FIFTH SCIENTIFIC CONFERENCE

Faculty of Veterinary Medicine
Assiut University
8 - 10 November 1992

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Proc. 5th Sci. Conf., Fac. Vet. Med., Assiut Univ., Nov. 8-10,1992. EGYPT

BLOOD SERUM LIPIDS OF BUFFALO-CALVES DRINKING WELL WATER

BY

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INTRODUCTION

Water hardness is usually the result of high concentrations of calcium and magnesium. Several studies concerned with human cardiovascular disease indicated that the frequency of the disease in greater in soft water areas than in hard water areas. Minerals in drinking water are more readily absorbed than from food because water does not usually contain chelating agents which might prevent absorption of elements (PORTER et al., 1988).

In swine, the effect of water hardness has been studies by BULENGA et al., (1967) who reported that atherosclerosis lesions were less severe in animals given hard water than in those given soft water. In rabbit BORGMAN and LIGHTSEY (1982) studied the influence of hard water upon rabbit health, the results indicated that hard water may reduce liver cholesterol concentrations and the severity of cholelithiasis. The authors continued that calcium and magnesium present in the hard water may have some influence upon lipid metabolism.

PORTER et al., (1988) reported that, lower concentrations of total cholesterol, very low-density lipoproteins (VLDL) cholesterol and lowdensity lipoproteins (LDL) cholesterol and greater concentrations of high density lipoproteins (HDL) cholesterol, were found in rabbits given hard water for several weeks, in comparing with those given the deionized water. The authors noted that water hardness did not affect the hepatic or renal concentrations of lipid and cholesterol. In rats, given additional dietary calcium, serum cholesterol was lowered and the fecal excretion of bile acids was increased (FLEISCHMAN et al., 1966).

Many farms in desert area depend upon wells as source of drinking water that may contain higher than the permissible limits of some elements. Drinking water for livestock-which contains high levels of dissolved salts

Proc. 5th Sci. Cong., Fac. Vet. Med., Assiut Univ., Nov. 8-10,1992. EGYPT

particularly magnesium salts has frequently been reported to cause health problems such as scouring, loss of condition, refusal to drink and even death (ADDISON, 1968).

However, available literature lacks much about the influence of mineral constituents in water. It is important to study the effect of water harness on the calves health. Accordingly, the aim of the present work was to throw light upon the effect of drinking well water on some changes of lipid metabolism in male buffalo-calves.

MATERIAL AND METHODS

Twenty apparently healthy male buffalo-calves, from 8-12 months old of body weight ranged from 150 to 220 kgs, were chosen from the farm of Faculty of Vet. Med., Suez Canal University.

The animals were housed in an open yard system with a common shaded manager and water troughs in which water was offered ad libitum. Each animal fed daily ration formed from: Concentrate mixture 4 kg, rice straw 2 kgs and Barseem hay 2.5 kg. Calves were divided into two equal groups according to the type of drinking water. The first group (control group) included ten male buffalo calves that received fresh tap water ad-libibitum, and the second group (well water group) included ten male buffalo-calves that received well water from well at the site of farm.

The blood samples were collected from jugular vein in dry sterile centrifuge tube at the beginning of study and periodically every ten days for a duration of 50 days. blood samples were allowed to clot at room temperature, serum samples were separated by centrifugation at 300 r.p.m. for 15 minutes and kept frozen at -20°C till analyzed. Collected serum samples were then analyzed for total lipids, total cholesterol, triglycerides phospholipids and free fatty acids levels using colorimeteric methods according to FRINGS and DUNN (1970), ZAK et al., (1954), ZAK et. al., (1954), FOSTER and DUNN, (1973); ZILVERSMIT and DAVIS (1950) and DUNCOMBE (1964), respectively. Statistical analysis of the obtained results were carried out using the method of SNEDECOR and COCHRAN (1967).

RESULTS

The obtained results concerning the levels of various serum lipid constituents in male buffalo-calves drinking well water and calves drinking fresh tap water have been statistically summarized in five tables.

Serum total lipids level exhibited non-significant ($P>0.05$) decrease at 10th and 50th days pot drinking in comparison to control group. Such decrease exhibited significant decrease ($P<0.05$) at the 20th and 30th days post

drinking. Fourty days post drinking, on the opposite induced highly significant (P<0.01) increase level.

A non significant (P>0.05) decrease was detected in serum level of total cholesterol during the first 10 days after drinking well water. This decrease became significant (P<0.01) at the 30th days after drinking which became a highly significant at the 40th days after drinking. This increase became non significant (P>0.05) during the first 20 days and at the 50th days after drinking when compared with the control group.

Mean serum triglycerides levels revealed nonsignificant (P>0.05) increase at the 10th, 40th, and 50th days after drinking well water. The value of serum triglycerides obtained after 20 days of drinking showed a very highly significant (P<0.001)decrease, followed by a significant (P<0.01) decrease at the 30th days after drinking well water in comparison with the respective values for control group.

A non significant (p>0.05) decrease in serum phospholipids level at the 10th, 20th, 30th, 40th and 50th days after drinking well water was recorded when compared with the values of control group.

The level of serum free fatty acids showed a highly significant (p,0.01) decrease at the 30th days after drinking. At the 40th days after drinking the level of serum free fatty acids revealed a highly significant (p<0.01) increase, followed by a significant decrease at the 50th days after drinking. During the first 10 days the level of serum free fatty acid showed a non significant (p>0.05) decrease, followed by a non significant (p>0.05) increase at the 20th days after drinking well water as compared with the values of control group.

DISCUSSION

The data of the present investigation (Table 1) revealed that, the total lipids in the serum of control group of buffalo-calves ranged from 265.2 to 370.42 mg/dl. Referring to buffalo-calves drinking well water , the result showed that, there was a highly significant (p<0.01) decrease in total lipids content at the 20th and 30th days, followed by a high significant increase after 40 days of drinking well water. Our results seems to agree with the data of EL-SAYED (1991) who observed that there was significant decrease in serum total lipids of well water drinking buffalo-calves and AZZA (1992) who stated that, the levels of serum total lipids showed a highly significant decrease in rabbit drinking hard water when compared with control rabbit. The recorded decreased values of total serum lipids of buffalo-calves drinking well water, in our study, could be

Proc. 5th Sci. Cong., Fac. Vet. Med., Assiut Univ., Nov. 8-10,1992. EGYPT

attributed to the linear effect of high Nacl levels in drinking well water, which increased the rate of passage of ingesta from the rumen decreasing microbial fermentation, consequently decrease in the production of volatile fatty acids (CROOM et al., 1982).

However, the reported increase in serum total lipids at the 40th days of drinking well water in buffalo-calves may be attributed to high fat diet administered to calves (BAZIN and BRISSON, 1975).

It is evident from the present data (Table 2) that the total serum cholesterol concentration of control group in buffalo-calves ranged from 90 to 123.75 mg/dl. Concerning the data for calves drinking well water, there was a significant ($p<0.05$) decrease in the total cholesterol concentration in serum samples collected at the 30th days which became highly significant elevated at the 40th days of drinking well water. This expected decrease in the serum total cholesterol agreed well with the results obtained by PORTER et al.,.(1988) who reported lowered concentration of total cholesterol VLDL cholesterol and LDL cholesterol and greater concentration of HDL cholesterol were found in rabbits given hard water for several of the weeks in comparing with those given the deionized water. Further more, FLEISCHMAN et al., (1966) stated that in rats given additional dietary calcium, serum cholesterol was lowered and the fecal excretion of bile acids was increased. Also such reported decrease in total cholesterol could be attributed to calcium supplementation in water as confirmed by YACOWITZ et al., (1965) who showed that calcium supplementation in human decreased serum cholesterol and excretion of fecal lipids. Moreover this decrease could be due to the action of calcium and magnesium on lessening the absorption of lipids in intestinal tract there by lowering the biosynthesis of cholesterol or bile salts of the liver. The highly significant increase in serum total cholesterol concentration at the 40th days of drinking well water may be attributed to the greater concentration of HDL cholesterol as reported by PORTER et al., (1988) in rabbit.

The present data in Table 3. showed that serum triglycerides content in control group of buffalo-calves ranged from 58.33 to 157.5 mg/dl. Referring to buffalo-calves drinking well water, serum triglycerides revealed a significant ($p<0.05$) decrease at the 20th and 30th days of drinking well water.

Our results seem to agree with the data of EL-SAYED (1991) who observed that, there was a significant decrease ($p<0.05$) in serum lipid of well water buffalo-calves. The decreased level of triglycerides in the serum

Proc. 5th Sci. Cong., Fac. Vet. Med., Assiut Univ., Nov. 9-10,1992. EGYPT

may be attributed to increase of plasma or adipose tissue lipoprotein lipase activity.

The present data Table 4. showed that the level of phospholipids in serum of control buffalo-calves ranged from 69.60 to 99.02 mg/dI whereas phospholipids level in the serum of buffalo-calves drinking well water, showed a non-significant ($p>0.05$) decrease during the whole period of experiment.

Serum free fatty acids level for normal (control) buffalo-calves, ranged from 5.94 to 31.33 mg/dI Table 5. In buffalo-calves that received well, serum free fatty acids showed a high significant ($p<0.05$) increase at the 40th days of the experiment, followed by a significant decrease at the 50th days. This decrease became highly significant after 30 days drinking well water as compared with the control group. The increased level of free fatty acids in serum of buffalo-calves drinking well water may be possibly due to the free fatty acids that take part in the production of triglycerides or may be attributed to the effect of anterior pituitary hormone (RUDMAN et al., 1962). Accordingly, the available literature ,regarding the relationship between the drinking well water and serum lipids pattern seem to be deficient to discuss our results. From the a fore mentioned results it could be concluded that drinking well water to buffalo-calves induced a significant changes in the levels of most serum lipids which may have some influence upon lipid metabolism. Thus, it can be advised that all animals farms in the desert areas must be advised to perform artificial softening of drinking water before its use to reduce water salinity an harmful effect.

SUMMARY

Twenty 8-12 month old buffalo-calves were available at the experimental farm of Suez Canal University. Calves were divided into two equal groups according to the type of drinking water, control group received fresh tap water adlibitum and well water group received well water. Blood samples were collected at the beginning of study and periodically every ten days for a duration of 50 days, for studying the effect of drinking well water on serum total lipids, total cholesterol, triglycerides, phospholipids as well as non-esterified fatty acids (free fatty acids).

The results indicated that concentration of serum total lipids levels showed a highly significant ($P<0.01$) decrease at the 20th and 30th days, followed by a highly significant ($P<0.01$) increase after 40 days of drinking well water. However, the level of serum total cholesterol showed a significant ($P<0.05$) decrease at the 30th days and highly significant ($P<0.01$) increase at the 40th days of drinking well water. The

Proc. 5th Sci. Cong., Fac. Vet. Med., Assiut Univ., Nov. 8-10,1992. EGYPT

level of triglycerides showed a higly significant (P<0.01) decrease at the 20th days, followed by a significant (P<0.05) decrease after 30th days. The level of serum phospholipids showed a non significant (P<0.05) change. However, the level of free fatty acid showed a highly significant (P<0.01) increase at the 40th days of the experimental, followed by significant (P<0.01) decrease at the 50th days. This decrease became highly significant (P<0.01) at the 30th days after drinking well water as compared with the control group. This study showed that using drinking well water to buffalo-calves induced a significant changes in the level of most serum lipids.

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Proc. 5th Sci. Cong., Fac. Vet. Med., Assiut Univ., Nov. 8-10,1992. EGYPT

level of triglycerides showed a higly significant (P<0.01) decrease at the 20th days, followed by a significant (P<0.05) decrease after 30th days. The level of serum phospholipids showed a non significant (P<0.05) change. However, the level of free fatty acid showed a highly significant (P<0.01) increase at the 40th days of the experimental, followed by significant (P<0.01) decrease at the 50th days. This decrease became highly significant (P<0.01) at the 30th days after drinking well water as compared with the control group. This study showed that using drinking well water to buffalo-calves induced a significant changes in the level of most serum lipids.

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Table (1): The effect of drinking well water on serum total lipids of male buffalo-calves in mg/dl.

Time	Control group	Well water group
1- First day	265.2 ± 7.75	258.12 ± 6.01
2- After 10 days	296.27 ± 6.87	264.04 ± 13.34
3- After 20 days	335.47 ± 5.09	225.42 ± 7.71***
4- After 30 days	370.42 ± 11.33	224.88 ± 4.79***
5- After 40 days	268.63 ± 5.99	315.16 ± 7.93**
6- After 50 days	341.79 ± 8.39	324.00 ± 6.85

** : Highly significant ($P < 0.01$).

***: Very highly significant ($P<0.001$).

Table (2): The effect of drinking well water on serum total cholesterol of male buffalo-calves in mg/dl.

Time	Control group	Well water group
1- First day	122.5 ± 17.30	91.25 ± 8.75
2- After 10 days	123.75 ± 2.40	90.00 ± 8.52
3- After 20 days	92.5 ± 7.5	96.25 ± 8.29
4- After 30 days	118.75 ± 7.39	88.75 ± 3.64*
5- After 40 days	90.00 ± 3.75	133.75 ± 7.55**
6- After 50 days	116.25 ± 6.43	116.27 ± 7.56

* Significant ($P < 0.05$).

** Highly significant ($P < 0.01$).

Table (3): The effect of drinking well water on serum triglycerides of male buffalo-calves in mg/dl.

Time	Control group	Well water group
1- First day	58.33 ± 9.22	69.99 ± 7.14
2- After 10 days	64.16 ± 5.83	93.33 ± 31.14
3- After 20 days	157.5 ± 7.14	52.5 ± 10.91***
4- After 30 days	145.83 ± 29.16	58.33 ± 9.22*
5- After 40 days	93.33 ± 14.29	116.66 ± 13.04
6- After 50 days	110.83 ± 17.00	106.8 ± 7.88

***: Very highly significant ($P < 0.001$).

*: Significant ($P < 0.05$).

Table (4): The effect of drinking well water on serum phospholipids of male buffalo-calves in mg/dl.

Time	Control group	Well water group
1- First day	78.43 ± 3.46	63.72 ± 7.75
2- After 10 days	99.02 ± 7.96	74.50 ± 11.53
3- After 20 days	75.49 ± 5.04	64.7 ± 7.81
4- After 30 days	74.51 ± 8.26	63.72 ± 3.46
5- After 40 days	69.60 ± 4.75	60.77 ± 8.29
6- After 50 days	97.06 ± 6.82	95.09 ± 9.50

Table (5): The effect of drinking well water on serum non-esterfied fatty acids (free fatty acids) of male buffalo-calves in mg/dl.

Time	Control group	Well water group
1- First day	5.94 ± 1.05	3.16 ± 0.39
2- After 10 days	9.34 ± 1.29	6.12 ± 2.19
3- After 20 days	9.89 ± 0.68	11.97 ± 3.86
4- After 30 days	31.33 ± 0.51	14.08 ± 2.86**
5- After 40 days	15.70 ± 1.19	30.98 ± 2.86**
6- After 50 days	17.65 ± 1.34	6.81 ± 2.47*

** : Highly significant ($P < 0.01$).

* : Significant ($P < 0.05$).