl)	92.3±27.2**	75.2±20.5
Total proteins (mg/dl	7.88±1.43*	7.12±1.50
Cholesterol(mg/dl)	84.5±2.17^{NS}	78.4±1.84
Urea (mmol/l))	5.24±1.25*	4.51±1.44
AST (U/L)	109.38±34.94*	93.76±25.44
ALT (IU/L)	28.03±6.21*	25.23±5.40

The values are represented by mean ± S.E,* Indicates significant difference from control group at P < 0.05

** Indicates significant difference from control group at P < 0.01, NS – Non significant.

AST:Aspartate aminotransferase, ALT: Alanine transaminase

Table 3: Hematological parameters of apparently healthy cattle and those with rumen impaction

Parameters	Rumen impaction (n=32)	Control group (n=38)
PVC (10^6/iL)	32.656 ± 6.01*	36.64 ± 6.93
RBC (10^6/iL)	8.13 ± 2.09 ^{NS}	8.98 ± 1.75
Hb (g/dl)	13.11 ± 2.01 ^{NS}	13.85 ± 1.76
MCV (fl)	40.60 ± 7.36 ^{NS}	40.27 ± 4.98
MCHC (g/dl)	40.33 ± 5.82 ^{NS}	39.16 ± 6.51
MCH (pg)	16.71 ± 3.09 ^{NS}	15.60 ± 3.32
WBC (10^3/ $mm^{3)}$	21.60 ± 15.69*	15,07 ± 7.10

The values are represented by mean ± S.E, * Indicates significant difference from healthy group at P < 0.05

NS – Non significant.PCV: packed cell volume, WBC: White blood cell count, RBC: Erythrocyte count, Hb: Hemoglobin, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration.

Table 4: pH value in apparently healthy cattle and those with rumen impaction

Parameter	Control group (n=40)	Rumen impaction (n=30)
Ruminal fluid pH	6.56±0.47	6.64±0.64$^{N.S}$

NS – Non significant at P> 0.05

DISCUSSIONS

Rumen impaction in cattle with indigestible foreign body (plastic) is one of the most commonly occurring problems of the digestive tract of ruminants [15] previously reported from Jordan [8] Pakistan [16] Nigeria [10,11] Sudan [3,17, 18], India [19,20] Germany [21] Rwanda [22] and Iraq [23].

Nearly similar prevalence rate 23.9% was reported by Dawit *et al.*[24] in Ethiopia. However, more or less consistent overall foreign body prevalence of 59.14% was reported by Khurshaid *et al*.[18] in Pakistan, 43.4% and 41.8% were reported by Negash *et al*.[25] and Sheferaw *et al*.[26] in Ethiopia respectively, 38.6% and 12% were reported by Ngoshe [27] and Akinbobola *et al*.[28] in Nigeria and 17.4% by Mushonga *et al*.[22] in Rwanda.

The prevalence of rumen impaction in the current study is substantially higher in the cattle population [20] compared to results published in other countries [29] and revealed that the prevalence in males is higher compared with the prevalence in females. This is due to the low number of females slaughtered than the males.

Eating indigestible foreign bodies may be related to mineral deficiency, poor nutrition, anemia [30,31] or due to easy access to vegetable wastes in polythene bags [32, 33]. It is very common in developing countries possibly because of un-organized small- scale farming and poor standard in animal management and feeding [34]. Animal owners do not provide sufficient feed as well as quality feed to the animals. This deficiency forces the animal to pick up outside roughages.

The position of the impacted material in the rumen was more important than the size and weight of the material causing the impaction. Many large and heavy impacted materials in the rumen do not cause clinical impaction except where the rumino-reticular orifices were or completely blocked by the presence of these materials or pressure [35].

Clinical rumen impaction results by the accumulation of indigestible foreign bodies in rumen which interferes with the flow of ingesta leading to distention of the rumen and passing of scanty or no feces [36]. The pronounced clinical symptoms were emaciation, abdominal distension and asymmetry, complete cessation of rumination, lack of feces in the rectum, foamy salivation, recumbency, inappetence and weight loss [19].

In the current study, glucose was significantly (p < 0.01) high in impacted animals compared to the control group. These results agreed with those obtained by Hussain *et al*. [37] (85.91±12.42 mg/dl), Turkar *et al*. [38] (125.40 ± 20.12mg/dl), but lower concentrations was reported by Vanitha *et al*. [19] El-Attar *et al*. [39] and Akinrinmade and Akinrinde [6]. The higher glucose level may be due to stress of impaction leading to adrenocorticosteroid release, which has glycogenolytic effect, leading to hyperglycemia. The secretion of insulin in ruminants is induced by butyrate and propionate [40] which in turn may lead to suppression of

gluconeogenesis and increases in lipogenesis. After rumen impaction, volatile fatty acids are not synthesized in sufficient quantities to meet the energy demand of the animal, so the animal has to depend on oxidation of glucose rather than volatile fatty acid for metabolism [41].

The significantly ($p < 0.05$) high total proteins in impacted cows compared to the control group was also reported by Athar *et al*. [42] and Hussain *et al*. [37]. The increased total proteins value may be due to the inflammation [43].

The significantly ($P < 0.05$) increased urea in cattle with rumen impaction compared to the control animals could be correlated with anorexia, starvation, decreased rumeno-reticular activity and dehydration, as these conditions leads to renal insufficiency [38,39].

Similarly, Turkar and Uppal [38]and Tripathi *et al*. [44] reported a significant ($P < 0.05$) increase of AST and ALT levels in cattle with the rumen impaction compared to the control animals, The increased levels of AST and ALT could result from liver necrosis due to toxaemia from damaged rumen mucosa [45] or absorption of toxic products from the alimentary tracts, starvation and constipation leading to cellular disturbances of liver parenchyma [38,45].

The absence of significant difference in the RBC, Hb, MCV, MCHC and MCH values in cattle with rumen impaction compared to the control group is in accordance to the observations of Singh *et al.*[46] but counteract with Vanitha *et al*.[19] who reported a significant increase in RBC, MCV, MCHC, MCH. A significant increase in Hb had also been reported by Akinrinmade and Akinrind [6]. The significant decrease ($P < 0.05$) in mean values of PCV in cattle with rumen impaction compared to the control group may result from the inadequate dietary intake and dietary deficiency as a result of presence of foreign materials in the rumen [6,19,36,43]. However, the significant increase ($P < 0.05$) in WBC in cattle with rumen impaction compared to the control group might be in response to stress and infection [42,46,47].

CONCLUSION

The study revealed 28.30 % prevalence of rumen impaction in cattle in Batna city, this result is high enough and may play an important role not only in loss of cattle because of its high mortality and morbidity rates but also it contributes for reduced production and productivity. In order to save the environment and free grazing ruminants, an appropriate solid waste disposal system need to implement to reduce the prevalence of rumen impaction in cattle and also to protect the environment. We concluded also that hemato-biochemical parameters should be taken into consideration in the diagnosis of rumen impaction in living cattle.

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