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# Some Serum Biochemical and Carcass Traits of Arsi Bale Rams Reared on Graded Levels of *Millettia ferruginea* Leaf Meal

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**Abstract:** Livestock husbandry plays a pivotal role in the agrarian society of Ethiopia. Small ruminants are mostly reared by landless and small land holders to support their income and as a source of food. However, due to population pressure and increase in crop husbandry the grazing land is shrinking at a fast pace. Seasonal shortage of fodder is a regular occurrence thereby affecting the reproductive and productive performance of the livestock. Hence, use of perennial trees is becoming popular to supplement the meager feed resources available in the area, one such tree which is commonly used by the farmers of Gedeo region of Ethiopia is the Millettia ferruginea, however there was lack of scientific information about the use of this tree as a source of fodder. A study was conducted to assess the effect of feeding graded levels of Millettia ferruginea leaf meal to Arsi Bale rams native to the region, the treatment encompassed four diets T1,T2,T3 and T4 which was contained 0, 1,2 and 3% of the body weight of the rams. The leaf meal was fed for 90 days and body weight of the rams was assessed on a weekly basis, at the end of the experiment blood was taken by veni puncture and serum was obtained after clotting of the whole blood this was carried out to assess some serum biochemical parameters which were important to understand the effect of the leaf meal on some vital organs of the rams. The rams were slaughtered after overnight fasting. The results indicated that average crude protein levels of the leaf meal was 23.58% and the level of condensed tannin (as leucocyanidin equivalent) was 0.413. The results indicated that while there was no significant difference between the slaughter weight of the rams across treatments, there was different ( $P<0.01$) with higher values observed for rams receiving T2 diet, while rib eye area was assessed to be higher for those receiving T3 diet. The study further indicated that there were no significant differences among all the serum biochemical traits studied. Therefore, it can be concluded from the study that Millettia ferruginea leaf meal can be incorporated as an affordable source of fodder for sheep.

**Key words:** Millettia ferruginea leaf meal · Arsi Bale rams · Carcass traits · Serum biochemistry · Ethiopia

## INTRODUCTION

Livestock is an important part of the agrarian society in Ethiopia. This sector has been contributing substantially to the economy of the country. It is understood eminent that livestock products and by-products in the form of meat, milk, eggs, cheese and butter etc. provide the needed animal protein that contributes to the improvement of the nutritional status of the people. Livestock also plays an important role in providing export commodities, such as live animals, hides and skins to earn foreign exchanges to the country.

The contribution of livestock to the national economy is estimated to be 46% of the agricultural GDP [1] This indicates the potential and opportunity of the country for livestock development intervention, though Ethiopia is endowed with huge livestock resources, the return from the sector is not proportional to the number, which is attributed to many factors. These include poor genetic potential of the indigenous animals, inadequate veterinary services, shortage of animal feed as well as the absence of good management. Poor feed supply and feeding system tends to have far reaching consequences implication, in the crop-livestock farming areas,

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permanent pasture provide as much as 85% of the feed resources and in the pastoral areas grazing and browsing provide nearly 100% of feed resources [2]. The natural pasture and crop residues have low protein, digestible energy and minerals, which may result in low performance of the livestock [3, 4] In rural areas of Ethiopia, small ruminants are often not supplemented with concentrate feedstuffs, resulting in slow growth and relatively old age when marketed at market [5]. This causes a significant large proportion of consumed nutrients to be used for maintenance rather than growth, with an associated low efficiency of production [6].

Hence, it becomes important to utilize lesser known sources of feed resources especially from perennial sources like fodder trees to minimize the gap between demand and supply of livestock feed especially in the seasons when the fodder becomes limiting. One such lesser studied and potential sources of fodder can be the leaves obtained from Millettia ferruginea, locally known as "Birbira". Some reports indicate that the leaves of this plant are used by the famers of the Sidama and Gedeo zones of Ethiopia for feeding their ruminants. *Millettia ferruginea* (Hochst.) Baker; Leguminacae) locally known as Birbira is a large shady tree which grows up to 35 meters in height. The tree is endemic to Ethiopia and is widely distributed in many parts of the country. This tree performs well in moist lowland as well as in the dry, moist and wet semi-highland climate of the country up to an elevation of 1000-2500 m above the mean sea level [7].

The timber of this tree is commonly used as firewood, construction purposes, for the manufacture of tool handles and household utensils. The tree also serves as shade tree in coffee growing areas [7, 8, 9]. It is also planted as road side shade tree and also in agro forestry they are also planted improve the fertility of the soil [10]. Furthermore, the seeds are pulverized and are used to poison the fish by the natives [11, 9, 10]. As reported by [7] the different parts of this tree are also used in indigenous medical purpose. [12] indicated that the farmers in the Sidama region cultivate this tree for its timber, leaves for fodder and for allied needs. As observed by [13] the mixture of the powder of the dried fruits of *M. ferruginea* along with butter is are topically applied to treat skin infection, powder of the fruits mixed with honey is taken orally for the treatment of amebiosis, [14] Tilahun and Mirutse, (2007). Extract from its seed have been reported to be effective in controlling storage insect pests such as adzuki bean beetle, (*Callasobruchus chinensis*), maize weevil, (*Sitophilus zeamais* ) and bean bruchid, *Zabrotes subfaciatus*. The aqueous and chloroform extracts of the seed kernels has been found to be promising against some species of aphids.

However, there is lack of scientific studies on the assessment of this tree as a potential source of fodder. Thus, this study is aimed at evaluating the supplementation of *Millettia ferruginea* leaf meal at graded levels with locally available grass hay on carcass and some serum biochemical traits yearling Arsi Bale rams.

## MATERIALS AND METHODS

The study was conducted at Dilla Agricultural technical vocational education and training College (ATVETC) live stock farm. Dilla is the capital town of Gedio Zone, situated in southern part of Ethiopia The area is situated at of 6° 27'N latitude and 38° 30'E longitude with an altitude ranging between 1550 – 1700 m.a.s.l. The temperature in the region varies between 13 – 28.4°C and the relative humidity ranges from 60 – 70%. Agro climatically Gedio Zone is rich in floral composition. Perennial cash crops in the region include enset (*Enset ventricosum*) and coffee (*Coffe arabica*). The dominant pasture grass types consist of *Digitaria nodosa*, *Sporobolus natalensis* and *Eragrostis papposa* [15] (Matiwos, 2007).

The study was initiated using twenty four intact yearling rams. The rams were procured from Wonago market situated in the Gedeo Zone. The age of the animals was assessed using dentition method as suggested by [16] Charray *et al.,* (1992).

The experimental rams were acclimatized for two weeks during this period they were provided with appropriate antihelmentics and sprayed with acaricides to take care of the external parasitic. They were also vaccinated against common infectious disease in the area, viz.ovine pasteurollosis and anthrax. After the end of the adaptation period the rams were weighed in the morning for two consecutive days. The rams were then penned individually at Dilla ATVET College during which time experimental sheep where offered grass hay ad libdium, to adapt them to the treatment feeds prior to the beginning of feed trial that lasts for 90 days. The treatment diets ( as presented in Table 1) consisted of *Millettia ferruginea* leaf meal which was 1,2 and 3% of the total body weight of the rams.

Table 1: Dietary treatment with levels of *Millitia ferruginea* leaf meal

| Treatments | Hay | *Millitia ferruginea* leaf meal (% body weight) |
|---|---|---|
| T1 (control) | Adlibitum | 0 |
| T2 | Ad libitum | 1 |
| T3 | Ad libitum | 2 |
| T4 | Ad libitum | 3 |

Foliage (leaf) which is not over mature nor too young were harvested from different *Millettia ferruginea* trees around Dilla town, the plucked leaves were spread on plastic sheet and air dried under shade for 4-5 days. The dried leaves were ground by hand and stored appropriately for later use. The natural pasture was harvested for the preparation of hay.20 ml of molasses was added individually to all animals across the treatments, molasses acted both as a binder to reduce wastage of feed and also as a source of energy.

The experiment was conducted using a randomized complete block design (RCBD). At the end of acclimatization period, the animals blocked in six blocks with four animals per block. Blocking was done based on their initial body weight of the rams. Later on, animals within a block were distributed randomly between treatments. The amount of feed given was adjusted every 10 days based on the gain or loss of body weight of the animals.

The supplementary feed (*Millettia ferruginea* leaf meal) was offered twice daily at 8:00 hrs and 16:00hrs in two equal portions for all the rams receiving supplementary feed. The feed offered to the experimental animals and corresponding refusals were recorded daily throughout the experimental period to determine daily feed intake. Sample of feed offered per batch and refusal of each animal were collected over the experimental period and stored in plastic bags. Sub-samples of feed offered and refusal were taken after thorough mixing for determination of nutrient composition and some of the samples taken were dried at 60°C for 72 h in forced draft oven for proximate analysis. The dry matter, ash, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF) and acid detergent lignin (ADL) of the feed ingredients, hay and Millettia ferruginea leaf meal were assessed according to the method suggested by AOAC [46]. Animals had adlib access to water and salt blocks. The condensed tannins were assessed as *leucocyanidin* equivalent and as per methods suggested by [17] Makkar (2003).

Initial body weight of the rams was determined as an average of body weight after overnight fasting for two consecutive days, there after the body weight measurements were taken every 10 days after overnight fasting in the morning using a spring balance with an error margin of ±100 grams. Sheep in all groups were gathered in one place at 7.00 am and were given sufficient time to urinate and defecate. Weighing of the rams were then conducted at random. The daily live weight gains was calculated as the difference between the initial live weight and final live weight divided by number of experimental days in between. At the end of the experiment all the rams were slaughtered after overnight fasting. Prior to the slaughter the rams were weighed over the same spring balance used for the growth trail. Individual the rams were slaughtered by severing the carotid artery and jugular vein. The animals were allowed to bleed and then the weight was retaken to identify the loss of blood. After flaying and dressing, the whole gastrointestinal tract with and without its contents were weighed separately. The visceral organs such as heart, kidney, spleen, lung, liver, reproductive organs, head and skin were also weighed on an individual basis using a digital balance having an error margin of ± 0.05 grams. Immediately after dressing and evisceration, carcass weight was recorded to assess dressing percentage on slaughter weight and empty body weight basis. Empty body weight was adjusted by subtracting the contents of the gastrointestinal tract from the body weight at slaughtering. The hot carcass weight was estimated after removing weight of head, thoracic, abdominal and pelvic cavity contents as well as legs below the hock and knee joints. The cross sectional areas of rib eye muscle between $12^{th}$ and $13^{th}$ ribs were traced from each side on transparency paper and the areas were measured by using planimeter (Laso) and the average of the two rib-eye areas were taken for each sample.

Serum was extracted from the clotting of the blood of all the animals just prior to their slaughter. The blood was collected on individual basis in a sterilized test tube; the clotted blood was centrifuged at 5000 rpm for 5 minutes. The clear serum devoid of any blood corpuscles was decanted in a sterile test tube which in turn was immediately transferred in an ice box. The serum was then transferred to the ART laboratory of Referral Hospital of Hawassa University for further investigation.

The analysis was carried out using Humastar 300 serum analyzer. The serum was analyzed for serum total protein (using biuret method), Urea (using the urease method), Creatinine (using kinetic method). Alkaline Phosphates (using Monster phosphohydrolase) method while both Aspartate Aminotransferase, Alanine Aminotransferase (using u/v/ kinetic method ). The data was analyzed statistically using [18] SPSS v.12 (2003) for Windows. The means were compared using Duncan's Multiple Range test and the values were considered significant at $P<0.05$.

## RESULTS AND DISCUSSIONS

The proximate compositions of the treatment feeds are presented in Table 2. The results indicate that the crude CP content of the hay offered to the experimental animals was lower when compared to [19, 15] The CP value of hay as assessed in the present study are however, higher than the values reported by [20]. The average NDF and ADF values of hay as obtained in this study are lower than the values reported by [15] The CP content of hay used in the current study, (which predominantly consisted of mixed sward grass hay), was far below the maintenance requirement of animals, as indicated by [21]. The low CP content could be attributed to the over maturity of the mixed sward grass from which the hay was prepared. According to [22] as the plants mature there is a lowering of CP content and increase in lignifications thereby enhancing the crude fiber (CF) values.

The crude protein (CP) content of the *Millettia ferruginea* (MF) leaves were lower than the results obtained by (19,23). But higher than the values reported by [24] and [25] However the result of current study was comparable to the observations of [26], they reported that the multipurpose trees contain medium to high level of CP ranging Between 6 to 23%. The results pertaining to the condensed tannin (CT) values as obtained in this study was lower than the values reported by [27-29]. However the result of current study was comparable to [26] they observed that the multipurpose trees contain medium to high level of CP that ranges from 6 to 23%. The values pertaining to CP content of the *Millettia ferruginea* leaf meal as obtained in the present study are comparable to the values pertaining to the leaf meal of *S sesban* as reported by [30] Solomon (2004) and also [24] Wondosen (2009), the values pertaining to the DM and OM content as assessed in this study are higher than the values reported by [30] and also [23].

However, the average NDF values as assessed in this study was lower than the values reported by [23] but higher than the values reported by [3] however the reverse was true for the average ADF content.

The results pertaining to CP content as obtained in the study finds similarity with the study of [27] Dicko and Sikena (1992) indicates that the multipurpose trees have higher CP content similarly the high NDF and ADF values of *Millettia ferruginea* leaf meal as assessed in the study finds similarity with the observations of [32] Skerman (1977).

The results of the present study result shows that the CT of *Millettia ferruginea* leaf meal was comparable with those reported by [29, 33] Barry,1989 Waghorn *et al.,* 1990) and [30] Degen *et al.,* (1997), for total CT as leucocyandin equivalent for leaf meal from various multipurpose tree leaf meal The low values of condensed tannins as assessed in this study finds similarity with the observations of [34] Bekele (2007). Studies by [35] and Duncan (1984) indicate that higher CT content depresses body weight. However, the total available condensed tannin as observed in the study indicates that the values are quite low and [33] Barry (1989) indicated that the values as observed in this study are optimum for growth of sheep. However, the values need further assessment from taking leaves at different stages of maturity.

The results pertaining to carcass traits of rams receiving different graded levels of *Millettia ferruginea* leaf meal is presented in Table 3. The slaughter weight after overnight fasting indicate that the values were higher for the rams raised in T4, followed by those from T2, T3 and T1 diets. While the results pertaining to the empty body weight indicated that the values for empty body weight too was not significantly different among from the different treatments. The results from the skin weight indicated significant differences between the treatments with rams from T3 having higher values for the trait. The results pertaining to the weight of empty gastrointestinal tract indicated that there was non significant difference between the treatments but the value in rams raised on T3 was numerically higher. The weight of the kidneys and liver too was ($P<0.01$) higher in the supplemented groups when compared to those in T1 the results find consonance with the observations of [34, 35]. The average dressing percentage too varied across treatments the average dressing percentage as observed in the study is lower than the values reported by [36] in rams raised on *Lucaena leucocephala* hay, the results as obtained in this study are however comparable with the results obtained by [37]. However the values reported by [38] Eckerman *et al.,* (2011) are similar only for the rams raised on T1 treatment. The results as reported by [39] indicate that the dressing percentage as obtained in T2 is similar to that of Dorper and Suffolk rams while those from T1, T3 and T4 are comparable to those of Katahdin rams. The dressing percentage as obtained for T2 and T4 are comparable with the results obtained by [40] for Washera rams. The rib eye area as assessed in this study indicate that the value was

Table 2: Proximate composition of hay and *Millitia ferruginea* leaf meal used in the experiment

| Treatment Feeds | DM | Ash | OM | CP | NDF | ADF | ADL | C.T* |
|---|---|---|---|---|---|---|---|---|
| Hay | 98.60 | 9.70 | 88.82 | 5.98 | 70.44 | 35.04 | 2.69 | |
| *Milletia ferruginia* | 98.48 | 7.42 | 91.06 | 23.58 | 43.07 | 24.32 | 7.30 | .413 |

DM=dry matter; OM=organic matter; CP=crude protein; NDF=neutral detergent fiber, ADF=acid detergent fiber;, ADL=acid detergent NDF=neutral detergent NDF=neutral detergent fiber fiber lignin. CT.= condensed tannins as leucocyanidin equivalent

Table 3: Edible and non-edible Carcass characteristics of Arsi Bale rams fed hay and supplemented with *Millitia ferruginea* leaf meal

| Sno | Traits | Treatment-1 Mean±sd | Treatment-2 Mean±sd | Treatment-3 Mean±sd | Treatment-4 Mean±sd |
|---|---|---|---|---|---|
| 1 | Slaughter weight (Kg) | 12.2±1.6 (12.0-12.4) | 14.1±1.4 (12.9-16.0) | 13.4±1.8 (10.4-15.0) | 14.4±2.2 (11.7-18.0) |
| 2 | Empty slaughter weight (Kg) | 9.1±1.5 (8.2-11.4) | 9.5±1.3 (8.2-10.6) | 8.9±1.3 (7.4-10.7) | 9.6±1.9 (7.0-12.7) |
| 3 | Blood (% Empty weight) | 6.8±2.9 (4.5-10.9) | 6.4±1.8 (4.7-9.0) | 8.6±2.7 (6.6-13.6) | 8.9±2.2 (5.6-12.5) |
| 4 | Head(% Empty weight) | 10.4±1.7 (7.9-11.9) | 10.5±0.5 (10.0-11.2) | 10.9±0.9 (9.7-12.1) | 10.6±0.9 (8.7-11.6) |
| 5 | Skin(% Empty weight) | 13.7±2.0$^{b}$ (10.6-15.1) | 15.7±2.1$^{ab}$ (12.6-17.2) | 18.3±4.1$^{a}$ (13.6-24.5) | 15.4±1.5$^{ab}$ (13.3-17.3) |
| 6 | Empty Gastrointestinal tract (% Empty weight) | 8.9±1.8 (7-10.9) | 9.3±2.2 (7.8-12.6) | 11.1±2.1 (8.5-14.0) | 9.1±2.4 (5.0-11.5) |
| 7 | Heart(% Empty weight) | 0.7±0.3 (0.4-1.1) | 0.7±0.1 (0.6-0.9) | 0.7±0.1 (0.6-1.0) | 0.7±0.1 (0.6-0.9) |
| 8 | Kidney(% Empty weight) | 0.5±0.03$^{b}$ (0.46-0.54) | 0.6±0.07$^{a}$ (0.5-0.7) | 0.6±0.05$^{a}$ (0.5-0.7) | 0.6±0.07$^{a}$ (0.5-0.7) |
| 9 | Spleen (% Empty weight) | 0.24±0.13 (0.14-0.44) | 0.25±0.06 (0.2-0.3) | 0.23±0.04 (.16-.28) | 0.21±0.04 (0.16-0.26) |
| 10 | Lung(% Empty weight) | 1.7±0.6 (1.3-2.7) | 1.8±0.4 (1.3-2.4) | 2.4±0.5 (1.7-3.2) | 2.3±0.5 (1.9-3.0) |
| 11 | Liver(% Empty weight) | 2.0±0.3$^{b}$ (1.6-2.4) | 2.6±0.2$^{a}$ (2.3-2.7) | 2.7±0.3$^{a}$ (2.2-3.0) | 2.4±0.3$^{a}$ (2.1-3.0) |
| 12 | Reproductive organs(% Empty weight) | 1.4±0.8 (0.5-2.3) | 1.4±0.7 (0.7-2.3) | 1.6±0.6 (0.4-2.1) | 1.5±0.7 (0.5-2.2) |
| 13 | Dressing % | 43.7±7.4$^{b}$ (32.8-49.3) | 51.5±6.2$^{a}$ (46.0-55.0) | 45.5±3.3$^{ab}$ (39-48) | 49.1±3.6$^{ab}$ (45.5-54.0) |
| 14 | Rib eye | 5.19±0.2$^{d}$ (5.0-5.4) | 6.04±0.43$^{c}$ (5.4-6.5) | 8.1±0.24$^{a}$ (7.6-8.3) | 6.5±0.3$^{b}$ (6.1-7.1) |

$^{a, b,c, d}$ Means with different superscripts are significantly different, P<0.01

Table 4: Serum biochemical parameters of rams reared on different treatments with *Millitia ferruginea* leaf meal

| Sno | Traits | Treatment-1 Mean±sd | Treatment-2 Mean±sd | Treatment-3 Mean±sd | Treatment-4 Mean±sd | SL |
|---|---|---|---|---|---|---|
| 1 | Alkaline Phosphatase (iu/l) | 146.8±32.4 (97.0-176.0) | 122.5±47.2 (76.0-183.0) | 145.2±30.3 (89.0-189.0) | 158.8±74.1 (49.0-281.0) | ns |
| 2 | SGOT/AST (iu/l) | 118.6±58.7 (51.0-182.0) | 99.7±54.8 (36.0-186.0) | 110.5±56.0 (34.0-219.0) | 132.4±74.2 (56.0-331.0) | ns |
| 3 | SGPT/ALT (iu/l) | 68.7±13.5 (50.0-87.0) | 51.1±22.8 (22.0-89.0) | 47.4±16.7 (23.0-87.0) | 61.0±43.6 (9.6-183.0) | ns |
| 4 | Createnine (mg/dl) | 1.56±0.6 (0.9-2.6) | 1.6±0.6 (0.7-2.5) | 1.25±0.5 (0.5-2.0) | 1.26±0.5 (0.3-1.9) | ns |
| 5 | Urea (mg/dl) | 53.2±10.8 (35.0-65.0) | 56.3±8.5 (46.0-71.0) | 46.7±23.7 (17.0-97.0) | 46.0±9.8 (27.0-61.0) | ns |
| 6 | Protein(gm/dl) | 6.7±0.7 (5.9-7.8) | 7.2±1.2 (5.3-8.9) | 7.04±0.9 (5.4-8.7) | 7.25±0.7 (5.9-8.6) | ns |

highest for rams raised on T3, T4, T2 and T1 diets was comparable with the observations of [41] for Washera sheep, but lower than those reported by [42] for Horro lambs raised on Sesbania and concentrate mix and also of [40] Abebe *et al.,* (2011) for Washera rams reared on concentrate ration. The results pertaining to serum biochemical traits for the rams raised on graded levels of *Millettia ferruginea* leaf meal is presented in Table 4, the results indicate that there are no significant differences for all the traits studied and across the treatments. The results indicate that the values of serum alkaline phosphatase as obtained in the study are within the normal range of values as reported by [43, 44] for sheep, however the values further indicate that the levels are lower in rams raised on T2 when compared to other treatments including that of the control population. Such values of serum alkaline phosphatases as obtained in this study can be linked with normal functioning of the hepatic system of the rams across treatments, however the trend as observed in rams of T4 treatment has to be closely monitored for long term effects of the leaf meal. The results of serum glutamate oxaloactate tranaminase (GOT/AST) and pyruvate transaminase (GPT/ALT) too fall within the range of values as assessed by [43, 44] with non significant differences between the treatment groups, the GOT values being numerically lower amongst the rams of T2 treatment when compared to those of the other treatment groups. The serum creatinine and urea levels too are within the normal range as assessed by [43, 44] with no significant differences observed between treatments however the rams raised on T2 had values which was in the higher values for the trait, the results for serum urea as assessed in the study indicated that the values as obtained in this study had values higher than those reported by [43] while the values are well within the range reported by [44] indicating that a close monitoring for this trait becomes necessary for long term experiments of *Millettia ferruginea*. The level of blood

urea is a realistic predictor of both nitrogen utilization) and nitrogen intake in sheep, [45] Torell *et al.,* (1974). The higher values (though not statistically significant) indicates better protein utilization in sheep raised on T2 diet in comparison to those of other diets Which is again reflected by higher dressing percentage (Table 3). The levels of serum protein as assessed in this study indicates that the values are again not significantly different between the treatments with higher levels being exhibited by the rams raised on T4 diet, the values as assessed in this study are comparable to those reported by [46, 43, 44] However, to come to a definite conclusion regarding the effect of *Millettia ferruginea* leaf meal on serum biochemical traits it is necessary to conduct further studies on a large population size and feeding on leaves of different maturity levels.

## CONCLUSION

The results also indicated that the while there was no difference in slaughter weight of the rams between the treatments while there was difference in dressing percentage and rib eye area, the rams receiving treatment 2 had the highest dressing percentage followed by those reared on treatment 4, while the rib eye area was highest for the rams reared on treatment 3. The results pertaining to the serum biochemical traits indicate non significant differences between the treatments. Hence, it can be concluded from the present study that *Millettia ferruginea* leaf meal can be incorporated in the diets of sheep even till 3% of the body weight of rams without any adverse effect on the vital organs.

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