Sex ratio in the population of Ufa (Republic Bashkortostan) and in the offspring of people,exposed to 2,3,7,8-TCDD from 2,4,5-T plant in 1965-1967 (second and third generation)

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Abstracts

The considerable decrease in the sex ratio for offspring in 2,4,5-T cohort group in Ufa,"Khimprom" was established versus the data for the population as a whole with no deviations from the norms. The data obtained are compared with the blood TCDD levels in 1992 and/or in 1996/97 (experimentally) and 1967 (calculated).

Introduction

One of the potentional adverse effects of dioxin-like supertoxicants is their attac on the hormonal system of man.It is possible, that the sex ratio may be considered as biological marker of the toxicants effect such as PCDD/PCDFs,PCB and also of other unidentified factors on the population.

In paper[1] the male proportion for Canada population after 1970 was established to be decreased ($p<0,001$), namely in four regions studied, but only in the Atlantic region it was statistikally significant. For the United States the less-defined decline for the population as a whole ($p<0,001$) was recognised; in 4 of the 9 regions the decrease was significant ($p<0,05$), in 3 - it was not significant, and in 2 there was an increase in the male proportion, but it was statistically not significant.

The global changes in demographic rates of the populations of the whole countries can be related to the ecological loading of the territories.In some specific cases these changes may be more pronounced. In publication [3] the fact of the sex ratio alteration of Seveso population for the affection zone A is reported: from 35,13 % in 1984 (7 years after the accident) to 48% in 1984-1994 period, and later this alteration became statistically unsignificant.

But in the group of 9 families with high level of TCDD in serum samples from both parents (104-2340 ppt) the male births were not observed at all. In the group with a relatively low TCDD level (26-65 ppt) in blood samples from both parents such an observation was not fixed.

Investigation objective

2,4,5-T accident in Ufa in 1965-67 became commonly known due to the measuring by A.Schecter and J.Ryan [3,4] the PCDD/Fs levels in blood samples of workers in 1991-92. The toxicants levels in blood in that period of time ranged from 80 to 280 pg I-TEQ/g blood lipid.The blood measuring of women-workers were carried out too.The measuring the same values in four years and the data obtained have shown, that about 30% of 2,3,7,8-TCDD have been excluded and this has made it possible to evaluate the half-life of 9,7-12 years basing on the first order kinetics. It will be noted that the measurings were performed in time range 2 times as high as the half-life.

The cohort group in Ufa is in many respects unique:

1.128 workers had "chloracne"diagnosis.They were the young technical school-leavers of 20-22 years old not working before anywhere.

2. 78 the most exposed workers had worked the whole two years working period of the 2,4,5-T-plant, others were working about one year and possibly had the mean exposure level,although "chloracne" was fixed in most of workers.A part of them kept working at this plant.

3.Among workers there were 8 women-technical engineers and laboratory technicians, that have been exposed yet to PCDD/Fs on the pilot-scale testing in 1964 and later when working at the commercial -scale plant of 2,4,5-T.Five of these women are working here till now. All the exposed women had children.

4.Among young workers there was only one family,in which both parents were working at 2,4,5-T-plant. These parents had one son born in 1967. In all other cases the second partner did not belong to the exposed group.

5. All workers had on the average two children, both after the exposure ,except for one unmarried childless worker with "chloracne" diagnosed till now . None of the children does not work at the given chemical plant.

6. In cohort group there is a third generation-grandchildren.As far as our knowledge goes none of the parents of these children does not work at the given plant. At present for cohort group the measuring of the PCDD/PCDFs levels in blood along with the immunological investigations and the sociological questionnaire are carried out.

Of interest were the following questions:

- What is the sex ratio (SR) in offspring of the cohort group?
- Whether or not this sex ratio differs from the statistical mean data in district , town and in the Republic as a whole?
- Whether the sex ratio differs in offspring of exposed women and men, considering that the second partner in all families did not belong to the exposed group?
- Whether the relation exists between the blood PCDD/Fs levels if only of one of exposed parent and the sex ratio in offspring?
- What is the sex ratio in third generation of this cohort group?
- Whether the 2,4,5-T production within the precincts of Ufa ,and namely in the district 1 ,had affected the sex ratio in this district and others in 70-ties and what is the situation at present?

Results and discussion.

The birth-rate data and the sex-ratio of the birth live for 1959-1996 were obtained from the State Regional Statistical Department on the Republic as a whole , on Ufa and on distinct Ufa districts,including one (industrial district 1) with the chemical facility--an emission source of PCDD/Fs in 1965-1967. The data are listed in Table 1 along with the anologues estimates on two regions of Republic: the first of them is the remote forest region without the chemical facilities and intensive agriculture (region 1) and the second one can be represented as one more chemical centre , including also the chlorine chemistry in Republic (region 2).

Table 1. Children birth-rate in Republic Bashkortostan in 1959-1966, m/f (m-male ,f- female proportion)

Region of RB,districts of Ufa	1959	1970	1979	1989	1996	r-coeff. (0.95)	p-level
Republik Bashkortostan	53706/ 51718	32393/ 31443	32329/ 32329	38071/ 36573	23088/ 22140	0,5393	0,3483
Ufa	6930/ 6857	5740/ 5489	7385/ 7210	9278/ 8641	4799/ 4366	0,8917	0,0469
Districts of Ufa							
1	884/ 881	781/ 757	1110/ 1056	2070/ 1930	825/ 721	0,9468	0,0146
2	1025/ 1021	905/ 877	1288/ 1222	1547/ 1439	811/ 748	0,9943	0,0005
3	1011/ 1011	583/ 558	550/ 577	636/ 612	333/ 291	0,5913	0,2935
4	1623/ 1529	1560/ 1460	1706/ 1683	1883/ 1686	945/ 843	0,5755	0,3115
5	317/ 327	255/ 252	381/ 382	445/ 400	253/ 239	0,8163	0,0913
6	963/ 981	678/ 638	961/ 968	1131/ 1091	680/ 593	0,7070	0,1818
7	1107/ 1103	978/ 947	1389/ 1322	1566/ 1483	952/ 931	0,5141	0,3755
Regions of Republic Bashkortostan							
1	294/ 251	198/ 196	165/ 161	231/ 207	164/ 136	0,0760	0,9033
2	813/ 760	326/ 315	273/ 268	342/ 299	176/ 201	-0,4348	0,4644

The male proportion decrease in none of the Ufa districts, in Ufa itself and in the Republic as a whole is not detected (Fig.1-3).Only for Ufa and two districts of it (1,2) the relations appeared to be statistically significant. P-level is 0,0469, 0,0146 and 0,005, respectively.For one of two regions of RB with an essential difference in the ecological loading some decrease in the sex ratio is noted, but it is statistically unsignificant:p-level -0,46. For the RB as a whole the significant deviations from the mean 50,7214 were not established.

Cohort group of 2,4,5-T.

For the entire cohort group (n=128) the sex ratio accounts for 0,46 (115 females/98 males)[5].

From 12 women working in 1964-67 on the 2,4,5-T plant 10 women had "chloracne".For 8 of them we have performed the sociological questionnaire and estimated the PCDD/PCDFs level in the whole blood samples according to the method, described elsewhere [6]. For 5 of them we could compare the results of 1996/97 with that of J.Ryan [4].This allowed the half-life of 9,7-12 years to be estimated and the initial exposure level to be calculated (416-1544 ppt 2,3,7,8-TCDD).

The sex ratio in offspring of that women group is 0,5385 (7m/6f), in the third generation-5m/1f.

In the 2,4,5-T cohort droup there were 78 men having worked wholly 2 years on the 2,4,5-plant.For 48 men of them the data of the sociological questionnaire are available.For 4 men the blood PCDD/Fs level measuring was performed by J.Ryan in 1992 [3,4], the same data we have obtained in 1996/97 for 15 workers.To our regret the data on the individual persons failed to intersect and we could not use them for the half-life evaluation for the men of 2,4,5-T cohort group.So the 10 years half-life model was used for the final exposure period 1967. This value accounted for 200-1200 ppt 2,3,7,8-TCDD.From 48 men examinated in 1967/69 chloracne is diagnosed for 45,the diagnosis for one of them was negative. The statistical questionnaire was performed for 28 persons , in the period after 1965 they have born 60 children (24 male and 36 female),that corresponds to the sex ratio - 0,400. In the men grop with the estimated TCDD-level for 1967 > 500 ppt the sex ratio amounted to 0,3125.The third generation of the man portion in 2,4,5,-T cohort group has the sex ratio about 0,528 (19m/16f).

Conclusions.

1.Some decrease in the sex -ratio in offspring of the 2,4,5-T cohort group in Ufa was established; male proportion- 0,4600 (98 males vs.115 females.) in comparing with the mean level in Ufa-0,5112, in RB - 0,5074 in 1970 -the mean children birth year of the 2,4,5 - T workers.

2.For the limited numbers of people having worked for two years on the 2,4,5-T plant this value accounts for 0,4306.

3.For offspring of women with mean and high exposure levels the change in the sex - ratio from the normal one -0,5454 (7m/6f) is not fixed providing the second parent had no occupational contact with 2,4,5-T.

4.In the men group- workers of 2,4,5-T the offspring sex-ratio has a maximum departure from norms- 0,400 (24m/36f).

5.For 19 persons from the cohort group the 2,3,7,8-TCDD levels for 1992 and /or 1996 are known. The level for 1967 was calculated on base of the first order model. For high exposed group : 2,3,7,8-TCDD (1967) > 500 pg/g lipids, SR=0,3125 for men and 0,555 - for women.
For mean exposed group : 100 pg/g lipids < 2,3,7,8-TCDD (1967) <500 pg/g lipids, SR=0,50 for men.

6.In the third generation the sex ratio changes were not established.

Acknowledgement

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Literature Cited

(1) Allan, B. B.; Brant, R.; Seidel, J. E.; Jarrel, J. F. Can. Med. Assos. J.Jan. **1997**, 1, 156(1), 37-41
(2) Mocarelli, P.; Brambilla, P.; Gerthoux, P. M.; Patterson Jr., D. G.; Needham, L. L. The Lancet. **1996**,348, aug. 10, 409.
(3) Schecter, A.; Ryan, J.J.; Papke, O.; Ball, M.; Jis, A. Chemosphere. **1993**, 27, 253-258.
(4) Schecter, A.; Ryan, J.J.; Papke, O. Chemosphere.**1994**, 29, 2361-2370.
(5) Basharova, G.R.Dioxin'96,**1996**,30,315-318.
(6) Amirova,Z.K.,Kruglov, E.A.,Loshkina,E.A.Dioxin'95, **1995**,26,169-171.

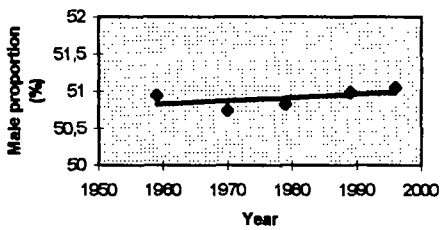


Figure 1. Estimated trend in the male proportion in RB from 1959 to 1996

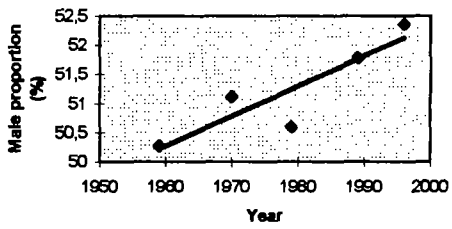
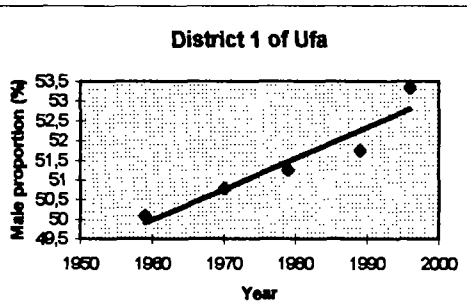
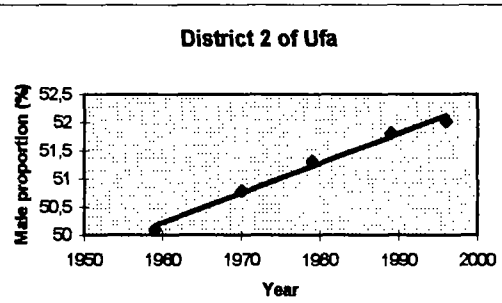
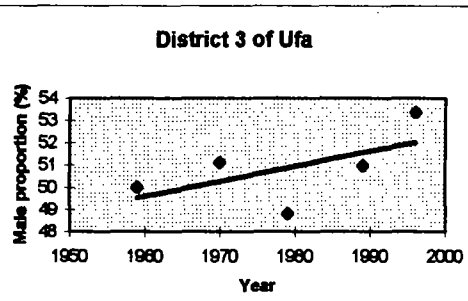
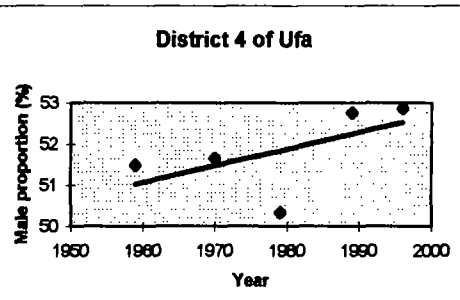


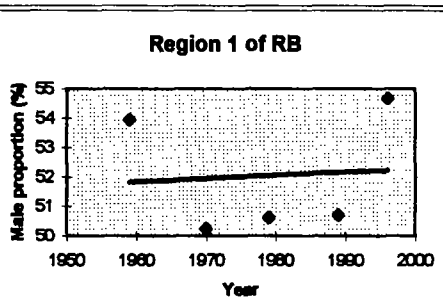
Figure 2.Estimated trend in the male proportion in Ufa from 1959 to 1996











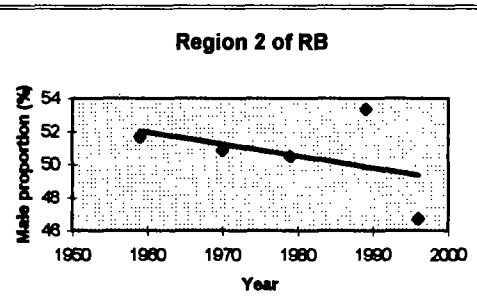


Figure 3. Estimated in the male proportion in RB from 1959 to 1996 .