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CLINICAL AND RADIOLOGICAL PREVALENCE OF SKELETAL FLUOROSIS AMONG RETIRED EMPLOYEES OF WONJI-SHOA SUGAR ESTATE IN ETHIOPIA
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CLINICAL AND RADIOLOGICAL PREVALENCE OF SKELETAL FLUOROSIS AMONG RETIRED EMPLOYEES OF WONJI-SHOA SUGAR ESTATE IN ETHIOPIA

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ABSTRACT

Objective: **To study the clinical and radiological prevalence of skeletal fluorosis among the retired employees of Wonji-Shoa sugar estate.**
Design: **Retrospective and cross-sectional study.**
Setting: **Wonji-Shoa sugar estate, an agro-industrial estate located in the Ethiopian Rift Valley.**
Subjects: **Two hundred and sixty three employees of the estate who retired between 1995 and 1996.**
Main outcome measures: **Clinical evidence of impaired squatting, neck and lumbar mobility, kyphosis, and X-ray evidence of fluorosis.**
Results: **Skeletal fluorosis was more evident among the males ($p<0.05$), and the prevalence was higher among the factory and the agricultural workers than among the administrative workers ($p<0.05$). Clinical prevalence was 20% versus the radiological prevalence of 70.3%, indicating that many cases were asymptomatic. Impaired neck and lumbar mobility and impaired squatting significantly agreed with the radiological diagnosis ($p<0.05$) while kyphosis was not.**
Conclusion: **Further clinical and epidemiological studies are suggested and strengthening of the existing defluoridation programmes within the area is recommended.**

INTRODUCTION

Endemic fluorosis is widespread in the East African Rift Valley due to high fluoride levels in water resources(1). The presence of endemic fluorosis has been known in the Ethiopian part of the Rift Valley as early as 1970 but the first literature and sketchy reports came in the mid and late seventies(2-4). However, an extensive epidemiological and clinical survey of endemic dental and skeletal fluorosis including the geochemistry of fluoride within the Ethiopian Rift Valley was thoroughly studied and reported by Tekelehaimanot *et al*(5). Their study showed the magnitude and seriousness of endemic dental and skeletal fluorosis mainly in three districts, Wonji-Shoa, Alementa and Samiberta. The highest prevalence was in Wonji-Shoa which is one of the agro-industrial estates established in 1954 within the central Ethiopian Rift Valley. It occupies an area of 5000 hectares and at present it has about 8000 employees working in three sectors: the factory, agricultural, and administrative sectors.

Between 1976 and 1984, 530 workers retired from Wonji-Shoa sugar estate (WSSE) at the ages of 45-50 years because of inability to perform strenuous jobs(5). Subsequently workers at the time of retirement were required to undergo radiographic examination of the lumbar spines, pelvis and clinical examination for estimation of fluorosis related disability. Kyphosis, impaired squatting, impaired neck and lumbar mobility were used as clinical parameters for assessing fluorosis related disability. The objective of this study was to make an estimation of the prevalence of radiological and clinical skeletal fluorosis among the retirees of the years 1995 and 1996.

MATERIALS AND METHODS

Employees of WSSE who retired within the years 1995 and 1996 were included in the study. Demographic and clinical data were obtained from a report of the examining medical board. Completed medical board reports and the X-rays of the lumbar spine and pelvis included, were available for 263(85.4%) of 3 08 workers who retired, and those with complete medical and radiographic examination reports were included in the study. Retirees without complete medical board reports, 35(14.6%) were excluded. Kyphosis, impaired squatting, impaired neck and lumbar mobility were used as clinical parameters for assessing fluorosis related disability. The X-rays of the lumbar spine, including the pelvis, and lateral views were blindly examined by a consultant radiologist and graded according to the Roholm classification(6), which identifies three stages of skeletal fluorosis.

RESULTS

There were a total of 263 retirees with a mean age of 55 years. Thirteen retirees were females, comprising 4.9% of the total. The average duration of

service within the estate was 20 years. Among the study subjects, 106(40.3%) worked in the factory, 125(47.5%) worked in agricultural and 32(12%) worked in the administration sectors.

According to the stipulated criteria for fluorosis related-disability, 146(55.5%) individuals were found to have had no clinical disability. The remaining 117(44.5%) were identified as having had some degree of clinical disability. The prevalence of five clinical signs that may be related to skeletal fluorosis related disability were evaluated by the medical board as presented in Table I. Among the clinically disabled, 54(46%) had kyphosis, 82(70%) had impaired squatting, 67(57%) had impaired neck mobility and 85(72%) had impaired lumbar mobility. Impaired squatting, cervical and lumbar impaired mobility showed statistically significant agreement with radiological fluorosis ($P<0.05$), while clinical kyphosis did not (Table 2).

Table 1

Prevalence of clinical signs of skeletal fluorosis among employees of Wonji-Shoa Sugar Estate 1995-1996

Clinical sign	Present (%)	Absent (%)	Total (%)
Kyphosis	54 (21)	209 (79)	263 (100)
Impaired squatting	101 (39)	162 (61)	263 (100)
Impaired neck mobility	77 (29)	186 (71.0)	263 (100)
Impaired lumbar mobility	105 (40.2)	158 (59)	263 (100)
Total	117	146	263

Table 2

Prevalence and agreement levels of fluorosis between radiological and clinical fluorosis among retirees from Wonji-Shoa Sugar Estate during 1995 and 1996

Clinical disability	Radiology fluorosis Yes (%)	No (%)	Total	Agreement (%)	kappa	P-value
Kyphosis	43 (23.4)	11 (14.1)	54	41.8	0.062	0.05
Impaired squatting	82 (45.3)	19 (24.7)	101	53.6	0.152	0.001
Impaired neck mobility	67 (36.8)	10 (13.3)	77	51.3	0.167	0.001
Impaired lumbar mobility	85 (47.3)	18 (23.4)	103	55.9	0.185	0.001
Total	185	78	263			

Table 3

Distribution by sex, of the three stages (Roholm) of radiological skeletal fluorosis, among employees, of Wonji- Shoa Sugar Estate, who retired between 1995 and 1996

Sex	Stage I	Stage II	Stage III	Total
Male	108 (60%)	42 (23.3%)	30 (16.6%)	180
Female	5 (100%)	-	-	5
Total	113	42	30	185

Table 4

Distribution by work of three stages of radiological (Roholm) skeletal fluorosis among retired employees of Wonji-Shoa Sugar Estate factory who retired during 1995 and 1996

Work Place	Stage I	Stage II	Stage III	Total
Factory	37(45.1%)	25(30.4%)	20(24.3%)	82
Agriculture	64(71.1%)	16(17.7%)	10(11.1%)	90
Administration	12(92.3%)	1(7.7%)	-	13
P-value*	0.0003	0.0003		
Total	113(61%)	42(23%)	30 (16%)	185

Chi-Squared test with df=2 was applied

Radiological findings: Of the 263 subjects studied, 185 (70.3%) had radiological signs of skeletal fluorosis. Among those affected 113 (61.1%) had stage I fluorosis, 42(22.7%) had stage II fluorosis and 30 (16.2%) had stage III fluorosis. Out of these, 5 (2.7%) females had skeletal fluorosis. The distribution of the three stages of skeletal fluorosis among the study subjects by sex is shown in Table 3, and all females had stage I fluorosis. The radiological prevalence of all stages of skeletal fluorosis was 180/250(72%) for males and 5/13(38.5%) for the female retirees. This difference was statistically significant (p=0.02, Fisher's exact test). All women with skeletal fluorosis had stage I of the disease. The distribution of all stages of fluorosis among the study subjects according to occupation is shown in Table 4. The prevalence of radiological skeletal fluorosis was 82/106(77.4%) among the factory workers, 90/125(72%) among agricultural workers, and 13/32(40.6%3 among the administrative workers. The difference was statistically significant, (p=0.0003). Among the 13 administrative workers who were found to have skeletal fluorosis, 12 had stage I fluorosis while only one individual had stage II fluorosis. None had stage III fluorosis.

DISCUSSION

For the diagnosis of endemic skeletal fluorosis, a simple clinical examination is not enough because many cases may be undetected. Though dental mottling and pigmentations are among the earliest signs of chronic fluoride intoxication, its absence does not exclude the affliction of the skeletal system(7). In this study the prevalence of certain clinical signs suggestive of skeletal fluorosis was low as compared to the radiological prevalence, which ranged between 20.6%-40.2% for the whole group, and between 23.4%-47.3% within the radiologically fluorotic group, showing a low agreement level of 41.8%-55.9%. These findings suggest that many cases had asymptomatic skeletal fluorosis and are consistent with those of Jolly *et al*(9) and Tamboli and Mathur(8) who showed 19.7% and 20% respectively.

Teklehaimanot *et al*(5) reported a prevalence of 46% and 65% of skeletal fluorosis among symptomatic 530 retirees and 300 workers respectively, on radiological criteria, and crippling fluorosis among 30% of the latter group. Such apparent disagreement between the clinical and radiological detection could be due to radiological underdiagnosis and/or some clinical complaints and findings may be unrelated to skeletal fluorosis. The earlier and mild to moderate skeletal changes need proper and specific skeletal views, radiographic techniques and expert interpretations, as radiological changes are discernible in the skeleton at a much earlier stage, and provide the only means of diagnosing early and asymptomatic stage of skeletal fluorosis(10). The poor association of clinical kyphosis with radiological fluorosis in our study could be explained by the absence of advanced skeletal fluorosis with which it is often associated(11). Significant differences in the prevalence and stage of skeletal fluorosis are observed among the different occupation groups and can be explained by the physical strain and the environmental temperature they were working in(12,13). Gender differences can be explained by the same phenomenon even though one may need a comparative female population to make a strong and valid conclusion.

In conclusion we strongly recommend a further and extensive clinical and radiological epidemiological study for early detection and understanding of the exact magnitude of skeletal fluorosis among the WSSE employees by designing appropriate radiological and clinical criteria for early detection and diagnosis of skeletal fluorosis to circumvent crippling fluorosis, while reviving and strengthening the existing defluoridation programme. The best alternative would, of course be, another source of drinking water supply like the Awash River as has been organised for the town of Nazareth.

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