

## Neuroticism and Extraversion in Turner's Syndrome

Willy Bækgaard and Helmuth Nyborg  
Institute of Psychology, University of Aarhus, Denmark

Johannes Nielsen  
Cytogenetic Laboratory, The Aarhus State Hospital, Denmark

The Maudsley Personality Inventory (MPI) was administered to girls with Turner's syndrome, their sisters, nonsiblings with growth retardation and primary amenorrhea, and to nurses. The results were compared to English and American normative values. The total group of Turner girls obtained a low Neuroticism (N) score compared to the control groups. When the total group was divided on the basis of their karyotypes, the low N score could be referred solely to girls with karyotype 45X, who scored significantly lower than any other group tested so far with the MPI. Turner girls with chromosomal abnormalities other than 45X scored within normal limits. No variables other than karyotype 45X were related to an extremely low N score. It was accordingly concluded that exceptional emotional stability, as reflected in a very low N score on the MPI, is concomitant with the total absence of one sex chromosome, probably due to a developmental abnormality of the central nervous system.

Girls with Turner's syndrome (Turner, 1938) lack a whole or part of a sex chromosome in all or a portion of their cells. Girls with Turner's syndrome are always growth retarded. They have primary amenorrhea and undeveloped secondary sex characteristics. Sometimes they also have cubitus valgus, webbed neck, and/or other physical aberrations. In clinical and developmental studies, Turner girls are often described as remarkably emotionally stable; they exhibit a compliant, equable, and accepting manner, with a relatively high tolerance for adversity (Nielsen, Nyborg, & Dahl, 1977).

The clinical description of Turner girls fits remarkably well with the normative description of a person scoring low on the Neuroticism (N)

scale (low N score) of the Maudsley Personality Inventory (MPI; Eysenck, 1962). According to Eysenck, a person with a low N score exhibits extraordinarily stable emotions, she is not easily aroused, is calm and even tempered, and has a high degree of tolerance for stress. The opposite end of the dimension—the Neuroticism pool—refers to the general emotional instability of a person with labile, strong, and easily aroused emotions.

The coincidence between the clinical description of Turner girls and Eysenck's normative description of a person with a low N score led Nielsen et al. (1977) to test the hypothesis that Turner girls could be found at the extreme stability end of the MPI (i.e., they were expected to obtain a low N score). This hypothesis was confirmed: Turner girls obtained a lower group mean N score than did their age-matched sisters with no chromosomal aberrations, no growth retardation, and no abnormal sexual development.

However, some differences were evident within the Turner group. The main purpose of the present study was to investigate whether the karyotype was an important factor in determining N and E (Extraversion) scores in a group of girls with abnormal sex chromosome complements. The Turner group was divided on the basis of karyotypes. The mean N and E scores of the

---

The karyotypings were made by Gudrun Dahl, MD, John F. Kennedy Institute, Copenhagen, Denmark. The manuscript was prepared while the second author was awarded a senior research fellowship from the Alexander von Humboldt-Stiftung, Bonn, West Germany. The study was supported by Danish Medical Research Council Grants 515-685 and 512-3194 to Helmuth Nyborg and is part of a larger study on the psychological, psychiatric, educational, and social development of females with Turner's syndrome.

Requests for reprints should be sent to Helmuth Nyborg, Institute of Psychology, University of Aarhus, 4 Asylvej, 8240 Risskov, Denmark.

two groups were compared to each other and to the mean scores of control groups.

### Method

#### Subjects

A total of 31 girls with Turner's syndrome were given the MPI; 13 of the Turner girls had karyotype 45X, whereas the other 18 Turner girls had other types of sex chromosome abnormalities and comprised the "other karyotypes" group. The ages of Turner girls with karyotype 45X, ranged from 16 to 26 years, with a mean of 19 years 2 months, whereas the mean age of Turner girls with other karyotypes was 26 years 11 months, with a range of 16 to 39 years.

And 16 of the Turner girls had normal sisters who were less than 5 years older or younger. These sisters consented to take the MPI and served as the sister control group. Their mean age was 24 years 2 months, with a range of 18 to 39 years. Another control group consisted of nine girls with growth retardation and primary amenorrhea as seen in Turner girls but without chromosome abnormalities. They were the nonsibling control group. The mean age in this group was 22 years 4 months, with a range of 17 to 30 years. Finally, 19 nurses served as a normal control group; their mean age was 22 years 8 months, with a range of 21 to 28 years.

#### Instrument and Scoring

According to Eysenck (1962), the MPI measures two relatively independent dimensions of

personality—neuroticism and extraversion—using two tests consisting of 24 questions each, each test having a maximum score of 48 and a minimum of 0. A high N score indicates neuroticism, a high E score points to extraversion. Each subject was tested individually with the MPI.

#### Analysis

The N and E scores were divided into the following groups:

1. all Turner girls ( $n = 31$ ),
2. Turner girls with karyotype 45X ( $n = 13$ ),
3. other karyotypes group ( $n = 18$ ),
4. sister control group ( $n = 16$ ),
5. nonsibling control group ( $n = 9$ ), and
6. nurses control group ( $n = 19$ ).

In addition, control values on the MPI from English women (Group 7: English norm group,  $n = 200$ ) and American students (Group 8: American norm group,  $n = 1,064$ ) were used. The mean N and E scores of the groups were compared for differences.

### Results

#### Neuroticism Scores

Significant differences in N score (see Table 1) were neither found between Groups 6, 7, and 8,  $F(2, 1280) = 1.21, p > .05$ , nor between Groups 4, 5, and 6,  $F(2, 41) = 1.27, p > .05$ . The N score in Group 1 was significantly lower than the combined mean of Control Groups 4,

Table 1  
Group Mean Neuroticism Score and Extraversion Score

Group	n	M age			Neuroticism score		Extraversion score	
		Years	Months	SD	M	SD	M	SD
1. Turner total group	31	23	8	5.99	16.87 <sup>a</sup>	9.26	26.84	9.08
2. Turner: karyotype 45X	13	19	2	3.58	11.62 <sup>b</sup>	6.06	31.23 <sup>c</sup>	7.37
3. Turner: other karyotypes	18	26	11	6.04	20.67	9.43	23.67	9.04
4. Sister control group	16	24	2	6.89	23.88	10.94	26.63	7.15
5. Nonsibling control group	9	22	4	4.59	22.00	7.62	30.25	9.22
6. Nurses control group	19	22	8	1.94	19.21	6.80	25.05	5.76
7. English norm group	200	—	—	—	19.45	11.02	25.17	9.33
8. American norm group	1064	—	—	—	20.66	10.65	28.73	8.18

<sup>a</sup> Significantly different from the mean of Groups 4, 5, and 6,  $t(73) = 2.17, p < .05$ .

<sup>b</sup> Significantly different from the mean of Groups 4, 5, and 6,  $t(55) = -3.78, p < .001$ .

<sup>c</sup> Significantly different from the mean of Groups 4, 5, and 6,  $t(55) = -4.59, p < .001$ .

5, and 6  $t(73) = 2.17$ ,  $p < .05$ . The N score obtained by Group 2 was significantly lower than the combined mean of Control Groups 4, 5, and 6,  $t(55) = -3.78$ ,  $p < .001$ . No significant differences in N scores were found between Group 3 and the combined mean of Control Groups 4, 5, and 6,  $t(60) = -.32$ ,  $p > .05$ .

#### *Extraversion Scores*

No significant differences in mean E score (see Table 1) were found between Groups 6 and 7,  $t(217) = -.06$ ,  $p > .05$ , whereas the differences between Groups 6 and 8,  $t(1,081) = -1.95$ ,  $p > .051$ , and between Groups 7 and 8,  $t(1,262) = -5.52$ ,  $p < .05$ , were significant. The E score for Groups 4, 5, and 6 did not differ significantly,  $F(2, 41) = 1.55$ ,  $p > .05$ . The mean score for Group 1 did not differ from the combined mean of Control Groups 4, 5, and 6,  $t(73) = -.12$ ,  $p > .05$ . However, Group 2 obtained a score that was significantly higher than the combined mean E score of Groups 4, 5, and 6,  $t(55) = -4.59$ ,  $p < .001$ .

The E scores obtained by Group 3 did not differ significantly from the combined mean of Control Groups 4, 5, and 6,  $t(60) = -1.23$ ,  $p > .05$ .

The correlations between N or E scores and age were insignificant, as were age trend analyses. The correlations between N and E scores were insignificant.

#### Discussion

It is important to establish appropriate control groups in order to distinguish the effect of sex chromosome abnormalities in girls with Turner's syndrome from the effects of growth retardation and abnormal sexual development typically observed in these girls (Nyborg & Nielsen, 1977). The sisters of the Turner girls served as one control group (Group 4) in the present study; they had normal karyotypes and showed no abnormalities in growth or sex characteristics. Because Turner's syndrome is most probably randomly distributed in a given population, the sister control group represented a random sample of normal subjects. The nonsiblings (Group 5) served as controls for the effects of abnormal sexual development and retarded growth on the MPI. Possible effects of age were ruled out because the groups were of comparable age, and age trend and correlational analyses gave insignificant results.

Since the MPI is not standardized in Den-

mark, a control group of Danish nurses was used to establish the normal values for the MPI in Denmark. No differences in N scores between the nurses control group (Group 6) and the English and American norm groups (Groups 7 and 8, respectively) were found, whereas the E score of the American norm group was significantly higher than the scores of Groups 6 and 7. However, the mean E score in Groups 6 and 7 did not differ. Evidently, the Danish translation of the MPI was not seriously biased.

The total Turner group (Group 1) scored lower than any of the comparison groups on the Neuroticism scale; the difference between Group 1 and the combined mean of Control Groups 4, 5, and 6 reached significance ( $p < .05$ ). It is evident, however, that the source of the low N score in the total Turner group was due to Turner girls with karyotype 45X, since Turner girls with other chromosomal abnormalities obtained scores similar to those of the controls on the Neuroticism scale. It is interesting to note that the N score obtained by Turner girls lacking an X chromosome is the lowest mean reported in a group given the MPI (cf. Eysenck, 1967). According to these findings, Turner girls are not a homogeneous group with respect to emotional stability but differ in relation to the amount of X chromosomal material lacking.

Primary amenorrhea, sterility, lack of secondary sex characteristics, and retarded growth in girls lacking one X chromosome cannot explain the low N score because the nonsibling control group, who presented the same signs as the Turner girls, nevertheless performed within the normal limits on the Neuroticism scale. Neither can physical nor other factors considered as concomitant with Turner's syndrome explain the result because only birth weight was significantly related to N score ( $p < .04$ ), but the relation was not specific to Turner girls with karyotype 45X (Nielsen et al., 1977). It was therefore concluded that the extreme emotional stability indicated by the low N score in Turner girls with karyotype 45X is most probably an expression of the lack of one X chromosome.

According to Eysenck, a low N score indicated emotional stability and high tolerance for psychological stress in frustrating situations. Turner girls do, in fact, usually show a high tolerance for stress (Money & Mittenhal, 1970). They are often teased in school and face the problems of delayed sexual development, stunted growth, and infertility. They usually cope remarkably well with these potentially frustrating situations (Nielsen et al., 1977). However, be-

cause girls with Turner's syndrome seem all too easily to accept authority, overprotection probably has an unfavorable effect on these girls. Nielsen et al. therefore proposed that these girls should be more strongly urged to realize whatever potentials they may have in order to cope with the social demands.

Turner girls with karyotype 45X obtained a significantly higher E score than did Turner girls with other karyotypes. The observation that Turner girls with karyotype 45X scored significantly higher on the E scale than Turner girls with other chromosomal abnormalities further indicates that girls with Turner's syndrome are not a homogeneous group.

It is interesting to speculate whether the characteristic low N score and the high E score in Turner girls lacking one X chromosome may be due to a developmental abnormality of the central nervous system. Thus, lack of X chromosomal material may influence the early development of the central nervous system and later the development of the higher cerebral integrative functioning due to some effect on cell division (mitotic rate) during embryonic brain development with disturbances in the interrelations of cell divisions, cell growth, and cell migration (Barlow, 1973).

### References

- Barlow, P. The influence of inactive chromosomes on human development. *Human Genetics*, 1973, 17, 105-136.
- Eysenck, H. J. *The Maudsley Personality Inventory*. San Diego, Calif.: Educational and Industrial Testing Service, 1962.
- Eysenck, H. J. *The biological basis of personality*. Springfield, Ill.: Charles C Thomas, 1967.
- Money, J., & Mittlethal, S. Lack of personality pathology in Turner's syndrome: Relation to cytogenetics, hormones, and physique. *Behavior Genetics*, 1970, 1, 43-56.
- Nielsen, J., Nyborg, H., & Dahl, G. *Turner's syndrome. A psychiatric-psychological study of 45 women with Turner's syndrome, compared with their sisters and women with normal karyotype, growth retardation and primary amenorrhoea*. Aarhus, Denmark: Acta Jutlandica. Det lærde Selskab. Aarhus Universitet, 1977.
- Nyborg, H., & Nielsen, J. Sex chromosome abnormalities and cognitive performance. III. Field dependence, frame dependence, and failing development of perceptual stability in girls with Turner's syndrome. *Journal of Psychology*, 1977, 96, 205-211.
- Turner, H. H. A syndrome of infantilism, congenital webbed neck and cubitus valgus. *Endocrinology*, 1938, 23, 566-574.

Received March 22, 1978 ■