J. Pest Control & Environ. Sci. Vol 3 No. 1 : 50 - 62 (1991)

BIOCHEMICAL CHARACTERISTICS OF DIFFERENT HUMAN BLOOD GROUPS IN ALEXANDRIA POPULATION

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ABSTRACT

Blood samples from twenty humans representing the general population in Alexandria were collected, 40% of which were from blood group A, 30% from blood group B, 10% from blood group AB, and 20% from blood group O. The following biochemical parameters were monitored in the blood samples: the specific activity of enzymes including acetyl cholinesterase (AChE), lactate dehydrogenase (LDH), glutamic oxaloacetic transaminase (GOT), glutamic oxalopyruvic transaminase (GPT), δ-amino levulinic acid dehydratase (δ-ALAD) and alkaline phosphatase (APase). In addition, levels of urea, hematocrit, hemoglobin, red blood cells (RBC's), white blood cells (WBC's) count and differential of WBC's contents were recorded.

INTRODUCTION

Steinberg and Bearn (1965) proved that blood group antigens are inherited. They used the term allotypes to define the individual variations within a species. Simmons (1968) described the significant importance of the blood group variants and their sub-groups sequence from the clinical point of view. Mourant, et al. (1978), concluded that there now exist more data on disease relationships with blood groups, specially of the ABO system, than with any of the other systems. According to Harris and Hirschborn (1980), the human ABO blood groups system, as a genetic marker, gained increased importance by the observations on the antigenic secretions of A and B substances not only in blood, but also in saliva and other body fluids such as pancreas, kidney, liver, lungs, testes, semen and amniotic fluid. These proved to be dimorphic characters depending on a pair of allelic genes situated at different loci from the ABO genes.

Khattab and Ismail (1960) reported that group A humans are more susceptible to both stomach cancer and rheumatic heart diseases than other blood groups, while individuals of group O are more susceptible to peptic ulcer. El-Hefnawy et al. (1963), found a pronounced association between blood group O and skin xeroderma pigmentosum due to photosensitivity. Similar results

were obtained in breast carcinoma incidents (Sadek, et al., (1966)). Khattab, et al. (1968), found a higher incidence of group A than group O in bilharzial cases. Thompson (1975) reported that there is an association between the ABO groups and certain diseases.

MATERIALS AND METHODS

Subjects

The selected human subjects were male workers (twenty) representing the general population of Alexandria, either occupationally exposed or unexposed to pesticides.

Sample Preparation

The blood sample (5 ml) was withdrawn from each subject's arm vein and divided into two parts. The first part (3 ml) was collected in a clean non-coated tube to separate serum. Serum was used for AChE, GOT, GPT, alkaline phosphatase (APase), LDH and urea. The second part (2 ml) was collected into an evacuated heparinized tube and used as fresh as possible for hemoglobin, hematocrit, blood cell count (RBC's and WBC's) and δ-ALAD.

AChE activity was assayed by Ellman, et al. (1961). Transaminases (GOT and GPT) were determined

according to Reitman and Frankel. method(1957). APase was assayed according to the method of Belfied and Goldberg (1971) LDH activity was measured by Cabaud, et al. 1955). Urea was determined by the method of Patton and Crouch (1977). Hemoglobin was determined by the method of Dijkstra (1960). The hematocrit value was measured by the micro-hematocrit method using an international micro-capillary centrifuge at 7500 RPM for eight minutes. The white and red blood count were done using hemocytometer adjusting to Brittan (1960) and Selward (1974). Erythrocyte ALAD activity was measured using the procedure described by Burch and Siegel (1971). Protein was determined by Lowry, et al. (1951).

RESULTS AND DISCUSSION

BLOOD GROUP DISTRIBUTION

A selected group of twenty individuals of the general population was investigated regarding the blood group type, and other biochemical parameters. Table 1 includes the percentage distribution of the blood groups in the present selected group and the general trend of distribution quoted from the Alexandria Blood Bank, as reported by Amer, et al. (1960) and El-Sebae (1984).

Table 1

Percentage Distribution of Blood Groups in Sampled Population of Alexandria.

Group	A	B	AB	O
Present data	40	30	10	20
Alex. Blood Bank	36	23	10	31

Data in Table 1 indicates the abundance of group A in the selected sample and in the general population, while AB was the least abundant group. Groups B and O are the second or the third in both data sources.

Comparative Enzymes Activity in Different Blood Groups

Table 2 presents the measured specific enzyme activities of AChE, LDH, SGOT, SGPT, δ-ALAD, and alkaline phosphatase in the selected twenty human blood samples of the four types of blood groups. The present results show that the highest ChE specific activity was recorded for blood group A, followed by Group O, then group B, and the least activity was observed for group AB. Such variation reflects the difference in neurological susceptibility between individuals from different blood groups. El-Sebae (1985), reported a parallel trend. Similarly, the maximum average specific activity was observed for group

Table 2

AChE, APase, GOT, GPT, LDH and δ-ALAD Activities in Different Blood Groups of General Population in Alexandria.

Samp. No.	Blood Group	AChE µmole sub/mg prot/min.	APase µmole/ mg prot/ min.	GOT u/ml	GPT u/ml	LDH u/ml	*δ-ALAD units
2	A	6.492	6.6	30	16	450	82.81
[illegible]	A	5.184	16.26	38.33	32.00	410	215.[illegible]
[illegible]	A	[illegible].742	8.04	25	27.2	210	192.07
8	A	[illegible].807	12.15	38.33	48	210	213.13
13	A	13.507	5.8	35	24	250	21[illegible]
15	A	[illegible].302	[illegible]	35	28.8	210	150.[illegible]
17	A	6.496	9.2	36.66	20.8	320	[illegible]
19	A	7.631	[illegible].2	36.66	19.8	360	296.25
[illegible]	B	6.629	14.02	28.33	32.6	210	176.13
[illegible]	B	[illegible].455	15.99	38.33	32	250	218.[illegible]
[illegible]	B	6.[illegible]	10.[illegible]	25	32	210	[illegible]
[illegible]	B	8.263	16.[illegible]	21.6	22.4	28	[illegible]
[illegible]	B	[illegible]	16.[illegible]	[illegible]	52.8	250	[illegible]
[illegible]	B	[illegible]	16	3[illegible].33	27.2	210	[illegible]
[illegible]	AB	[illegible]	[illegible].82	[illegible]	19.2	210	11[illegible]
12	AB	[illegible].651	9.6	26.66	22.4	380	17[illegible]
6	O	[illegible]	8.42	[illegible]	24	290	[illegible].59
[illegible]	O	[illegible]	6.8	36.66	14.4	500	17[illegible]
16	O	1[illegible].331	1[illegible]	30	19.20	450	189.9[illegible]
20	O	6.707	6.6	40	49.6	210	215.5[illegible]
Normal value				<40	<45	200-500	

*Units of ALAD activity = Corrected absorbance X 1000 x [illegible] / hematocrit

Table 3

Haematological Study in Human Blood Samples

Samp. No.	Blood Group	Urea g/L	Hemo. g/dL	Haem. %	RBC's Cells/ mm^3 X10^6	WBC's Cells/ mm^3 X10^3	Differential of WBC's 1	2	3	4	5
2	A	0.300	12.75	40	4.99	4.65	0	5	56	26	3
3	A	0.323	16.83	43	4.48	10.65	0	5	56	36	3
5	A	0.229	14.62	41	3.95	5.60	0	6	68	22	6
8	A	0.386	18.00	34	4.67	7.10	0	2	67	27	4
13	A	0.325	13.26	44	3.95	2.35	1	2	48	27	12
15	A	0.373	13.99	42	4.01	3.60	1	4	53	22	20
17	A	0.263	5.44	27	2.50	3.75	0	3	60	29	8
18	A	0.280	13.43	38	4.28	3.80	1	4	55	35	5
4	B	0.298	18.00	44	4.51	10.95	0	5	64	27	4
7	B	0.162	10.03	32	3.24	12.30	0	4	60	33	3
9	B	0.269	14.11	44	4.68	3.60	0	3	66	29	5
10	B	0.394	17.00	44	4.02	2.60	0	4	60	30	6
11	B	0.224	10.20	37	3.30	4.35	1	5	52	37	5
16	B	0.349	11.56	32	8.76	4.20	1	3	51	36	9
1	AB	0.270	14.30	45	4.91	8.55	0	4	59	33	4
12	AB	0.277	13.26	44	4.25	3.85	0	5	54	28	13
6	O	0.241	17.00	44	4.39	5.15	0	3	60	31	6
14	O	0.300	12.24	41	4.36	4.40	0	4	54	29	15
19	O	0.356	11.22	40	4.04	4.05	0	3	54	33	10
20	O	0.248	14.28	42	4.35	4.40	1	3	50	37	9
Normal value		0.15-0.45	16-18		4.5-6.5	5-10					

1 - basophils
2 - eosinophils
3 - neutrophils
4 - lymphocytes
5 - monocytes

A in LDH, SGOT, SGPT and δ-ALAD,followed by group O, then group B and the least was for group AB. However, the reverse was recorded for the alkaline phosphatase activity, where groups AB and B show relatively higher values of activity, while the least value is in groups A and then O. This might imply and explain that the blood group carriers of AB and B would be less affected by the toxic OP esters including pesticides. Such a trend in variation supports the variation in toxic responses.

Comparison of Biochemical Parameters in Blood Groups

Table 3 presents the data of comparative levels of urea, hematocrit, hemoglobin, RBC's, WBC's and differential WBC's contents in the four blood group samples. The levels of hemoglobin and hematocrit in the blood groups AB and O types were relatively higher than the blood group A. Thus it is not possible to generalize that one blood group is more sensitive.

The urea content tends to be higher in groups A and O, while AB showed lower values of urea. This might indicate higher nitrogen catabolism in the two types of groups A and O. The counts of the red blood cells and white blood cells indicate wide variation between the sampled individuals even between those belonging to the same blood group. This trend supports the specific variation between different individuals. Malik and Owens (1981) described the genetic regulation of bilirubin-UDP

glucouronyl transferase induction by polycyclic aromatic compounds and phenobarbital in mice. They reported that in humans, two patterns of inheritance of defective bilirubin glucouronidate activity have been described as type I and type II variants based on a lack of reduction and reduction in bilirubin concentrations in the blood after phenobarbital treatment, respectively.

Mourant, et al. (1978), assumed that variations in blood groups of the ABO system which is genetically dependent, reflects actually broad variation in the base line specific activity of plasma enzymes and biochemical constituents. These blood constituents act as a limiting factor for the behavior of the foreign molecules. Such basic interaction and information might help in quantifying the spectrum of susceptibility of human subjects with different blood groups towards the toxic chemicals mainly pesticides.

Now plasma or erythrocytes ChE is not the limiting factor, brain ChE is the most important limiting factor because it is the site of action for OP's and carbamates .

REFERENCES

Amer, Naila H., A.Z. Zaghloul and M.D. El-Borgy. (1980). A study of the availability of blood in Alexandria Blood Banks. Bull. High Institute of Publ. Health, Alexandria, 5: 235-251.

Bellfield, A and D.M. Goldberg. (1971). 12: 561.

Britton, G.J. (1963). Disorders of the blood (Textbook). G. Theed and J.A. Churchiu, Ed. LTD: London. W.T.

Burch, H.B. and Siegel, A.L. (1971). Improved method for measurement of δ-aminolevulinic acid dehydratase activity of human erythrocytes. Clin. Chem., 71: 1038-1041.

Cabaud, et al. (1955). Amer. J. Clin. Path., 30: 234.

El-Hefnawy, H.; O. Mohieldin, and A. Rasheed. (1963). ABO system of blood groups and its incidence in selected dermatosis in U.A.R. J. Egypt. Med. Assoc., 46: 1097-1106.

El-Sebae, A.H. (1985). Management of pesticide residues in Egyptian environment. In: Appropriate waste management for developing countries. Ed. Kriton Curi. Pelnum Publ. Corp. pp 563-577.

El-Sebae, Aly A.H. (1984). Biochemical and toxicological response to insecticides in different blood groups Public Health Doctorate Thesis. High Institute of Publ. Health, Alexandria University.

Ellman, G.L.; K.D. Courtney; V. Andress, Jr. and R.M. Featherstone. (1961). A new and rapid colorimetric determination of acetyl

cholinesterase activity. Biochem. Pharmacol., 7: 88-95.

Harris, H. and K. Hirschborn. (1980). Advances in human genetics. Vol. 10. Plenum Press: New York and London, pp 950.

Khattab, I.M. and A.A. Ismail (1960). ABO blood groups in relation to rheumatic heart disease. J. Egypt. Med. Assoc., 43: 441-445.

Khattab, I.M.; M.T. El-Genghey and M. Sharaf. (1968). ABO blood groups in bilharzial hepatic fibrosis. J. Egypt. Med. Assoc., 51: 245-250.

Lowry, O.M.; N.J. Rosebrough; A.L. Farr and R.J. Randall. (1951). Protein measurement with folin phenol reagent. J. Biol. Chem., 193: 265-275.

Malik, N. and I.S. Owens. (1981). Genetic regulation of bilirubin- UDP- glucuronosyl- transferase induction by polycyclic aromatic compounds and phenobarbital in mice. J. Biol. Chem., 25: 9599-9504.

Mourant, K.A C and K.D. Sobczak. (1978). Blood groups and diseases Oxford Univ. Press: New York and Toronto, pp 298.

Patton, C.J. and S.R. Crouch. (1977). Anal. Chem., 49: 464-69.

Reitman, S. and S. Frankel. (1957). A colorimetric method for the determination of serum glutamic oxaloacetic and glutamic pyrovic transaminases. Am. J. Clin. Path., 28: 56-63.

Sadek, A.M.; N. Guemen and M.A.S. Fahim. (1966). The relationship between secretor status of blood group substances and gastro-duodenal disease and cancer. Alex. Med. J., 11: 274-290.

Seiverd, E.C. (1974). Haematology for medical technologists. 3rd Edition. Lea and Febiger: Philadelphia.

Simmons, A. (1968). Technical haematology. 2nd Edition. J.B. Lipincott Co., pp 476.

Steinberg, A.G. and A.G. Bearn. (1965). Progress in medical genetics. Vo. IV. William Heinemann Medical Books Ltd.: London, pp 575.

Thompson, R.B. (1975). A short textbook of haematology. 4th Edition. Pitman Medical, pp 387.

Ziglestra, N.C. (1960). Clin. Chem Acta, 5: 719.

الملخص

تم دراسة العلاقة بين مجاميع الدم المختلفة وبعض الثوابت البيو كيمائية في دم بعض الافراد من محافظة الاسكندرية . وقد أظهرت النتائج أن نسبه توزيع مجاميع الدم في العينات المختبرة (٢٠٠ عينه) كالتالـــي :- ٤٠٪ من الافراد كانت فصيلة الدم A ، ٣٠٪ كانت B ، ١٠٪ كانت AB ، ٢٠٪ ينتمون الى فصيلـة O وكانت هذه النتائج تماثل النتائج المتحصل عليها من بنوك الدم . كما تم ايضا تقدير بعض الانزيمات في عينات الدم وقد اوضحت النتائج ان اكثر الافراد نشاطا للكولين استريز لها فصيلة الدم A يليها فصيلة الدم D ثم B واقلهم نشاط لها فصيلة الدم AB ، وهذا يوضح اختلاف الحساسيه العصبيه بين الافراد التي لها فصائل دم مختلفة . وقد وجد ايضا ان انزيمات اللاكتيك ديهيدروجينيز ، والجلوتاميك اوكسالو اسيتيك ترانس امينيز ، والجلوتاميك اوكسالو بيروفيك ترانس أمينيز ، والدلتا أمينو ليفيوليتيك اسيد ديهيدراتيز اكثر نشاط في الافراد التي لها فصيلة دم A واقلها نشاط في الافراد ذات فصيله الدم AB . بينما وجد عكس ذلك بالنسبه لانزيم الفوسفاتيز القلوي الذي كان اكثر نشاط في افراد مجموعة AB ، B واقل نشاط في مجموعة A ، O . وتم ايضا تقدير بعض الثوابت البيوكيميائية في دم الافراد المختبرة مثل البيوريا والهيماتوكريت والهيموجلوبين وعدد كرات الدم الحمراء والبيضاء وقد وجد ان هناك اختلاف في هذه الثوابت بين الافراد حتى تلك التي تنتمي للمجموعة الواحدة .