WATER BORN GOITROGENS AND THEIR ROLE IN ENDEMIC GOITER AMONG LAMBS AND KIDS

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ABSTRACT

The present work aimed to investigate the relationship between gross bacterial contamination of drinking water by human and animal sewage and the occurrence of goiter in lambs and kids. The study was carried out on 35 lambs and 67 kids with different clinical manifestations of goiter. Another group of apparently healthy animals was selected and used as a control for the study. Fifteen water samples were collected from different polluted watering sources of animals. The samples were subjected to bacteriological examination with special reference to pathogenic *Escherichia coli* strains. Blood samples were collected from all animals and were used for determination of thyroid function tests and some hemogram parameters. Tissue specimens for histopathological studies were collected from thyroid glands of clinical group after animals' slaughter. Pathogenic *E. coli* strains were detected in 10 water samples. Significant alteration was recorded in thyroid function parameters of clinically affected animals as compared to the control group. The anaemic manifestations reported in some diseased cases were confirmed by the reduction of studied blood parameters. Significant elevation in both total blood serum cholesterol and triglycerides were reported in all diseased cases. The thyroid glands of diseased lambs and kids showed histopathological abnormalities with focal lymphocytic infiltration. The study stress the role played by pathogenic *E. coil* strains as a goitrogenic agent for the disease and attracts the attention towards the potential danger of sewage pollution of drinking water sources and its impact on public health.

Keywords: small ruminants, goiter, *E. coli*, hormones, hemogram, lipogram

1. INTRODUCTION

The open sewage disposal in some water canals continue to threaten the public health in Egypt since many diseases can be transmitted by this practice. The rearing of animals, particularly sheep and goats on open areas, where such contaminated water canals being used for their watering, represent a potential danger for their health. Gross bacterial Contamination of drinking water by sewage is a cause of goiter in humans in countries where hygiene is poor (Radostits et al., 1994 and Bjergbæk and Roslev 2005).

The thyroid gland is the largest of the endocrine organs that function exclusively as endocrine gland. The functional unit of the gland is the thyroid follicle which is responsible for trapping, synthesis, storage, and release of thyroid hormones (Jones, et al., 1997). Conditioned iodine deficiency is directly related to the presence of goitrogens in foodstuffs offered to livestock. The thyroid gland is greatly affected by the nature of the diet and water, particularly goitrogenic substances Contained in them (Underwood, 1977).

The aim of the present work was to study the effect of sewage polluted water on thyroid gland function of lambs and kids. The study included the determination of the goitrogenic agents, namely *E.coli* as an indicator of sewage pollution, in drinking water and its relation to the clinic-pathological and histopathological alteration of thyroid gland and its function.

2. MATERIALS AND METHODS

1. Animals

A total of 35 lambs and 67 kids, 6–11 months old, were subjected to the study. The animals were collected from various flocks rearing by sewage-polluted water canals in some villages of Assiut. Based on clinical and clinic pathological findings, animals were subdivided into clinically and sub-clinically affected groups. A total of 18 healthy lambs and 12 healthy kids were collected from farms with clean water resources and were used as control groups.

2. Samples and adopted methods

2.1. Water samples: Fifteen water samples were collected from different sewage polluted waterways that constitute the main source for watering animals. The samples were evaluated for *E.coli* contamination using different polyvalent antiserum (Edwards and Ewing, 1972).

2.2. Blood: Two blood samples were collected from each animal, one with EDTA anticoagulant for haematological examination (Coles, 1986) and the other without anticoagulant for serum collection. Serum was used for the determination of thyroid stimulating hormone (TSH) (Bigos., 1984), Triiodothyronine (T_3) and Thyroxine (T_4) (Wood, 1980), Total cholesterol (Watson, 1960) and triglycerides (Royer, 1969).

2.3. histopathological examination: Thyroid gland tissue specimens were picked up from clinically affected group and were sent to histopathology laboratory, Faculty of Veterinary Medicine, Assiut University for histopathological evaluation according to (Jubb, et al., 1993).

2.4. Statistical analysis: Obtained data were statistically analyzed using one-way ANOVA (the findings were expressed as Means ± SE) by means of statistical Package for the Social Sciences for Windows (SPSS, version 10.0, Chicago, IL, USA),

3. RESULTS AND DISCUSSION

Out of the examined 15 water samples, 10 samples were positive for the typical pathogenic *E. coli* strains. Pathogenic strains of *E. coil* were determined using different polyvalent antiserum. This finding suggests a correlation between the presence of pathogenic *E. coli* strains and the occurrence of hypothyroidism in animals. This correlation can be explained in the light of the finding that pathogenic strains of *E. coli* synthesis anti-thyroid compound (Progoitrin), which diminishes the iodine uptake and inhibit organification by the thyroid gland (Gaitan, 1980).

Clinically affected animals included 10 lambs and 25 kids. The Prominent signs reported among clinically diseased lambs and kids were enlargement of the thyroid gland, the gland can be palpated if not visible in some cases. In General, diseased animals showed partial or complete loss

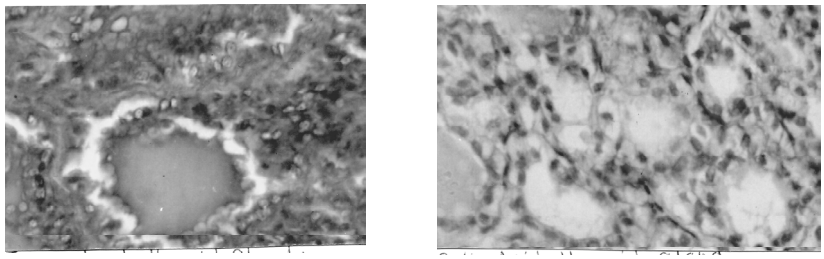
of their coat (hair or wool), extensive alopecia and weakness, murmurs and thrills were recorded at the jugular furrow of most diseased cases. The recorded clinical signs were more or less in harmony with Radostits et al., (1994). Skin pigmentation in some diseased cases could be a sequel of increased melanocytes in epidermis as a response to hypothyroidism (McDonald and Pineda, 1989). Murmur and thyroid thrill were due to the increased arterial blood supply of the gland. Gupta, et al (1998) added that hypothyroidism has a negative effect on growth.

The thyroid function parameters of the clinically-affected groups have showed highly significant deviation ($P<0.001$) as compared to the control group. The rest of the examined animals, 25 lambs and 42 kids, comprised the sub-clinical groups that did not show apparent clinical manifestation of goiter, however, their thyroid function parameters were significantly deviated ($P<0.05$) from that of the control groups (Table 1). Similar results were recorded by Sokkar et al, (2000). However, TSH has showed contrary pattern of $T_3$and T_4 as it showed significant increase. Elevated TSH explained the enlargement of thyroid gland (McDonald and Pineda 1989). The increased values of lipid components were the reflection of the reduction of thyroid hormones (Feling et al, 1981). The lipogram picture of studies animals have showed significant elevation of total cholesterol and triglycerides in clinically affected groups. However, non significant changes were recorded in sub-clinical groups (Table 2). Haematological examination revealed non significant changes in both clinical and sub-clinical groups (Table 3). The reduction in the values of hemogram parameters was in accordance to that previously reported by Sokkar et al, 2000 in lambs and confirmed the anaemic manifestation recorded in diseased animals. These changes could be attributed to the lowered basal metabolic rate due to hypothyroidism.

Histopathological findings revealed marked pathological affection of thyroid glands of clinically affected animals. The gland has irregular follicles with tip nucleus and vacuolated cytoplasm of their lining epithelium. The lumen of the follicle was filled with vacuolated colloid. Inter-follicular inflammatory cell infiltration, increase vascularity and connective tissue proliferation were also recorded (Figure 1). The histopathological findings were in correlation with the thyroid gland functions of the clinically affected animals and were in accordance with that reported by Sokkar et al, (2000). Presence of lymphocytic infiltration supports the suggestion of secondary hypothyroidism due to *E. coli* infection.

4. CONCLUSIONS

The study attracts the attention for the danger of human and animal sewage that pollutes the environment as well as drinking water resources with the subsequent potential hazards on the general public health. The work stress the role of pathogenic *E. coli* strains as goitrogenic agent predispose for the occurrence of goiter in animals with uncontrolled drinking water sources.



(A) (B)

Figure 1. Histopathological finding of thyroid gland cross section showing: (A), Lamb thyroid gland with detached follicular epithelium, vacuolated colloid, congested blood vessels and interfollicular inflammatory cell infiltration (B), Kid thyroid gland with degenerated follicles infiltrated with inflammatory cells and fibrosis and follicles without colloid

Table 1. Mean Blood serum values ± SE of TSH, T3 and T4 in studied animals

Animal Groups		No.	TSH (µIU/ dl)	T3 (ng/dl)	T4 (µg /dl)
Lambs	Control group	18	2.89 ± 0.02	102.42 ± 3.07	5.31 ± 0.42
	Clinical group	10	6.18 ± 0.92***	48.25 ± 3.81***	1.81 ± 0.01***
	Sub-clinical group	25	3.31 ± 0.51*	88.43 ± 3.11**	4.01 ± 0.21*
Kids	Control group	12	3.12 ± 0.42	154.14 ± 3.92	4.12 ± 0.03
	Clinical group	25	7.11 ± 0.38***	72.35 ± 4.11***	2.21 ± 0.01***
	Sub-clinical group	42	4.18 ± 0.71*	118.71 ± 3.52**	3.88 ± 0.24*

Table 2. Mean values ± SE of some blood serum lipids in studied animals

Animal Groups		No.	Total cholesterol (mg/dl)	Triglycerides (mg/dl)
Lambs	Control group	18	76.2 ± 4.82	28.4 ± 1.51
	Clinical group	10	87.2 ±7.02**	46.7 ± 2.72***
	Sub-clinical group	25	78.5 ± 4.56	37. 2 ± 3.41*
Kids	Control group	12	110.8 ± 3.51	25.5 ± 1.32
	Clinical group	25	140.8 ± 3.11**	44.6 ± 2.05**
	Sub-clinical group	42	134.11 ± 4.81*	38.5 ± 3.31*

Table 3. Mean values ± SE of hemogram parameters in studied animals

Animal Groups		No.	RBCs (million)	PCV %	Hb gm %
Lambs	Control group	18	10.91 ± 0.21	38.81 ± 1.21	11.51 ± 0.81
	Clinical group	10	8.52 ± 0.91**	33.41 ± 1.02**	9.24± 0.02**
	Sub-clinical group	25	8.68 ± 0.94**	33.82 ± 1.08**	9.71 ± 0.87**
Kids	Control group	12	11.23 ± 0.35	32.61 ± 1.12	10.25 ± 0.49
	Clinical group	25	9.31 ± 0.67**	30.12 ± 1.15*	9.13 ± 0.18*
	Sub-clinical group	42	9.95 ± 0.94**	30.81 ± 1.09*	9.52± 0.41*

***(P<0.001), **(P<0.01), *(P<0.05)

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