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ADENOSINE DEAMINASE POLYMORPHISM IN A SWEDISH POPULATION[1]

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SUMMARY

Adenosine deaminase (ADA) isoenzymes in a Swedish population of 342 unrelated individuals have been determined according to the method of Spencer et al. (1968). The gene frequencies found were 0.9357 and 0.0643 for ADA 1 and ADA 2 respectively. These frequencies are in good accordance with previous investigations.

Adenosine deaminase (ADA) is an enzyme that deaminates adenosine into inosine. The detection of this enzyme activity after gel electrophoresis can be accomplished by the following reactions, a method described by Spencer et al. (1968).

The base in the inosine resulting from ADA activity is split off by the activity of nucleoside phosphorylase in the presence of phosphate (or arsenate) and the free base, hypoxanthine, is converted to xanthine in a reaction catalysed by xanthine-oxidase. In this last reaction, which demands the presence of phenazine-methosulphate, a tetrazolium salt, MTT, is oxidized into a blue formazan.

The inheritance of the ADA genotypes has been shown to be autosomal codominant (Spencer et al. 1968, Hopkinson et al. 1969, Renninger and Bimboese 1970) with genotype frequencies, in different populations, within the following intervals: ADA 1-1: 0.774-0.958; ADA 2-1: 0.042-0.217; ADA 2-2: 0.0-0.009. (Table I).

MATERIALS AND METHODS

The individuals tested were unrelated blood donors (235 males) and unrelated patients at an outpatient medical clinic (107 females). Blood was collected by venipuncture and haemolysates were made the same day. A drop or two of mercaptoethanol was added to the red cells to preserve ADA-activity and the cells were frozen at –30°C. The samples were thawed immediately before application to the gel.

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TABLE I
FREQUENCIES OF ADA GENOTYPES IN DIFFERENT POPULATIONS

Population	ADA 1-1	ADA 2-1	ADA 2-2	Total	Reference
Japanese					
N	345	15	0	360	Yamasama 1970
F	0.9583	0.0417	0.0		
Negroes					
N	283	17	0	300	Hopkinson et al. 1969
F	0.9433	0.0567	0.0		
English					
N	1223	127	3	1353	Hopkinson et al. 1969
F	0.9039	0.0939	0.0022		
German (Hessen)					
N	522	56	1	579	Renninger & Bimbose 1970
F	0.9016	0.0967	0.0017		
German (Berlin)					
N	443	56	1	500	Lefèvre & Niebuhr 1970
F	0.8860	0.1120	0.0020		
Danish					
N	1164	153	4	1321	Dissing & Knudsen 1970
F	0.8812	0.1158	0.0030		
German (Stuttgart)					
N	383	50	2	435	Sonnenborn & Renninger 1970
F	0.8805	0.1149	0.0046		
German (Southwest)					
N	257	44	1	302	Tariwerdian & Ritter 1969
F	0.8510	0.1457	0.0033		
Indians					
N	356	100	4	460	Hopkinson et al. 1969
F	0.7739	0.2174	0.0087		
Swedish					
N	300	40	2	342	Present paper
F	0.8772	0.1170	0.0058		

The gel was 11% starch in a phosphate buffer (pH 6.5). On the cathodal side of the gel, small pieces of chromatography-paper (Whatman no. 3), saturated with haemolysate, were inserted. The gel was connected to the bridge buffer, which was a pH 6.5 phosphate buffer, and electrophoresis performed in a refrigerator at about 3V/cm for 17-18 hours (Spencer et al. 1968).

RESULTS

The genotypes in the two groups (males/females) were distributed as indicated in Table II, and since no statistically significant difference was found when comparing the two groups they were pooled in the following calculations.

TABLE II
DISTRIBUTION OF ADA-GENOTYPES IN RELATION TO SEX

	ADA 1-1	ADA 2-1	ADA 2-2	Total
Males	208	25	2	235
Females	92	15	0	107
				342

$\chi^2 = 0.233$ (1 *DF*); $0.50 < P < 0.70$

The observations under ADA 2-1 and ADA 2-2 were pooled when calculating the χ^2 value.

The pooled observations are listed in Table III. Assuming a Hardy-Weinberg distribution, the gene frequencies of this population are: ADA 1: 0.9357; ADA 2: 0.0643. The observed values do not differ significantly from those expected in a Hardy-Weinberg distribution.

TABLE III
OBSERVED VS. EXPECTED FREQUENCIES OF ADA GENOTYPES

	ADA 1-1	ADA 2-1	ADA 2-2	Total
Observed				
N	300	40	2	342
F	0.8772	0.1170	0.0058	1.0000
Expected				
N	299.4	41.2	1.4	342
F	0.8755	0.1204	0.0041	1.0000

$\chi^2 = 0.0097$ (1 *DF*); $0.90 < P < 0.95$

The observations under ADA 2-1 and ADA 2-2 were pooled when calculating χ^2 value.

Our values do not differ significantly from those of three non-Swedish European populations:
England: $\chi^2 = 2.22$ (1 *DF*; $0.10 < P < 0.20$) (Hopkinson et al. 1969).
Germany (Hessen): $\chi^2 = 1.41$ (1 *DF*; $0.20 < P < 0.30$) (Renninger and Bimboese 1970).
Denmark: $\chi^2 = 0.057$ (1 *DF*; $0.80 < P < 0.90$) (Dissing and Knudsen 1970).

We have also determined ADA-genotypes in 43 routine paternity cases (43 women, 47 children, and 56 suggested fathers), but so far only in one case a man has had a genotype that makes his fatherhood improbable.

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RIASSUNTO

Gli isoenzimi della adenosin-deaminasi (ADA) sono stati determinati in una popolazione svedese composta di 342 persone non consanguinee. Le frequenze trovate sono di 0,9357 per ADA 1 e 0,0643 per ADA 2 e si accordano con quelle rilevate in precedenti ricerche.

RÉSUMÉ

Les isoenzymes de l'adénosine-déaminase (ADA) ont été déterminés dans une population suédoise de 342 sujets non-consanguins. Les fréquences génétiques trouvées sont de 0.09357 et 0.0643 pour ADA 1 et ADA 2 respectivement, ce qui se trouve en accord avec d'autres recherches antérieures.

ZUSAMMENFASSUNG

Bei einer schwedischen untereinander nicht verwandten Bevölkerung von 342 Personen wurden die Isoenzyme der Adenosin-Deaminasen (ADA) bestimmt. Das Vorkommen betrug 0.9357 für ADA 1 und 0.0643 für ADA 2. Diese Ziffern stimmen mit denen vorhergehender Untersuchungen überein.

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