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Non-Toxic goiter in adult goats: diagnosis and treatment (Short communication)

Fatgzim Latifi[1], Kastriot Belegu[2] and Arben Sinani[1*]

[1] *University of Prishtina, Faculty of Agriculture and Veterinary, Department of Veterinary, 10000, Prishtina, Kosova*
[2] *Agricultural University of Tirana, Faculty of Veterinary Medicine, Department of Morphofunctional Modules, 1025, Tirana, Albania*
[*] *Corresponding author:* arben.sinani@uni-pr.edu

Abstract

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Non-toxic goiter is a simple goiter is an enlargement of thyroid gland, which developed without causing hypothyroidism or hyperthyroidism. Little is known about this type of goiter in ruminants, particularly in alpine goats. The aim of this study was to report some interesting cases of non-toxic goiter in adult goats, as well as the diagnosis and treatment. Three adult (18- 36 months: age), female goats, with goiter, were investigated. For diagnosis, the case history and clinical signs were considered, and the goiter grade was determined. Chemical analysis of thyroid hormones of blood samples was estimated. All cases had a history of failed and dead births, with ratio 2:1 per birth, and births living and dead were born with a large sized goiter. The goiter in adult goats was ranged between grade I to II, which was simple, slightly visible and requires palpation. The thyroid hormones including, triiodothyronine (T3); Tetraiodothyronine (T4), and Thyroid stimulating hormone (TSH) were of normal level in the blood of these cases. The treatment used in this study, including iodine supplement, selenium, and vitamin B12 was beneficial and the animal health was improved, especially with conserving supplement of iodine as food additive.

Keywords: Hypothyroidism; non-toxic goiter; thyroid hormone; thyroid gland

Introduction

Goiter is the enlargement of the thyroid gland, which appears as a swelling at the throat region in the neck (Hughes & Eastman, 2012). Although it is typically not visible, the thyroid gland is placed superficially and is easily palpable. The size, shape, and consistency of the gland should be carefully examined throughout the inspection (Smith, 1990). Five different grades of goiter can be inspected according to the World Health Organization Division (WHO/UNICEF/ICCIDD, 2014). This grades evaluation includes, Grade 0: No goitre, or a goitre that is hardly palpable and barely visible. Grade IA: Clearly felt but not discernible with extended neck. Grade IB: Clearly visible and palpable with fully extended neck. Grade II: When the head is in its natural position, it is quite obvious, and the palpation is not required for diagnosis. Grade III: the thyroid enlargement is visible from a distance, and diagnosis not reliant on palpation.

In human, the main causes of goiter are iodine deficiency (Zimmermann & Boelaert, 2015), autoimmune diseases, and neoplasms (Hughes & Eastman, 2012). Similarly, in animals, the iodine deficiencies come in the first place as the common cause of goiter (Gaitan et al., 1991), then the autoimmune diseases such as autoimmune thyroiditis (Perillo et al., 2005; Pyzik et al., 2015). Theses causes, either autoimmune, or iodine deficiency or tumors, they usually lead to destruction of thyroid follicles, which are the functional unit of thyroid gland. Consequently, the destruction of thyroid follicles, impair functions and affects the production of thyroid hormones. This is usually associated with clinical or subclinical

forms of hypothyroidism (Chaker et al., 2022).

The thyroid hormones production is a closely controlled process by the tripartite axis formed of hypothalamus, pituitary, which has given rise to the term "hypothalamus-pituitary-thyroid axis" (Gauthier et al., 2020). The hypothalamus is where thyrotropin-releasing hormone (TRH) is made. Thyroid-stimulating hormone (TSH), also known as thyrotropin, is produced and secreted when TRH, once it has been released, binds to the TRH receptor in the pituitary gland (Liu et al., 2019). TSH binds to the TSH receptor (TSHR) in the thyroid and triggers the production of thyroid hormone. Triiodothyronine (T3) and tetraiodothyronine (T4), also referred to as thyroxine, are thyroid hormones that are released into the bloodstream when necessary. The nuclear TH receptor (THR) in the hypothalamus and pituitary allows THs to block TRH and TSH secretion, completing a negative feedback loop that keeps TRH, TSH, and THs at physiological levels (Gauthier et al., 2020).

For testing thyroid functions, the analysis of serum normal levels of thyroid hormones including T3, T4, and TSH is a must step. The low levels of T3 and T4 with normal or high values of TSH is indicated a mild hypothyroidism. On the other hand, the low levels of throxin with subnormal values of TSH are indicator of clinical hypothyroidism (Koulouri & Gurnell, 2013). These cases, in which disturbance in thyroid functions occur are termed toxic goiter, where iodine deficiency or other etiological factors affect thyroid functions, causing either hypothyroidism or hyperthyroidism. However, in some cases, usually in adults, where goiter occur but without any toxicity in thyroid functions, i.e. without causing hypo or hyperthyroidism and the thyroid functions are within normal values (Unlu et al., 2022).

Non-toxic goiter usually occurs in endemic areas, such as Albanian territory. The main cause usually, mild iodine deficiency, which appears only when animals become under physiological stress such as pregnancy and/or lactation, and expressed as an enlargement of thyroid gland without any toxicity for thyroid functions.

Toxic forms of goiter in animals are well studied, however little is known about the non–toxic goiter, especially the alpine goats. The aim of this study was to describe this type of goiter in adult alpine goats. This would be additive to the field of clinical endocrinology, and veterinary medicine, especially in this species.

Material and Methods

This study was performed in accordance with the ethical guidelines approved by the Institutional Animal Care and Use Committee of the Faculty of Veterinary Medicine, Agricultural University of Tirana, Albania. Three adult goats were used in this study, all from Elbasan, Albania. The case 1 was an adult goat aged 18 months, from Karakullak village, Elbasan, it was of a breed termed Alpine F3, crossed with Maltese. The case 2 and case 3 were adult alpine goats of age 1, and 3 years, respectively.

Nutrition: the cases were feed on alfalfa obtained from fields, where a nearby metallurgical combine was located. In addition to the alfalfa, also wheat, and free pasture (case 1); beets and breadcrumbs that are moistened with water (Case 2); corn flour, wheat bran (case 3) was included.

Diagnosis: the case history and clinical signs were considered, and the goiter grade was determined. Chemical analysis of thyroid hormones of blood samples was estimated. Blood samples: the blood samples were taken from jugular vein (*v. jugularis*), early in the morning and after feeding using evacuated tubs containing the anticoagulant K_3EDTA and tubes with gel separator and clot activator for blood serum harvesting. The harvested blood samples were left at room temperature for four hours to clot and then underwent centrifugation at 3000 rpm for 10 min.

Blood analysis for thyroid hormone was including, triiodothyronine (T3) (MAGLIUMI T3 (CLIA), cat. No.:130203003M; Omnia Health, China), Tetraiodothyronine (T4) (MAGLIUMI T4 (CLIA), cat. No.:130203002M; Omnia Health, China), and Thyroid stimulating hormone (TSH) (Elecsys TSH,cat. No.:08429324 190; Roche, Switzerland). The reference values for normal hormonal levels in adult goat were evaluated according to Davoodi et al. (2021), Paulikova et al. (2011).

Treatment: the proposed treatment was to provide an iodine supplement via oral route and/or as an iodide salt according to the grade of the goiter. In addition, a mineral supplement for selenium and calcium. A vit B12 via 'SC' injections were also proposed for these cases.

Statistical analysis

Data were evaluated for normality using the Shapiro-Wilk test, and the data were determined to be normally distributed and are presented as average ± standard deviation.

Ethical approval

The procedures were in accordance with the Ethics Committee of the Agricultural University of Tirana, Albania (Nº 1836-2023).

Results

Clinical signs and case history: the case n.1 had a goiter of grade II, which is quite visible when the head is in its natu-

ral position and the palpation is not required for diagnosis (Figure 1). While, the goiter of case 2 was of grade IB, which is visible and palpable with fully extended neck (Figure 2). The goiter in case 3 was of grade IA, which is clearly felt but not discernible with the extended neck (Figure 3). No obvious clinical signs and all goats were apparently healthy with normal hair coat and mucous membrane, except in case 3, in which the mucous membrane were pale. All cases had a history of failed and dead births, with ratio 2:1 per birth, and births living and dead born with large sized goiter. In case 1, besides the goiter, the living kid has a sparse hair of coat, particularly in the area extended from the throat to the lower part of the breast. In the case 1 and 2 there was no dystocia, but case 2 had a retained placenta, which was removed manually by the clinician. However, in case 3, during the birth, there was dystocia, which required a caesarean section.

The level of thyroid hormones was within normal levels as follows, the level of T3 and T4 was 208.47±14.84 ng.dl, 4.69±1.106µg.dl, in the three cases, respectively. Whereas, the level of TSH was 0.0053±0.0004µIU/ml in the three cases, respectively.

For treatment, case 1 and case 2 were administered vit. E and selenium 5 cc, via 'SC', once a week for three consecutive weeks; dexamethasone 5cc/day, 'IM', for three days; iodine solution(betadine) via oral route for 30 days 10 ml/10% solution; Ferrum B12 once three weeks 'SC', and calcium-10cc, 'IV' for 10 days. A conservative treatment formed of premixes, mineral stones; iodized salt in food for 3 months was also obtained. For case 3, the oral administration of iodine was not given, and only the conservative treatment for iodine supplement was considered. The goiter was decreased with treatment after 30 days, and after the three months of conservative treatment, the goats underwent breeding successfully.

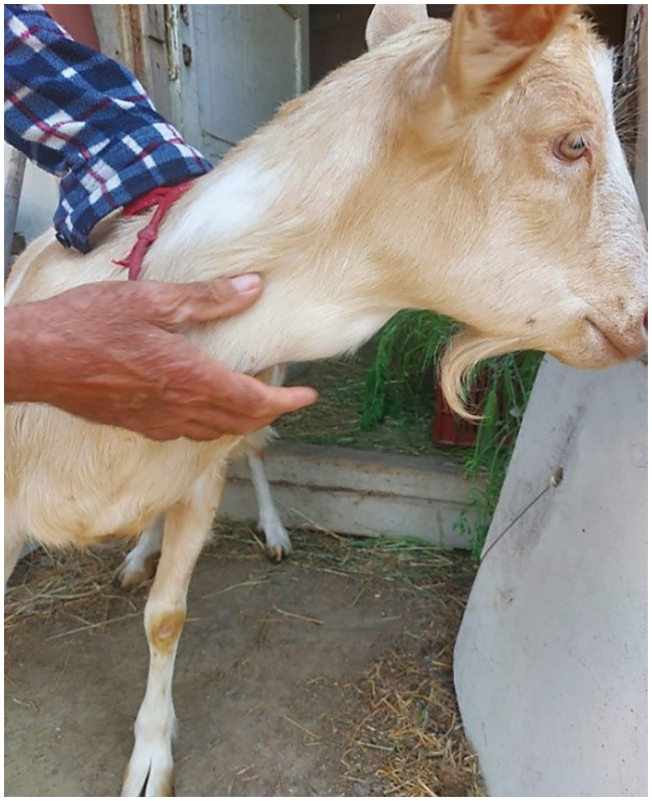

Fig. 1. An Apine goat – case 1, with goiter of grade II, which is quite visible when the head is in its natural position(black arrowhead) and the palpation is not required for diagnosis

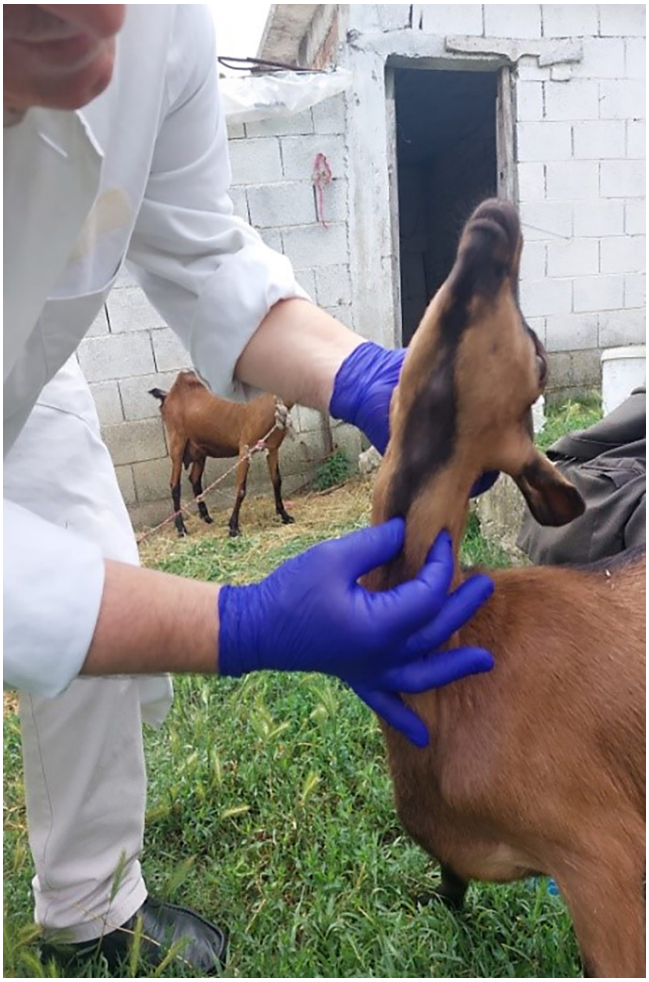

Fig. 2. An Alpine goat – case 2, with a goiter of grade IB, which is visible and palpable with fully extended neck

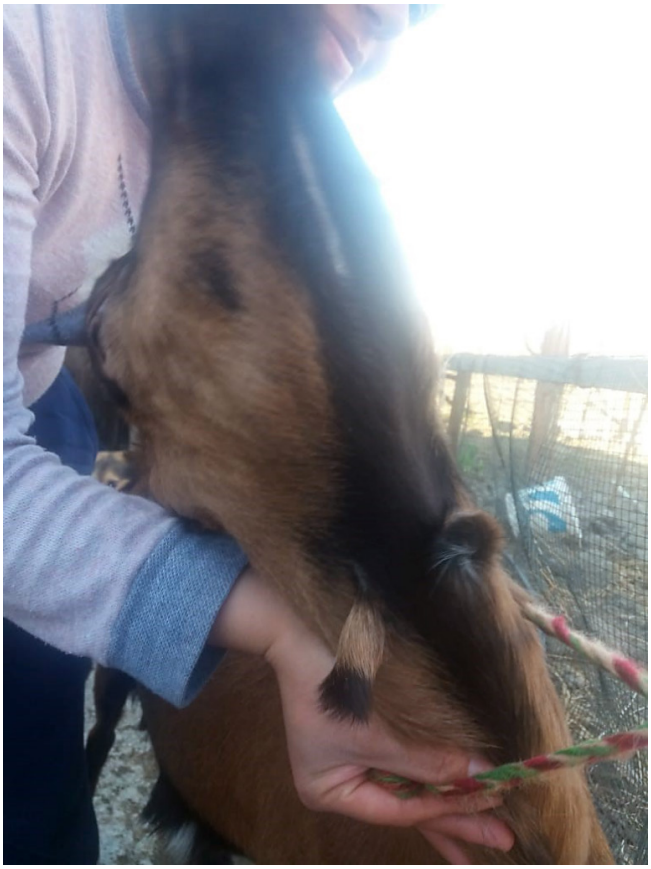

Fig. 3. An Alpine goat – case 3, with a goiter of grade IA, which is clearly felt but not discernible with extended neck

Discussion

This study reported some interesting cases of non-toxic goiter in adult Alpine goats. These cases have a slight enlargement of thyroid glands, with normal levels of thyroid hormones (Davoodi et al., 2022; Paulikova et al., 2011), which is typical to the simple non-toxic goiter disorder (Unlu et al., 2022). In contrast to the toxic forms of goiter, these animals do not exhibits changes in coat, skin and mucous membrane healthy appearance, and also no signs of compression and difficulty in breathing were observed. However, the kids, particularly males were born dead, with notable goiter. This together may be attributed to mineral deficiencies, in the soil or food, which is mild and tolerated by the animals, until they are involved in a physiological stress such as pregnancy.

The diagnosis of such simple goiter can be achieved by chemical tests, measuring functions of thyroid gland, clinical signs, particularly grade of goiter, and the environmental factors such as iodine and mineral deficiencies (Unlu et al., 2022). The grade of goiter enlargement described in this study was ranged between grades I, and grade II, which was mild enlargement, notable when neck extended and by palpation (WHO/UNICEF/ICCIDD, 2014).

To plan for a treatment for such simple goiter, which does not result from either an excessive or insufficient production of the thyroid hormones, the clinicians should refer to a number of acquired and environmental factors, particularly mild iodine deficiency in food and/or soil (Unlu et al., 2022). Several minerals, including iodine and selenium, should be considered for normal thyroid functions (Benites-Zapata et al., 2023). The thyroid gland has the highest concentration of selenium per gramme of tissue in an adult, which is essential to maintain the thyroid normal physiological functions (Gorini et al., 2021). While selenium is a cofactor of thyroid enzymes, iodine is an important vitamin needed for the generation of thyroid hormone (Triggiani et al., 2009). The amount of selenium in the body is influenced by the nutrition, environment, geographic location, and soil composition. Selenium is necessary for thyroid hormone metabolism and antioxidant defense mechanisms (Ventura et al., 2017). Numerous studies, notably those focusing on vitamin B12, have linked vitamin deficiencies to thyroid diseases (Benites-Zapata et al., 2023). Accordingly, the treatment used in this study, including iodine supplement, selenium, and vitamin B12 was beneficial and the animal health was improved, especially with conserving supplement of iodine as food additive.

Regarding the optimal method of treating non-toxic goiter, there is no general agreement. Non-toxic goiter progression is unpredictable and individualized (Knobel, 2016; Medeiros-Neto et al., 2012). Nevertheless, further studies are still required to investigate the etiological factors of such simple type of goiter in Albanian species, including the goats. Individuality and the grade of goiter were considered in the treatment of the studied cases, and because the goiter grade of case 3 was very mild, the oral iodine was not administered, and the iodine salt was curative and conservative.

To sum up, the simple non-toxic goiter in alpine goats was of clinical importance, regarding the animal breeding ability, and the survival of embryo. Both individual and conservative treatment should be considered in these cases. Further investigations focusing in this type of simple goiter in ruminants were recommended.

Conclusion

The simple non-toxic goiter in alpine goat has no obvious clinical signs, except the goiter, which is usually of mild

grade. However, it seriously affects the animal breeding and the survival of embryo. Treatment considered the mineral supplements including selenium, calcium, and iodine was successful. Conservative treatment was important to improve animal health and successful breeding.

References

Benites-Zapata, V. A., Ignacio-Cconchoy, F. L., Ulloque-Badaracco, J. R., Hernandez-Bustamante, E. A., Alarcón-Braga, E. A., Al-Kassab-Córdova, A. & Herrera-Añazco, P. (2023). Vitamin B12 levels in thyroid disorders: A systematic review and meta-analysis. *Front. Endocrinol*., *14*, 1070592. doi: 10.3389/fendo.2023.1070592. PMID: 36909313; PMCID: PMC9994182.

Chaker, L., Razvi, S., Bensenor, I. M., Azizi, F., Pearce, E. N. & Peeters, R. P. (2022). Hypothyroidism. *Nat. Rev. Dis. Primers, 8*(1), 30. https://doi.org/10.1038/s41572-022-00357-7

Davoodi, F., Zakian, A., Rocky, A. & Raisi, A. (2022). Incidence of iodine deficiency and congenital goiter in goats and kids of Darreh Garm region, Khorramabad, Iran. *Vet. Med. Sci.*, *8*(1), 336-342. doi: 10.1002/vms3.661. Epub 2021 Nov 4. PMID: 34735042; PMCID: PMC8788884.

Gaitan, E., Nelson, N. C. & Poole, G. V. (1991). Endemic goiter and endemic thyroid disorders. *World. J. Surg., 15*(2), 205-215. doi: 10.1007/BF01659054. PMID: 2031356.

Gauthier, B. R., Sola-García, A., Cáliz-Molina, M. Á., Lorenzo, P. **I., Cobbo-Vuilleumier, N., Capilla, V. & Martin-Montalvo, A.** (2020). Thyroid hormones in diabetes, cancer, and aging. *Aging Cell, 19*(11), e13260. https://doi.org/10.1111/acel. 13260.Epub 2020 Oct 13. PMID: 33048427; PMCID: PMC7681062.

Gorini, F., Sabatino, L., Pingitore, A. & Vassalle, C. (2021). Selenium: an element of life essential for thyroid function. *Molecules*, *26*(23), 7084. doi: 10.3390/molecules26237084. PMID: 34885664; PMCID: PMC8658851.

Hughes, K. & Eastman, C. (2012). Goiter - causes, investigation and management. *Aust. Fam. Physician, 41*(8), 572-576. PMID: 23145396.

Knobel, M. (2016). Etiopathology, clinical features, and treatment of diffuse and multinodular nontoxic goiters. *J. Endocrinol. Invest., 39*(4), 357–373.

Koulouri, O. & Gurnell, M. (2013). How to interpret thyroid function tests. *Clin. Med., 13*(3), 282-286. doi: 10.7861/clinmedicine.13-3-282. PMID: 23760704; PMCID: PMC5922674.

Liu, Y. C., Yeh, C. T. & Lin, K. H. (2019). Molecular functions of thyroid hormone signaling in regulation of cancer progression and anti-apoptosis. *Int. J. Mol. Sci., 20*(20), 4986. PMID: 31600974; PMCID: PMC6834155. https://doi.org/10.3390/ijms20204986.

Medeiros-Neto, G., Camargo, R. Y. & Tomimori, E. K. (2012). Approach to and treatment of goiters. *Med. Clin., 96*(2), 351–368.

Paulíková, I., Seidel, H., Nagy, O., Tóthová, C. & Kováč, G. (2011). Concentrations of thyroid hormones in various age categories of ruminants and swine. *J. Acta Veterinaria, 61*(5-6), 489-503.

Perillo, A., Passantino, G., Passantino, L., Cianciotta, A., Mastrosimini, A. M., Iacovazzi, P., Venezia, P., Jirillo, E. & Troncone, A. (2005). First observation of a Hashimoto thyroiditis-like disease in horses from Eastern Europe: Histopathological and immunological findings. *Immunopharmacology and Immunotoxicology, 27*(2), 241-253.

Pyzik, A., Grywalska, E., Matyjaszek-Matuszek, B. & Rolinsk, J. (2015). Immune disorders in Hashimoto's thyroiditis: What do we know so far? *Journal of Immunology Research*, (1), Article ID 979167. http://dx.doi.org/10.1155/2015/979167.

Smith, T. J. (1990). Neck and thyroid examination. In: Walker, H.K., Hall, W.D., Hurst, J.W., editors. *Clinical Methods: The History, Physical, and Laboratory Examinations.* 3rd edition. Boston: Butterworths; Chapter 138. Available from: https://www.ncbi.nlm.nih.gov/books/NBK244/.

Triggiani, V., Tafaro, E., Giagulli, V. A., Sabba, C., Resta, F., Licchelli, B. & Guastamacchia, E. (2009). Role of iodine, selenium and other micronutrients in thyroid function and disorders. *EndocrMetab. Immune Disord. Drug Targets, (Formerly Current Drug Targets-Immune, Endocrine & Metabolic Disorders)*, *9*(3), 277–294. doi: 10.2174/187153009789044392.

Unlu, M. T., Kostek, M., Aygun, N., Isgor, A. & Uludag, M. (2022). Non-toxic multinodular goiter: From etiopathogenesis to treatment. *The Medical Bulletin of Sisli Etfal Hospital, 56*(1), 21-40. doi: 10.14744/SEMB.2022.56514. PMID: 35515961; PMCID: PMC9040296.

Ventura, M., Melo, M. & Carrilho, F. (2017). Selenium and thyroid disease: From pathophysiology to treatment. *Int. J. Endocrinol.,* (1), 1297658. doi: 10.1155/2017/1297658. Epub 2017 Jan 31. PMID: 28255299; PMCID: PMC5307254.

World Health Organization (1994). WHO/NUT/94.6; http://whqlibdoc.who.int/hq/1994/WHO_NUT_94.6.pdf, accessed 5 June 2014).

WHO/UNICEF/ICCIDD (2014). Indicators for assessing iodine deficiency disorders and their control through salt iodization. Geneva: World.

Zimmermann, M. B. & Boelaert, K. (2015). Iodine deficiency and thyroid disorders. *Lancet Diabetes Endocrinol., 3*(4), 286-295. doi: 10.1016/S2213-8587(14)70225-6. Epub Jan 13. PMID: 25591468.

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