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Original Article

Goiter in Cross Breed Goat Kids at Basrah Province, Iraq

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Abstract

Cases of Goiter related to iodine deficiency in cross-breed goat kids in Basrah, Iraq are very scarce, and little information has been provided; therefore, the present study highlighted a clinical case of goat kids suffering from Goiter due to iodine deficiency with hematological and biochemical evaluation. The study examined 44 cross-breed goat kids, 1-3 months old (males and females), who showed painless palpable enlargement on one side of the cranio-ventral neck region or near the throat rejoin with weakness and alopecia. Ten clinically healthy kids of the same age were considered a control group. This study's diseased and control group was subjected to complete clinical examinations. Diseased animals show painless palpable and visible enlarged thyroid glands with or without enlargement of the neck, sparse hair coats with little alopecia, slow growth rate, irregular appetite or unwillingness to suck, weakness, and emaciation. Furthermore, the presence of thyroid thrill during palpation of jugular furrow was also detected. Moreover, diseased goat kids show no significant difference in body temperature; however, a significant increase was encountered in respiratory rate with a significant decrease in heart rate. On the other hand, no significant changes have been detected in the hematological analysis between diseased goat kids and the control group concerning the chemical analysis between the diseased cross-breed goat kids and the control group; the results of the present study indicated a significant increase in TSH, whereas, T3, T4, FT4, glucose level, Vit. E (α-tocopherol) and serum glutathione peroxides were lowered in diseased cross-breed goat kids compared with the control group. In contrast, a significant hyper- cholesterolemia was indicated in diseased animals than in the control group. It was concluded that Goiter in kids could reflect harm effects terminated mostly with death. Therefore, improving the maternal diet is an important reason to reduce the development of the disease.

Keywords: Cross-breed goat kids, Goiter, Iraq

1. Introduction

Goiter is an Iodine deficiency disorder and a common disease in newborns and younger animals characterized by non-inflammatory and non-neoplastic enlargement of the thyroid gland (1). Low iodine intake and/or the failure to get dietary iodine could be the leading causes of Goiter in kids. In addition, it also occurs when pregnant dams have a low iodine intake or ingest goitrogens (2). Moreover, several causes also interfere with the predisposition to cause iodine deficiency in animals, such as idiopathic, hereditary familial Goiter, congenital hypothyroidism, and dysmaturity syndrome in some animals (3).

The hyperplasia of the thyroid gland results from the deficiency of iodine was prevalent in different iodine deficient areas over the world before the animal's diet was supplemented with the iodized salt; for now, outbreaks of Goiter could be more sporadic; however, fewer animals are affected (2).

It is still documented that the non-neoplastic goiters indicated in all adult animals are caused by Iodine deficiency, which is a definitive cause. However, many

goiters could occur for non-obvious reasons (idiopathic) (4).

It has been documented that, Goiter is the main feature of iodine deficiency with a characteristic enlargement of the thyroid gland in all domestic mammals, birds, and even reptiles. Nevertheless, this deficiency, when it occurs during the pregnancy period, could be the exact cause, and the newborns who survive after birth will develop Goiter in later stages of their life (2, 5). On the other hand, Goiter in utero mostly occurs either as a primary or may be due to a secondary iodine deficiency (1). Moreover, feeding pregnant animals with a deficient iodine ration or goitrogenic compounds food which interfere with thyroxinogenesis plays a significant role in increasing the prevalence of Goiter in kids (5). Further, Iodine deficiency could always be excepted when a diet rich in calcium is fed to domestic animals, reducing the intestinal absorption of iodine (6).

It was shown that Iodine deficiency occurs due to a decreased production of thyroxin (T4), as well as the stimulation of secretion of thyrotrophic hormone (T3) secreted by the pituitary gland with apparent hyperplasia of the thyroid gland (5).

The most important clinical manifestations of kids with Goiter are the thyroid lobes of the young animal, usually at least double the size, soft to touch, and dark red color. However, in more severe cases, signs of hypotrichosis or alopecia could be seen, and enlargement of the neck with a thickness of the skin becomes flaccid and edematous (2). Moreover, in light clinical cases, diseased animals show an excellent response to iodized salt treatment. At the same time, some diseased animals might die as soon as possible after birth (7).

Cases of Goiter related to iodine deficiency in cross-breed goat kids in Basrah, Iraq, are very scarce, and little information has been provided. Therefore, the present study highlighted a clinical case of goat kids suffering from Goiter due to iodine deficiency with hematological and biochemical evaluation.

2. Materials and Methods

The study examined 44 cross-breed goat kids, 1-3 months old (males and females), who showed painless palpable enlargement on one side of the cranio-ventral neck region or near the throat rejoin with weakness and alopecia. Ten clinically healthy kids of the same age were considered a control group. This study's diseased and control group was subjected to complete clinical examinations.

2.1. Collection of Samples

Ten (10) milliliters of blood were drained from each animal via a jugular vein. Three (3) milliliters of blood were mixed with EDTA used for a complete blood picture, including the estimation of RBC, Hb, PCV, and TLC, using the HEMOCALCOLATER AND ANALYZER FROM GENEX, USA. Moreover, according to Harvey (8), differential leukocyte count was calculatedHarvey, Stevens (8) using Giemsa stain blood smears.

Serum was extracted and used for estimation of Thyroid function tests (TFTs) which include estimation of Thyroid stimulating hormone (TSH), Triiodothyronine (T3), Thyroxin (T4), Free Triiodothyronine (FT3), and free thyroxin (FT4) using Fluorescent immunoassay method (Finecare™ FIA Meter) according. to manufacturer instructions from GUANGZHOU WONDFO BIOTECH CO., LTD/ BELGIUM. Moreover. Glucose was estimated by the Enzymatic colorimetric method / LINEAR CHEMICALS S.L. SPAIN. In addition, The total cholesterol was determined via spectrophotometric methods (Colorimetric Assay Kit) using commercial kids from ELABSCIENCE / USA.

2.2. Evaluation of Vit. E and Selenium

The spectrophotometer method estimated the α-tocopherol (Vitamin E) using a colorimetric assay kit (THE ELBA SCIENCE BIOTECHNOLOGY). Moreover, the estimation of glutathione peroxides in serum was done using the ELIZA test (Sandwich Elisa test) following the instructions of (THE AL-SHKAIRATE ESTABLISHMENT FOR MEDICAL SUPPLY, JORDON).

2.3. Statistical Analysis

Data were analyzed statistically using mean and standard error of mean with the student t-test (9)

3. Results

Diseased cross-breed goat kids exhibited various clinical signs such as painless palpable and visible enlarged of the thyroid gland with or without enlargement of the neck (100%) (Figure 1), sparse hair coats with little alopecia (88.63%), slow growth rate (79.54%), irregular appetite or unwilling to sucking (77.2%), weakness and emaciation (72.7%). Furthermore, the presence of thyroid thrill during palpation of jugular furrow was detected in (63.6%) of diseased animals (Table 1).

Moreover, diseased cross-breed goat kids show no significant difference in body temperature. However, a significant increase ($P<0.05$) was encountered in respiratory rate with a significant decrease ($P<0.05$) in heart rate (Table 2).

On the other hand, no significant changes have been detected in hematological analysis between diseased cross-breed goat kids and the control group (Table 3).

Concerning the chemical analysis between the diseased cross-breed goat kids and the control group, the results of the present study indicated a significant increase ($P<0.05$) in TSH. However, T3, T4, FT4, Glucose level, Vit. E (α-tocopherol) and Serum glutathione peroxides were lowered ($P<0.05$) in diseased cross-breed goat kids compared with the control group. In contrast, a significant hyper-cholesterolemia ($P<0.05$) was indicated in diseased animals than in the control group (Table 4).

Figure 1. Enlarge thyroid gland in a cross-breed goat kid

Table 1. Clinical signs of diseased cross-breed goat kids with Goiter

Clinical signs	Diseased animals	%
Painless palpable and visible enlarged thyroid glands with or without enlargement of the neck	44	100
Sparse hair coats with little alopecia	39	88.63
Slow growth rate	35	79.54
Irregular appetite or unwillingness to suck	34	77.2
Weakness and emaciation	32	72.7
Presence of thyroid thrill during palpation of jugular furrow	28	63.6

Table 2. Body temperature, respiratory and heart rate of diseased cross-breed goat kids with Goiter and control group

Parameters	Control group n=10	Diseased animals n=44
The body temperature C °	38.11±0.12	38.7±1.56
The respiratory rate/mint	22.23±2.11	41.8±3.4*
The heart rate/mint	81.56±2.67	62.4±9.7*

* (P<0.05)

Table 3. Hematological analysis of diseased cross-breed goats kids with Goiter and control group

Parameters	Control group n=10	Diseased yearling goats n=44
RBC $\times 10^6$	7.44±1.16	7.39±1.41
Hb g/dl	13.45±1.45	13.67±1.46
PCV %	33.4±1.81	33.11±2.34
TLC $\times 10^3$	12.35±1.78	12.31±2.21
Neutrophils /absolute	6059±634.13	6188.76±311.21
Lymphocytes /absolute	5754±111.21	5802.11±111.32
Monocytes /absolute	172±40.11	171±12.41
Eosinophils /absolute	202±11.31	201.14±41.11
Basophils /absolute	31±1.11	30.11±12.54

* (P<0.05)

Table 4. Chemical analysis of diseased cross-breed goat kids with goiter and control group

Parameters	Control group n=10	Diseased yearling goats n=44
TSH U/L	2.3	6.3*
T3 nmol/I	0.88	0.53*
T4 nmol/I	29.23	18.67*
FT3 pg/ml	4.1	4.2
FT4 ng/dl	1.2	5.8*
Total cholesterol mg/dl	91.22±4.6	122.87±23.11*
Glucose mg/dl	55.23±2.56	41.34±6.67*
Vit. E (α-tocopherol) mg/L	21.11±1.12	15.34±5.43*
Serum glutathione peroxides mU/mg Hb	20.12±1.51	17.28±6.22*

* (P<0.05)

4. Discussion

The enlargement of the thyroid gland could be Goiter, which refers to a non-inflammatory and unneoplastic big size gland that might be detected in all domestic animals and even birds, nevertheless.

Swellings of the upper part of the neck could be confused with Goiter sometimes; such enlargement might occur as enlargement of the regional lymph nodes or salivary glands. However, signs of hypothyroidism will be developed more commonly in suspected neonates (10).

It was shown that, in the neonate, the disease (Goiter) could be seen and indicated when pregnant dams consume a diet with low iodine contained. However, goitrogens plants could also play a good role in inducing the disease. On the other hand, it was documented that intestinal absorption will be lowered when the diet contains high calcium. An increased dietary intake of calcium could depress intestinal absorption of iodine. Moreover, the Thyroxine libration will decrease, reflecting a thyroid gland hyperplasia (2).

In the current study, diseased cross-breed goat kids exhibited various obvious clinical signs, also indicated by Campbell, Croser (11), Constable, Hinchcliff (2). Where enlargement of the thyroid gland is primarily diagnosed in neonates (lambs and goat kids) after birth. However, this will sometimes reflect the thermo-irregularity indicated in diseased animals with arrhythmias in addition to decreased surfactant secretion (3). Moreover, it has been shown that goats are more susceptible to the deficiency of iodine due to their eating habits, as it chooses food more selectively and consume little soil (6, 7). On the other hand, Constable, Hinchcliff (2) added that palpation with Auscultation of the furrow of the jugular vein could indicate the thyroid thrill and murmurs reflected by high blood supply of the gland arteries.

Ruminants store iodine very effectively in the thyroid and maintain thyroid hormone secretions through moderately long periods when iodine intakes are deficient, but the developing fetus does not have this thyroid hormone reserve which consequently affects the growth and development of the fetus. Further, in these iodine deficient geographical areas, it is recommended that pregnant dams should receive an oral iodine drench at least one or double times during the last two months of their pregnancy period in areas that have known iodine deficient soils, fodder, feed, and water (3). In addition, iodinated plants are considered the primary source of iodine, as synthesis and composition of iodine itself do not occur in the body.

Lower plasma concentrations of thyroid hormones in goitrous younger kids were possibly due to endemic or dietary deficiency of iodine. Nevertheless, iodine deficiency during pregnancy may be the primary reason, and the kids surviving after birth develop Goiter in later stages of life (12, 13). Furthermore, we must bear in mind that there are unique specific plants such as kale, rape, soybeans, cabbage, and turnips that could induce Goiter, especially when consumed in large amounts and considered as goitrogens agents. However, it was shown that the processing of cooking and heating of these plants would break down their toxic goitrogenic materials. On the other hand, it was proved that organo-chlorides substances such as Dichlorodiphenyltrichloroethane and its group compounds, as well as lithium, could also induce Goiter in animals (2, 3).

It has been shown that goitrogenic materials interfere with the libration of thyroxine. Thus, with a deficiency of iodine, an increased secretion of the TSH will occur as a reflex of the pituitary gland's reduced circulating thyroid hormone levels, resulting in a noticeable increase in the thyroid gland size (14). Moreover, the disease is considered less significant in adults. However, in newborn animals is highly significant with evident hypothyroidism and enlargement of the affected gland (15). In addition, goats are highly susceptible to iodine deficiency, due to their preferred browsing behavior and their breeding season (3, 6).

The fetus undergoes rapid development during the winter and early spring, but this is when the soil and pasture iodine levels are at their minimum. Studies have demonstrated that the iodine intake of grazing livestock increases during November, reaching a maximum during summer, decreases rapidly after autumn rains, and continues to decrease throughout winter and early spring. Further, goats have a higher requirement for iodine than other livestock, with the rapidly growing goat kids being more susceptible to iodine deficiency than other animal species (16).

Results of the chemical changes between diseased cross-breed goat kids and the control group indicated a significant difference between the diseased and control group of cross goats kids, as a significant rise of TSH was seen in sick goat kids than in the control group. Similar outcomes were mentioned by Constable, Hinchcliff (2), Kadum and Luaibi (7).

Thyroid-stimulating hormone (TSH) is the preferred initial test in assessing thyroid functions. Moreover, this hormone is librated by the pituitary gland, which assists and is responsible for hormone production and

regulation and its metabolism within the animal body. Moreover, the libration of other hormones like thyroxine might depend on the activity of TSH, which participates in energy production and nerve functions (5). Furthermore, Joshi, Alam (1), and Suttle (16) also added that Thyroid hormones have precise functions in the regulation of average body temperature as well as in the regulation of metabolism and production of body energy besides, improving immunity, increasing growth rate, regulation of the circulatory system, Improving muscular activates and reproductive health.

It was mentioned that insufficient iodine in the gland resulted in the creation of un-iodinated non-active pre-hormone instead of thyroxine, which enhances the pituitary gland for libration of thyroid-stimulating hormone, which in turn reflected the hyperplasia indicated in thyroid tissue and the apparent enlargement of the thyroid gland (2).

Results indicated low levels of T3 and T4 in diseased cross-breed goat kids compared with the controls. It was documented that, Triiodothyronine, T3, and Thyroxine, T4 levels could stay at a constant level and indicate the set- point of the hypothalamic–pituitary–thyroid axis in any suspected animal (17).

Triiodothyronine (T3) represents 80% of the thyroid hormone produced by the normal gland. As T3 is the active thyroid hormone, it could be ordered by the body cells to produce more energy, along with many other functions. Moreover, much of the T3 in the body at any given time is bound to proteins, which makes it not immediately usable by the body (18).

Thyroxine is the common thyroid hormone present in circulation. Furthermore, it is believed that the total T4 mechanism could be changed when binding proteins differ and measures the bound and free hormone. Whereas a Free T4 (FT4) measures what is not bound and able to enter and affect the body tissues. Moreover, the level of free T4 reflects the amount of thyroxine in the blood and works as a storage hormone, and starts inactive; then, the body converts it to T3 when and where it is needed. Nonetheless, to be converted, it goes through a process called monodeiodination, meaning it will lose an atom of iodine to become T3 (17).

Furthermore, Thyroxine deficiency will result in several abnormalities such as hair abnormality and severe muscular weakness in the suspected animals (2, 3). However, it was shown that the increased TSH values with decreased FT4 and/or FTI reflect evident clinical hypothyroidism (7). On the other hand, it was indicated that FT3 is a significantly closer friend to FT4, as they both will play a significant role in thyroid hormones. Nevertheless, According to FT3 and FT4, high or low results could directly determine hyperthyroidism or hypothyroidism (17, 18).

The present study's results indicated a significantly higher cholesterol level in diseased cross-breed goat kids than in controls. In addition to hypoglycemia of diseased kids with little low but significant decrease in both Vit. E (α-tocopherol) as well as Serum glutathione peroxides, identical results were also indicated by Constable, Hinchcliff (2), Kadum and Luaibi (7), Campbell, Croser (11).

It knows that cholesterol is commonly synthesized in both hepatic tissues and the intestinal walls. Further, it can also be obtained from food. Moreover, it is considered the primary source of the body's energy and is a good precursor of bile acids and some steroid hormones. It is also needed to maintain normal cell functions (19). It was shown that Hypercholesterolemia occurs in Goiter-affected kids could due to hypocholesterolemic activities of thyroid hormones (20). Moreover, Hypoglycemia might have resulted due to poor glucose absorption in the absence of adequate thyroxine level; these results are consistent with what was found by MIHAI, TIPISCA (5).

It was documented that Vitamin E and selenium are both known as antioxidant agents. Thus, any depression of these levels in the body will substantially affect oxidative damage to different tissue cells within the body (21). Moreover, it was also documented that, Triiodothyronine is an active form of thyroid hormone at the cellular level which needs to be converted from thyroxine to Triiodothyronine by selenium-containing

enzyme deiodinase. Therefore, the deficiency of selenium might result in a disturbing level of thyroxine and decrease in Triiodothyronine, and elevated plasma cholesterol (18).

A development of Goiter in goat kids due primarily to deficiency of iodine could suggest depressed levels of iodine in the dame's milk. However, deficiency in the area was also expected; in addition, the natural level of the amount of iodine in the body and according to the breed of the animal must also be taken into account, as the breed of the animal plays an important role.

Authors' Contribution

Study concept and design: A. J.
Acquisition of data: K. M. A. S.
Analysis and interpretation of data: M. H. L.
Drafting of the manuscript: K. M. A. S.
Critical revision of the manuscript for important intellectual content: K. M. A. S.
Statistical analysis: K. M. A. S.
Administrative, technical, and material support: K. M. A. S.

Ethics

This study was approved by the ethics committee of the University of Basrah, Basrah, Iraq.

Conflict of Interest

The authors declare that they have no conflict of interest.

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