ARAŞTIRMA MAKALESİ

Sağlık Bilimleri Dergisi

Sağlık Bilimleri Dergisi, 10 (1-2): 17-22, 2007
Erişim: www.sagbil.yyu.edu.tr

YÜZÜNCÜ YIL ÜNİVERSİTESİ

The effect of seasonal changes on fluor levels in water and blood samples taken from sheep living in the region of Muradiye and Çaldıran*

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Abstract: In this study, the effects of seasonal changes on fluor concentration in water and blood samples taken from sheep in the region of Muradiye and Çaldıran were investigated. Five sheep from each 15 villages contituted animal materials and water materials examined were that the sheep consumed. The mean fluor concentration in the water samples taken from the region of Çaldıran determined by specific fluor electrode in January, April, July and October were 1.78 ± 0.51 ppm, 1.59 ± 0.97 ppm, 2.03 ± 0.79 ppm and 2.38 ± 1.67 ppm respectively. In the same months the mean fluor concentration in the water samples taken from the region of Muradiye were 0.29 ± 0.05 ppm, 0.34 ± 0.34 ppm, 0.55 ± 0.46 ppm and 0.55 ± 0.44 ppm respectively. According to these results higher fluor concentration in the water samples taken from Çaldıran were significantly high compared to normal values. On the other hand, water samples taken from Muradiye had lower fluor concentration compared to the normal values. Increase in fluor concentration in water samples taken from the region of Çaldıran during October was significant statistically ($P<0.05$). The mean fluor concentration in the plasma of the sheep obtained from the region of Çaldıran determined by specific fluor electrode in January, April, July and October were 0.55 ± 0.02 ppm, 0.48 ± 0.02 ppm, 0.53 ± 0.03 ppm and 0.93 ± 0.05 ppm respectively. In the same months, the mean fluor concentrations in the plasma samples taken from sheep obtained from the region of Muradiye were 0.52 ± 0.01 ppm, 0.44 ± 0.01 ppm, 0.51 ± 0.01 ppm and 0.75 ± 0.03 ppm respectively. Changes in plasma fluor concentrations determined in October obtained from both Çaldıran and Muradiye were statistically significant ($P<0.05$). As a result, determination of high concentration of fluor in autumn in this study could be the results of reduction in the water amount in this season, therefore fluor concentration condensated in the water samples.

Key words: Fluor, plasma, seasons, water

Muradiye ve Çaldıran yöresinden alman su ve koyunlarm kan örneklerindeki fluor düzeyine mevsimsel değişimlerin etkisi

Özet: Bu çalışmada, endemik florozis görülen Van'ın Muradiye ve Çaldıran ilçelerine bağlı köylerden alınan su ve koyunlanıı kan plazmasındaki flor düzeyine mevsimsel değişikliklerin etkisi araştırıldı. Hayvan materyalini her köyden 5'er adet koyun, su materyalini ise bu köylerdeki koyunlarm tükettiği sular oluşturdu. Spesifik flor elektrodu ile yapılan ölçümlerde Çaldıran ilçesinden alınan su numunelerinde flor oranı ocak, nisan, temmuz ve ekim aylarında sırasıyla ortalama 1.78 ± 0.51 ppm, 1.59 ± 0.97 ppm, 2.03 ± 0.79 ppm ve 2.38 ± 1.67 ppm, Muradiye ilçesinde 0.29 ± 0.05 ppm, 0.34 ± 0.34 ppm, 0.55 ± 0.46 ppm ve 0.55 ± 0.44 ppm olarak tesbit edildi. Çaldıran ilçesinden alınan su örneklerindeki flor düzeyleri normal değerlerden yüksek, Muradiye ilçesinde ise normal düzeylerden düşük olduğu tesbit edildi. Çaldıran ilçesinden alınan su numunelerindeki flor düzeyinde ekim ayındaki artış önemli ($P<0.05$) bulundu. Spesifik flor elektrodu ile yapılan ölçümlerde Çaldıran ilçesinden alınan koyunlarm kan plazmasındaki flor düzeyleri ocak, nisan, temmuz ve ekim aylarında sırasıyla 0.55 ± 0.02 ppm, 0.48 ± 0.02 ppm, 0.53 ± 0.03 ppm ve 0.93 ± 0.05 ppm, Muradiye ilçesinde 0.52 ± 0.01 ppm, 0.44 ± 0.01 ppm, 0.51 ± 0:01 ppm ve 0.75 ± 0.03 ppm olarak tesbit edildi. Muradiye ve Çaldıran ilçelerinden ekim ayında alınan kan plazmalarındaki flor düzeyindeki değişim istatistiksel olarak önemli ($P<0.05$) bulundu.

Sonuç olarak, su ve kan numunelerinde bulunan flor düzeyinin sonbaharda yüksek bulunması, iklim şartlarına bağlı olarak su miktarındaki azalma sonucunda sulardaki flor konsantrasyonunun artmasından kaynaklanabileceği ihtimalini düşündürmektedir.

Anahtar sözcükler: Flor, mevsimler, plazma, su

INTRODUCTION

Fluor, an inorganic substance, has important function especially for skeleton and tooth tissues. It is one of the element required to be taken exogenously (1). Chronic fluor poisining is called florosis which developes as a result of small amount of its intake for a long time. Florosis described First time in 1937 in the Madras province of India (1,2).

Florosis apart from health problem in man, it is also important for animals (in terms economic loses) living in the regions which fluor levels high in water sources, plants consumed by animals grown up in the soil having high levels of fluor and animals living in an around the area which contaminated by industrial enterprises (3,4,5,6).

In our country, florosis cases have been come across especially in the Eastem Anatolia (Ağrı - Doğubeyazıt, Tendürek Mountain and its around and Muradiye), İsparta region and Kızılcaören village of the province of Eskişehir (3,5,7,8).

This study was performed to determine seasonal changes in fluor concentrations in water samples and plasma samples of sheep living in the volcanic regions; Çaldıran and Muradiye which located on the foot of Tendürek Mountain. Studies examining seasonal changes in this region couldn't be cited. Therefore, results obtained in the present study couldn't be compared properly. Results obtained in this study showed that especially water and plasma samples obtained during autumn had higher fluor concentration. This stuation could be do to low amount of rain and increase in evaporation in this season therefore condensated the water in terms of fluor.

In the present study, the effects of seasonal changes in the level of fluor in water sources and plasma concentrations in sheep living in the towns Muradiye and Çaldıran and their villages which located on the foot of the Tendürek mountain were investigated.

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MATERIALS AND METHODS

In the present study, water samples taken from 8 villages of Muradiye town and 7 villages from Çaldıran town in the province of Van and plasma samples taken from 5 sheep aged between 2-3 from each above villages in January, April, July and October were the materials of the present study.

In this study, fluor standart solution, TIS AB (Total lonic Strength Adjustment Buffers) solution and EDTA were the Chemical materials. The equıpments used in this study were Ionometer (Orion 720 S A), fluor electrode (Orion 96 09 00) and magnetic stirrer (IKAMAG).

The fluor concentrations in the samples were determıned as described by Singer et ali (9) and Bildik (10). Fluor concentration were determined using equal amount of water and TISAB solution for water samples and equal amount of plasma and TISAB solution for plasma samples.

The mixtures were stirred continuously by magnetic stirrer and mV values read, then ppm values calculated from calibration curve. The obtained values analysed according to Duncans multiple comparison described by Düzgüneş et al (11).

RESULTS

The fluor concentrations determined in water and plasma samples taken from Muradiye and Çaldıran towns and their villages during (January, April, July and October) 2001, were given in Table 1 and 2. Variation figures of water and plasma samples in Muradiye and Çaldıran regions were given in Figüre 1 and 2.

Furthermore, changes due to season in fluor levels in the plasma samples taken from sheep living in the Muradiye and Çaldıran regions were given in Table 3. Flor levels determined in water samples were higher in the Çaldıran region compared the same values obtained from Muradiye region.

Changes in fluor levels in water taken from two different towns are given in Figüre 1. Although flor levels were higer in water samples obtained from Çaldıran than Muradiye; in summer and autumn, fluor levels determined to increase in both towns. But this increase were statistically significant ($P<0.05$) only on the samples obtained from Çaldıran during summer and autumn.

Fluor levels of the plasma were higher in sheep living in the villages of Çaldıran town compared to the values obtained from the villages of Muradiye town.

Fluor concentrations in the plasma samples were not statistically significant during winter, spring and summer. However these values obtained in autumn were significant statistically ($P<0.05$) (Table 3 and Figüre 3).

DISCUSSIONS

Fluorosis is seen very often in the animals raised in this region because water and soil in the volcanic region contains too much fluor.

Table 1: Fluor levels (ppm) in water samples taken at different seasons in the Muradiye and Çaldıran towns and their villages.

VILLAGE NAME	JANUARY	APRIL	JULY	OCTOBER (2001)
MURADİYE				
Kemerköprü	*	*	0.129	0.178
Aşağı Argit	*	0.169	0.885	1.191
Görecek	0.223	0.173	0.339	0.147
Gümüştepe	*	0.198	0.162	0.226
Gönderme	*	1.096	0.990	1.235
Babacan	0.358	0.308	1.355	0.651
Devetaş	0.298	0.281	0.292	0.484
Çiçekli	0.309	0.196	0.287	0.313
ÇALDIRAN				
Aşağı Yanıktaş	1.914	3.040	3.630	3.999
Kılavuz	2.269	1.006	1.981	4.325
Aşağı Mutlu	*	2.917	2.404	3.396
Burçakalan	*	0.805	1.640	0.982
Başeğmez '	1.606	1.570	1.778	2.971
Alakaya	2.167	0.907	1.213	0.283
Soğuksu	0.990	0.941	1.599	0.753

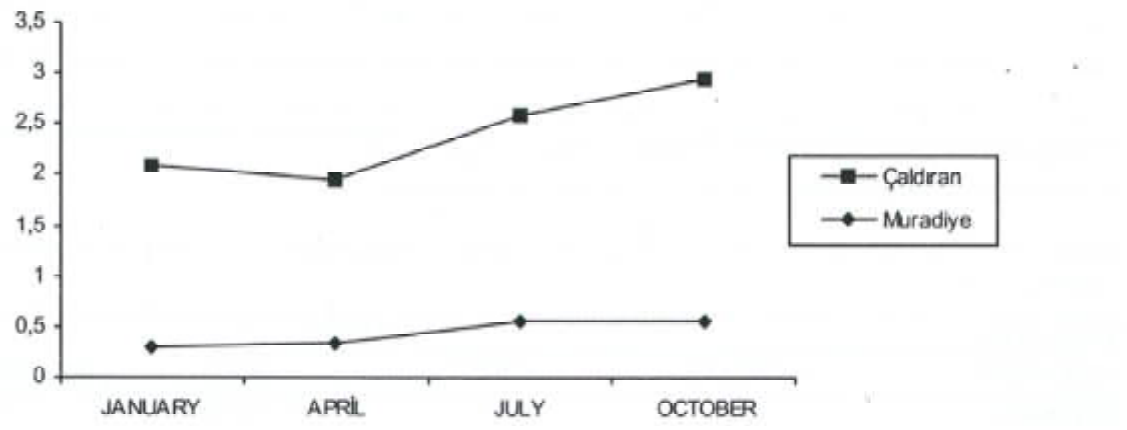

Figure 1: Seasonal changes of fluor levels in drinking waters taken from Muradiye and Çaldıran towns.

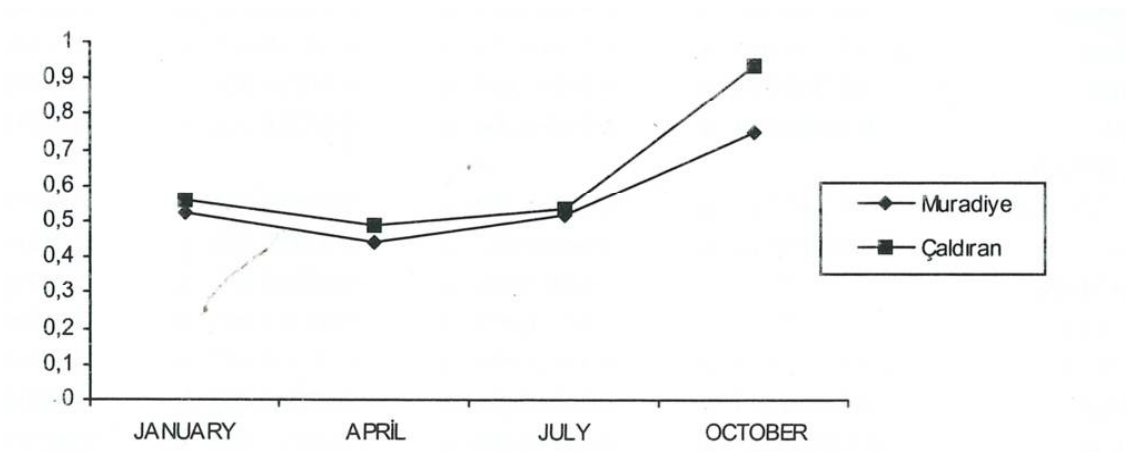

Figure 2: Seasonal changes of fluor concentrations in plasma samples taken from sheep living in the Çaldıran and Muradiye region.

Table 2: Seasonal changes of fluor level in the plasma of the sheep living in the Muradiye and Çaldıran towns and their villages.

	JANUARY					APRIL					JULY					OCTOBER (2001)				
MURADİYE	**S1**	S2	S3	S4	S5	Sİ	S2	S3	S4	S5	Sİ	S2	S3	S4	S5	Sİ	S2	S3	S4	S5
Kemerköprü	*	*	*	♦	*	*	*	♦	*	*	0.502	0.510	0.536	0.539	0.475	0.773	0.794	0.853	0.753	0.547
Aşağı Argit	*	*	*	*	*	0.414	0.403	0.396	0.419	0.416	0.512	0.512	0.536	0.545	0.495	0.785	0.731	0.815	0.712	*
Görecek	0.654	0.673	0.613	0.506	0.591	0.414	0.46	0.434	0.419	*	0.407	0.422	0.457	0.479	0.519	0.753	0.861	0.785	0.826	♦
Gümüştepe	*	*	*	*	*	0.416	0.442	0.43	0.411	0.385	0.523	0.497	0.565	0.552	0.534	0.809	0.815	0.839	*	*
Gönderme	0.480	0.471	0.46	0.489	*	0.48	0.448	0.446	*	*	0.576	0.556	0.532	0.51	0.499	0.746	0.658	0.448	0.627	*
Babacan	0.567	0.529	0.506	0.552	0.532	0.453	0.456	0.451	0.414	0.422	0.568	0.512	0.51	0.556	0.57	0.68	0.746	0.722	0.712	*
Devetaş	0.474	0.485	0.412	0.529	0.46	0.482	0.534	0.467	0.478	0.451	0.592	0.499	0.475	0.479	0.465	0.663	0.818	0.916	0.64	0.911
Çiçekli	0.575	0.536	0.512	0.524	*	0.46	0.434	0.458	0.454	0.471	0.487	0.562	0.586	0.508	0.521	0.743	0.743	0.705	0.731	*
ÇALDIRAN																				
Aş.Yanıktaş	0.554	0.588	0.508	0.476	*	0.64	0.536	0.487	0.503	0.498	0.525	0.547	0.47	0.514	0.477	0.875	0.988	0.831	0.999	*
Kılavuz	0.602	0.586	0.529	0.536	*	0.705	0.633	0.591	0.594	*	0.457	0.489	0.497	0.568	0.413	1.074	1.092	1.016	1.069	*
Aş.Mutlu	*	*	*	*	*	0.491	0.586	0.43	0.463	*	0.39	0.387	0.499	0.603	♦	0.931	1.084	1.074	1.042	1.106
Burçakalan	*	*	*	*	*	0.46	0.414	0.482	0.426	*	0.42	0.796	0.708	0.662	0.731	0.893	0.931	0.719	*	*
Başeğmez	0.512	0.631	0.578	0.529	0.613	0.427	0.467	0.478	0.51	0.448	0.669	0.708	0.788	0.768	*	0.98	0.94	1.03	0.959	*
Alakaya	0.550	0.583	0.61	0.633	0.567	0.436	0.438	0.419	0.399	0.383	0.403	0.383	0.479	0.454	*	1.096	0.988	*	*	*
Soğuksu	0.586	0.474	0.503	0.534	0.556	0.438	0.424	0.451	0.414	*	0.345	0.47	0.467	0.458	0.47	0.411	0.798	0.788	*	*

*: Samples couldn't be taken because of transportation problem (snow). S: Number of the sheep which fluor level determined in their plasma.

Table 3: Mean±SD fluor levels due to seasons plasma samples obtained from sheep living in the Muradiye and Çaldıran regions.

VİLLAGES	SEASONS			
MURADİYE	**JANUARY**	**APRIL**	**JULY**	**OCTOBER (2001)**
Kemerköprü	*	*	0.512±0.01	0.744±0.052
Aşağı Argit	*	0.409±0.04 a	0.520±0.009 b	0.760±0.02 c
Görecek	0.607±0.029 a	0.431±0.010 b	0.456±0.020 b	0.806±0.024 c
Gümüştepe	*	0.416±0.010 a	0.534±0.012 b	0.821±0.009 c
Gönderme	0.475±0.006 a	0.458±0.011 a	0.534±0.014 ac	0.619±0.063 bc
Babacan	0.537±0.010 a	0.439±0.009 b	0.543±0.013 a	0.715±0.014 c
Devetaş	0.472±0.019 a	0.482±0.014 a	0.502±0.023 a	0.789±0.059 b
Çiçekli	0.536±0.014 a	0.455±0.006 b	0.532±0.018 a	0.730±0.009 c
ÇALDIRAN				
Aşağı Yanıktaş	0.53H0.025 a	0.532±0.028 a	0.506±0.015 a	0.923±0.042 b
Kılavuz	0.563±0.018 a	0.630±0.027 a	0.484±0.026 b	1.062±0.016 c
Aşağı Mutlu	*	0.492±0.034 a	0.469±0.051 a	1.047±0.031 b
Burçakalan	» *	0.445±0.016 a	0.663±0.065 b	0.847±0.065 c
Başeğmez	0.572±0.023 a	0.466±0.014 b	0.733±0.027 c	0.977±0.019 d
Alakaya	0.588±0.015 a	0.415±0.011 b	0.429±0.022 b	1.042±0.054 c
Soğuksu	0.530±0.020 ac	0.431±0.008 a	0.442±0.024 a	0.665±0.127 bc

*Samples couldn't be taken because of transportation problem (snow), SD: Standart Error

In a study carried out by Choubisa (13) report that drinking water containing 3.2 ppm fluor caused skeletal fluorosis in buffalo at 37.5 % and 29 % in cattle, but in calves skeletal fluorosis couldn't be observed. The reason for the aged animals having skeletal fluorosis is suggested to be due to long term experience to fluor.

Fluor concentration in blood examined first by Taves in 1968 and reported normal fluor concentration in human serum for iyonic fluor 0.01-0.02 ppm and for total fluor; 0.08-0.10 ppm (14). Similarly, in a study (12) serum and plasma fluor concentrations in healthy persons were reported to be 0.01-0.2 mg/lt.

Armstrong at al. (15) noted that incrising levels of fluor consuption with diet significantly increased plasma fluor levels from 0.1 to 1 ppm in rats. Similarly, 600 ppm fluor consumption as NaF elevated plasma fluor level up to 3.3 ppm (16).

In a study (17) carried out by Singer and Armstrong on rats and rabbits reported that ionic fluor concentration in plasma higher than total or bound fluor level, but the reason for this stuation and the importance of it was not discussed.

Carlson (18) examined changes in fluor concentration in plasma obtained from cattle which exposed to high level of fluor intake periodically and found that these cattle that had periodically high level of fluor intake had high level of fluor concentration in their plasma (1 ppm), compared to control values which were under 0.1 ppm fluor concentration.

Furthermore, Shearer and Suttie (19) carried out a study on rats. They divided rats into 3 groups one being control group. Rats in İst group received periodically 200 ppm and rats in 2nd group received 450 ppm fluor, and plasma fluor concentrations were analysed. While fluor concentration in control group reported to be 0.09 ±0.06 ppm, its concentration in the first group was 0.32 ± 0.05 ppm and in the second group was 1.31 ± 0.22 ppm.

Fluor concentration in ground water are generally about 1 ppm level. On the other hand, deep waters having contact to pressured gases and minerals or especially fluor and hot water sources, the fluor concentration may increase to 15 ppm. According to Oruç (20), spring water coming from the foot of Tendürek mountain contain high amount of fluor, as a result of it, fluorosis can be seen in the people and animals living in this region (20). In two different studies (22,23) carried out in the same region reported that waters coming frofn the North and South foot of the mountain especially waters in the Doğubeyazıt and Çaldıran plain contain high amount of fluor. Fluor levels in the Çaldıran located in the Van province were reported to be 5.7-15.2 ppm and in the city of Ağrı were 10.3-12.5 ppm.

Ergun at al (22) analysed urine samples of sheep and human and found fluor concentration as 8.1 ppm, and 4.3 ppm respectively. They also determined it in the bone ashes of the sheep as 3374-5149 ppm.

In the present study, the fluor concentrations analysed by specific fluor electrode determined in water samples taken from villages of Muradiye and Çaldıran were given in Table 1. Fluor levels of water samples taken from the villages of Muradiye town were lower than normal values. On the other hand, it was higher than normal values in the samples taken from villages of Çaldıran. Seasonal mean values of fluor in water samples according to towns were given in Figüre 1. Fluor levels in the water samples taken from Muradiye at January were 0.29 ± 0.05 ppm, at April 0.34 ± 0.36 ppm, at July 0.55 ± 0.46 ppm and October 0.55 ± 0.44 ppm. Although July and October values were higher than January and April values it wasn't statistically significant. Fluor levels in the water samples taken from Çaldıran at January was 1.78 ± 0.51 ppm, at April 1.59 ± 0.97 ppm, at July 2.03 ± 0.79 ppm and at October 2.38 ± 1.67 ppm. When January and April values compared with Jully and October values statistically important increases ($P < 0.05$) were seen during Jully and October.

Oruç , 1974 (20) also studied in the same region as in the present study and samples were taken from Aşağı Mutlu, Alakaya and Soğuksu villages of Çaldıran. Fluor concentration in water samples reported to be 7.5 ppm, 5 ppm and 2.5 ppm respectively using colorimetric method. However, in the present study water samples fluor concentrations were 2.404 ppm, 1.213 ppm and 1.599 ppm respectively using specific fluor electrode. Differences observed in this study compared to Oruç's study could be due to different methods used to determine fluor concentration.

In the present study, blood plasma concentrations of the sheep living in the villages of Muradiye and Çaldıran were given in Table 2. Fluor concentrations in the plasma samples examined in this study were higher than the values given in the literatüre (12,14). Seasonal mean values of fluor according to towns (in plasma samples) were given in Figüre 2. Fluor levels in the plasma samples taken from Muradiye at January were 0.52 ± 0.01 ppm, at April 0.44 ± 0.01 ppm, at July 0.51 ± 0.01 ppm and at October 0.75 ± 0.03 ppm January, April and July values were not statistically different. On the other hand, October values were higher than the values obtained at January, April and July.

Fluor levels in the plasma samples taken from Çaldıran at January were 0.55 ± 0.02 ppm, at April 0.48 ±0.02 ppm, at July 0.53 ±0.03 ppm and October 0.93 ± 0.05 ppm. From the result it can be seen that October values were higher statistically ($P<0.05$) compared to the other values. Results in this study show that autumn values (October) of both towns were higher than other seasons. The same stuation can also be seen when the Table 3 examined.

Fluorosis is an important problem for both public and animal health and also for economical losses. Therefore, radical precautions have to be taken to refine water contaminate with fluor.

For this purpose, new water sources having very low fluor concentrations need to be reach or clean water mixed with high concentrated water sources to reduce fluor concentration and put them to the consumption. Chemical ne ıtralisation of the fluor may well be applied to such water sources as reported by Girgin (26) who used Aliminum oxid treated with 1 N HCL. It was reported that 15 g treated $A1_2O_3$ aded to water containg 15 ppm fluor cause reduction in fluor concentration to 0.32 ppm. However such applications need to be throughly investigated then can be put forward for the consumption for both public and animal healths. Economical losses can also be reduced througly this way.

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#: Yüksek Lisans Tezinden özetlenmiş ve Y.Y.Ü. Bilimsel Araştırma Projeleri Başkanlığı tarafından 2000- VF-043 nolu proje olarak desteklenmiştir.