X AND Y CHROMATIN SURVEY AMONG 1,581 JAPANESE JUVENILE DELINQUENTS

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Summary Consecutive X and Y chromatin survey among 1,581 Japanese juvenile delinquents had been undertaken for three years. Among 1,371 males, five 47,XYY males and four 47,XXY males were found (0.36% and 0.29% respectively), while no numerical abnormalities of X chromatin were found in 210 females. Frequency of 47,XYY males in the present study is significantly higher than that of newborns. With respect to sample size, for which the frequencies of 47,XYY and 47,XXY males have been estimated, a possible bias in the studies reported previously was suggested.

INTRODUCTION

Since the original study of Jacobs *et al.* (1965), many authors have reported an unusually high frequency of 47,XYY males among criminals. The present study was undertaken to estimate the frequency of abnormal sex chromosome individuals among Japanese juvenile delinquents. The present finding in male delinquents will be discussed in connection with the results of previous studies.

MATERIALS AND METHODS

X and Y chromatin survey was performed on consecutive cases for a period from February 12, 1974 to February 11, 1977 at Yokohama Juvenile Detention and Classification Home. With the consent of the subject, new admissions were screened on weekly or biweekly basis. X chromatin screening by cresyl-violet staining of buccal smear was performed in both sexes, and Y chromatin by quinacrine mustard staining of blood smear only in males. If numerical abnormalities of chromatin were indicated, peripheral lymphocyte culture and karyotyping were performed.

During the period of three years, the total numbers of admissions excluding non-Japanese were 1,670 males and 251 females, among whom 1,371 males and 210 females were examined.

RESULTS

Double Y chromatin bodies were found in five males and the karyotype was confirmed to be 47,XYY in all cases by standard Giemsa and quinacrine mustard stainings. Four males with positive X chromatin had a 47,XXY constitution. None of the females showed numerical X chromatin abnormality.

DISCUSSION

Among 1,371 males, five 47,XYY males and four 47,XXY males were found, and the frequencies are 0.36% and 0.29%, respectively. Table 1 shows the results of previous surveys on the frequencies of 47,XYY and 47,XXY males among juvenile

Table 1. Surveys of 47,XYY and 47,XXY males among juvenile delinquents.

	Authors	Country	Examined No.	XYY	XXY
1	Wegmann and Smith (1963)	U.S.A.	505	—	0
2	Inouye and Kurihara (1969)	Japan	2,361	—	5
3	Marinello <i>et al.</i> (1969)	U.S.A.	15	0	—
4	do.		42	1	—
5	Kahn <i>et al.</i> (1969)	England	387	2	0
6	do.		200	0	2
7	Ferrier <i>et al.</i> (1969)	U.S.A.	103	0	2
8	Matsaniotis <i>et al.</i> (1970)	Greece	59	1	1
9	do.		80	1	0
10	Hook and Kim (1971)	U.S.A.	337	4	2
11	Hübner (1971)	Poland	30	0	0
12	Asaka <i>et al.</i> (1971)	Japan	113	1	2
13	Jacobs <i>et al.</i> (1971)	Scotland	607	1	2
14	do.		1,119	4	2
15	Nielsen and Henriksen (1972)	Denmark	151	3	2
16	Dodson <i>et al.</i> (1972)	U.S.A.	475	0	0
17	Forsius <i>et al.</i> (1972)	Finland	145	1	0
18	Mekanandha and Banpotkasem (1972)	Thailand	100	1	1
19	Murken (1973)	Germany	110	1	1
20	do.		147	1	2
21	Kovács <i>et al.</i> (1973)	Hungary	173	1	—
22	Borgaonkar (after Hook 1973)	U.S.A.	1,112	2	0
23	de Toni (after Hook 1973)	Italy	145	2	—
				27/5,650 (0.48%)	24/8,141 (0.29%)
	Present study		1,371	5 (0.36%)	4 (0.29%)

—: This indicates that the survey was not performed.

Table 2. Frequencies of 47,XYY and 47,XXY males among newborn males.

Authors		Country	XYY		XXY	
Sergovich <i>et al.</i>	(1969)	Canada	4/	1,066 (0.38%)	1/	1,066 (0.09%)
Lubs and Ruddie	(1970)	U.S.A.	3/	2,184 (0.14%)	4/	2,184 (0.18%)
Bochkov <i>et al.</i>	(1974)	U.S.S.R.	0/	1,303 (0%)	1/	1,303 (0.08%)
Jacobs <i>et al.</i>	(1974)	Scotland	10/	7,849 (0.13%)	9/	7,849 (0.11%)
Bell and Corey	(1974)	Canada	5/	5,395 (0.09%)	40/37,	233 (0.11%)
Nielsen and Sillesen	(1975)	Denmark	3/	5,761 (0.05%)	6/	5,761 (0.10%)
Hamerton <i>et al.</i>	(1975)	Canada	4/	7,176 (0.06%)	6/	7,176 (0.08%)
Goad <i>et al.</i>	(1976)	U.S.A.	4/	8,011 (0.05%)	20/20,	666 (0.10%)
Iijima and Higurashi	(1976)	Japan	3/	2,645 (0.11%)	—	
Walzer and Gerald	(1977)	U.S.A.	11/13,	751 (0.08%)	9/13,	751 (0.07%)
Total			47/55,	141 (0.09%)	96/96,	989 (0.10%)

Table 3. Previously reported frequencies of 47,XYY and 47,XXY males among juvenile delinquents according to population size.

Population size	Pooled frequency of 47,XYY males	Pooled frequency of 47,XXY males	No. of report in Table 1.
≤100	4/ 326 (1.23%)	2/ 269 (0.74%)	3.4.8.9.11.18
101–200	10/1,287 (0.78%)	11/ 969 (1.14%)	6.7.12.15.17.19.20.21.23
201–500	6/1,199 (0.50%)	2/1,199 (0.17%)	5.10.16
>501	7/2,838 (0.24%)	9/5,704 (0.15%)	1.2.13.14.22

delinquents. Corresponding figures among newborns are in Table 2. Present results do not differ significantly from pooled frequencies of previous studies on juvenile delinquents. The present figure on 47,XYY males differs significantly from that of 47,XYY males among newborns ($\chi^2=11.9$, d.f.=1, $p<0.01$). Although no significant difference in the frequency of 47,XXY males is seen between the present and newborn surveys, the difference is close to the significant level.

A tendency is noted in Table 1 that as the sample size increases, the frequency of 47,XYY males decreases. If the previous studies in this table are divided into four groups with respect to a sample size, the pooled frequency decreases from 1.23% in the first group with a sample size fewer than 100 to 0.24% in the last group with a sample size of more than 500, as seen in Table 3.

This result suggests the possibility that, if the sample size is small, negative data may have been discarded or may not have been reported. Therefore, caution should be exercised in findings with a sample size of less than 100 or 200. If we take the results of the studies with more than 200 subjects, the frequency of 47,XYY males among juvenile delinquents is estimated approximately 0.35%, which closely agrees with the present figure. In case of 47,XXY males, the association of the frequency with sample size is less clear than that in 47,XYY males. However the pooled frequencies of the studies on more than 200 subjects (0.16%) is evidently lower than the rest which examined fewer than 200 subjects (1.05%).

From this point of view, we may conclude that the frequency of 47,XYY males among juvenile delinquents as well as among criminals or mental defectives may have been overestimated in the previous studies. However, the association of 47,XYY males with criminality cannot be ruled out, because the frequency of such individuals among juvenile delinquents are higher than that of newborn by all means.

REFERENCES

- Asaka, A., Takemura, S., Inouye, E., Kayaba, T., Kajimura, Y., Miyazawa, S., Aoki, N., and Sugimoto, K. 1971. XXY and XYY individuals among Japanese juvenile delinquents. *Acta Crim. Jpn.* **37**: 297-298.
- Bell, A.G. and Corey, P.N. 1974. A sex chromatin and Y body survey of Toronto newborns. *Can. J. Genet. Cytol.* **16**: 239-250.
- Bochkov, N.P., Kuleshov, N.P., Chebotarev, A.N., Alekhin, V.I., and Midian, S.A. 1974. Population cytogenetic investigation of newborns in Moscow. *Humangenetik* **22**: 139-152.
- Dodson, W.E., Al-Aish, M.S., and Alexander, D.F. 1972. Cytogenetic survey of XYY males in two juvenile court populations. -with a case report- *J. Med. Genet.* **9**: 287-288.
- Ferrier, P.E., Ferrier, S.A., and Nielson, J. 1969. Chromosome study in a group of maladjusted boys with antisocial behaviour. *Ann. Génét.* **12**: 247-249.
- Forsius, H., Kaski, U., Schröder, J., and de la Chapelle, A. 1972. Is there a common psychopathology of XYY boys? A clinical report on three cases of XYY and one XY/XYY. *Acta Paedopsychiatr.* **39**: 28-41.
- Goad, W.B., Robinson, A., and Puck, T.T. 1967. Incidence of aneuploidy in a human population. *Am. J. Hum. Genet.* **28**: 62-68.
- Hamerton, J.L., Canning, N., Ray, M., and Smith, S. 1975. A cytogenetic survey of 14069 newborn infants. *Clin. Genet.* **8**: 223-243.
- Hook, E.B., 1973. Behavioral implications of the human XYY genotype. *Science* **179**: 1-14.
- Hook, E.B. and Kim, D.S. 1971. Prevalence of XYY and XXY karyotypes in 337 nonretarded young offenders. *New. Engl. J. Med.* **283**: 410-411.
- Hübner, H. 1971. The Y chromosome in selected groups of men of the polish population. *Bull. Acad. Pol. Sci.* **19**: 467-472.
- Iijima, K. and Higurashi, M. 1976. Incidence of XYY in consecutive newborn males in Japan. *Jap. J. Hum. Genet.* **21**: 199-203 (in Japanese w. English abstract).
- Inouye, W. and Kurihara, T. 1969. Chromosome anomalies among criminals. *Clinic All-round* **18**: 127-134 (in Japanese).
- Jacobs, P.A., Brunton, M., Melville, M.M., Brittain, R.P., and McClellmont, W.F. 1965. Aggressive behaviour, mental sub-normality and the XYY male. *Nature* **208**: 1351-1352.
- Jacobs, P.A., Price, W.H., Richmond, S., and Ratcliff, R.A.W. 1971. Chromosome surveys in penal institutions and approved schools. *J. Med. Genet.* **8**: 49-53.
- Jacobs, P.A., Melville, M., Ratcliffe, S., Keay, A.J., and Syme, J. 1974. A cytogenetic survey of 11680 newborn infants. *Ann. Hum. Genet.* **37**: 359-376.
- Kahn, J., Carter, W.I., Dernley, N., and Slater, E.T.O. 1969. Chromosome studies in remand home and prison populations. In *Criminological Implications of Chromosome Abnormalities* (West, D.J. ed.) Cambridge.
- Kovács, M., Sellyei, M., Szabo, A., and Vass, L. 1973. Occurrence of XYY individuals among juvenile delinquents in Hungary. *Humangenetik* **18**: 85-87.
- Lubs, H.A. and Ruddle, F.H. 1970. Chromosomal abnormalities in the human population-estimation of rates based on New Haven newborn study. *Science* **169**: 495-497.

- Marinello, M.J., Berkson, R.A., Edwards, J.A., and Bannerman, R.M. 1969. A study of the XYY syndrome in tall men and juvenile delinquents. *J.A.M.A.* **208**: 321-325.
- Matsaniotis, N., Tsenghi, C., Metaxotou-Stavridaki, C., Economou-Mavrou, C., and Bilalis, P. 1970. The XYY syndrome in young Greek detainees. *Helv. Paediatr. Acta* **3**: 253-257.
- Mekanandha, V. and Banpotkasem, S. 1972. Cytogenetic study in severe juvenile delinquents. *J. Med. Assoc. Thailand* **55**: 32-35.
- Murken, J.D. 1973. The XYY syndrome and Klinefelter's syndrome: Investigations into epidemiology, clinical picture, psychology behavior and genetics. In *Topics in Human Genetics* Vol. II, Becker, P.E. *et al.* eds. Georg Thieme Pub. (Stuttgart).
- Nielsen, J. and Henriksen, F. 1972. Incidence of chromosome aberrations among males in a Danish youth prison. *Acta. Psychiatr. Scand.* **48**: 87-102.
- Nielsen, J. and Sillesen, I. 1975. Incidence of chromosome aberrations among 11148 newborn children. *Humangenetik* **30**: 1-12.
- Sergovich, F., Valentine, G.H., Chen, A.T.L., and Kinch, R.A.H. 1969. Chromosome aberrations in 2159 consecutive newborn babies. *New. Engl. J. Med.* **280**: 851-855.
- Walzer, S. and Gerald, P.S. 1977. A chromosome survey of 13751 male newborns. In *Population Cytogenetics—Studies in Humans—*, Hook, E.R. and Porter, I.H., eds. Academic Press New York.
- Wegmann, T.G. and Smith, D.W. 1963. Incidence of Klinefelter's syndrome among juvenile delinquents and felons. *Lancet* **i**: 274.