

The Medicolegal Usefulness of the Kidd System in Exclusion of Parentage

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Summary. The blood samples of 2741 people from Germany were examined. The gene frequencies of Jk^a was found to be 0.49345 and of Jk^b 0.50655. The theoretical probability of exclusion lies at 18,57 %, the practical one only at 7.09 %, because, in many cases, the presumptive father is also the biological father. It is a system of dependable information. The Kidd system can be used as a classical system for exclusion of parentage.

Zusammenfassung. Es wurden 2741 Personen aus dem süddeutschen Raum untersucht. Die Genfrequenzen für Jk^a lauten 0,49345 und für Jk^b 0,50655. Es ergibt sich eine theoretische Ausschlußwahrscheinlichkeit von 18,57 % und eine praktische von lediglich 7,09 %, weil in vielen Fällen der vermutete Vater auch der biologische Vater ist. Es handelt sich um ein System mit hohem Informationsgehalt. Einem klassischen Ausschluß kann volle Beweiskraft zugesprochen werden.

Key words. Jk-blood system – Jk phenotype distribution, gene frequency – Kidd-System.

In 1959 the rare phenotype $Jk(a-b-)$ was found in a Philippino of Spanish and Chinese ancestry. It is suspected that such persons are homozygous for a third allele Jk . Since then the phenotype $Jk(a-b-)$ has often been found in Mongols as well as in persons of mixed races. This phenotype is seldom seen in the European population. However in 1961 Crawford et al. found a family that showed this rare phenotype for three generations.

In addition in 1968 Race and Sanger reported the cases of an English family and a Finnish family both with a $Jk(a+b-)$ father and a $Jk(a-b+)$ child.

In the following study we investigated the Kidd phenotype and gene frequency in a random sample in Germany. The medicolegal usefulness of this information as applied to the exclusion of parentage will be discussed.

2741 persons were tested. 0.05 ml anti- $Jk(a+)$ serum and 0.05 ml anti- $Jk(b+)$ serum of the firms Biotest (Frankfurt) and Molter (Heidelberg) were used. We specified the agglutination intensity of the supervision as ++.

Table 1. Phenotype distribution

Phenotype	observed values		expected values		X^2
	n	%	n	%	
Jk(a+b-)	686	25.03	667.43	24.35	0.516
Jk(a+b+)	1333	48.63	1370.23	49.99	1.011
Jk(a-b+)	722	26.34	703.34	25.66	0.495
Sum	2741	100.00	2741.00	100.00	2.022 df = 1

Gene frequency Jk^a: 0.49345Gene frequency Jk^b: 0.50655**Table 2.** Mother-Child-Association

Mother/Child	Jk(a+b-)	Jk(a+b+)	Jk(a-b+)	n
Jk(a+b-)	138	165	0	303
Jk(a+b+)	136	282	143	561
Jk(a-b+)	0	124	129	253
Sum	274	571	272	1117

Table 1 shows a comparison of the observed and expected values. The X^2 -test showed no significant ($X^2 = 2.022$; df. = 1; $0.20 > p > 0.10$). The random sample was genetically in equilibrium and is in accordance with the Hardy-Weinberg-Law.

Using information obtained from mother-child-typing, the hypothesis of inheritance can be demonstrated according to the co-dominance principle. That is, 1) a person cannot possess a blood factor that is absent from the blood of both father and mother; 2) a blood factor cannot be absent in a person of one of his parents is homozygous for this factor; 3) if a parent is heterozygous for a factor of which both alleles can be demonstrated by suitable tests, his child must possess a blood factor corresponding to one of these two alleles.

A heterozygous mother with the phenotype Jk(a-b+) cannot bear children with the phenotype Jk(a+b-) and visa versa. This is proven through the frequency pattern seen.

According to the Robert-Koch-Institute a person can be excluded from parentage when the hypothesis of inheritance is established with a certainty of 1 : 500. It can be seen in Table 2 that in our studies no opposing homozygous examples were observed. We can say that the certainty of 1 : 500 is attained. The Kidd system can be used successfully as a classical system for exclusion of parentage.

The theoretical probability of exclusion lies at 18.75 % (calculation after formula I, Prof. Steinhaus, regarding the allele frequency) respectively 18.40 % (calculation after formula II, Prof. Steinhaus, regarding the frequency of heterozygous), mean value 18.57 %, that is using the Kidd system out of 100 cases 18 can be excluded.

In this study 89 out of 1256 fathers were excluded of parentage; that is an exclusion probability of 7.09 %. The practical probability of exclusion naturally lies beneath the theoretical probability of exclusion, as the presumptive father is also often the biological one.

Table 3. Kidd-exclusion in serological and genetic testing**A. Serological evidence**

	one father disputed		two fathers disputed		more than two fathers disputed						
Men	accu- sed	plain- tiff	accu- sed	wit- ness	plain- tiff	wit- ness	accu- sed	wit- ness	plain- tiff	wit- ness	total
n	380	119	113	113	43	43	31	3	75	5	925
exclusion (n)	21	10	4	7	20	1	0	0	9	3	75 ⁺
exclusion (%)	5.53	8.40	3.54	6.19	46.51	2.33	0	0	12	60	8.11

B. Genetic evidence

n	269	62	331
exclusion (n)	4	10 (6 witnesses, 2 accused, 2 plaintiffs)	14
exclusion (%)	1.49	16.13	4.23

+ 3 exclusions occurring only in the Kidd system

2 cases of child Jk(a+b-), mother Jk(a+b-) -- accuses respectively plaintiff Jk(a-b+)

1 case of mother Jk(a+b-), child Jk(a+b+) -- witness Jk(a+b-)

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