

The ABO blood groups and Rh phenotypes in Eastern Saudi Arabia and Bahrain

Sir,

I read with interest the paper by Bashawri et al<sup>1</sup> on the "Frequency of ABO blood groups in the Eastern region of Saudi Arabia," and would like to provide a short critique of this work and contribute the comparative figures from Bahrain.<sup>2,3</sup> Primarily the Saudi study lacks an essential statistical analysis hence its design, sampling procedures, and interpretation of results are brought into question.

The study was based on the analysis of 2 samples obtained within a 5 year interval from 57,196 Saudi men attending the Blood Bank of the King Fahad Hospital of the University, Al Khobar, Kingdom of Saudi Arabia (KSA). Blood Banks are an ideal source of information on the frequency of ABO and Rh distribution providing that duplication is eliminated and that both sexes are represented. There is no such statement in the paper to indicate the elimination of multiple entries, which may inflate the figures of the predominant groups. The 2 male samples were calculated separately and combined but without any statistical analysis of homogeneity to appropriately conclude on the "Frequency of ABO blood groups in the Eastern region of Saudi Arabia". Such analysis is also important to exclude the possible influence of demographic factors such as migration of population during the 5 year interval. Genetic drift is another factor for consideration but its influence is unlikely to be witnessed in such short interval. I have calculated  $X^2$  of 54.65 with 7° of freedom between both male samples, which fortunately indicated their homogeneity. The  $X^2$  with one degree of freedom between the Rh positive and Rh negative groups of both samples was 43.65.

On the other hand, the inclusion of 200 Saudi female volunteers for comparative purposes is inadequate to establish significant conclusions on the ABO and Rh frequencies in the Eastern region. I again calculated a  $X^2$  of 2.81 with 7° of freedom between the combined sum of both male samples and the 200 female groups indicating borderline results. Equal sampling of females is essential to maintain the Hardy-Weinberg equilibrium. A useful source in these circumstances is students and newborns.<sup>3,4</sup> Therefore, the title of the article should have been changed to reflect the inclusion of males only. In the Arabian Gulf Cooperation Council (AGCC) countries, which share common socio-cultural factors, blood donation is resented by female gulf nationals and it is worth noting here that they constitute approximately 3.5% of all donors in Bahrain.<sup>2</sup> There is therefore an urgent need to adjust the blood donor pool with education.

The expression of ABO frequencies as percentages in the Saudi report is misleading and cannot be used to compare the results with other studies from KSA or elsewhere. Only the calculation of the pA, qB, rO, D and d gene frequencies using the standard formula such as those of Mourant et al<sup>5</sup> would provide meaningful data that would put the Saudi report into a local, regional and international anthropological map of comparison. Group O is common in many countries throughout the world but the gene frequencies would show the difference between one region and another. They also serve as a monitor of past or future changes in the cross-migration of people. I have manually calculated the following ABO allele frequencies for the combined male population of the Saudi study: 16.44, 11.97 and 71.40 for pA, qB and rO for the A, B and O gene frequencies (Table 1). It should be noted here that the calculated difference "D" between the ABO frequencies (for each of the male samples, combined male sample, and combined male samples and the 200 female volunteers) as laid in the Mourant et al<sup>5</sup> formula was a minus figure. On the other hand when a modified Mourant et al formula<sup>6</sup> was used, the correlation factor "ø" obtained was a zero figure. These very low figures indicate sampling error (namely duplication of blood bank records) and also reflect the effect of exclusion of appropriate female sample. However, for the purpose of obtaining the nearest frequencies the "D" and "ø" in both formula

**Table 1** - The ABO blood groups and Rh gene frequencies in 2 studies from Eastern region of KSA 35 years apart<sup>1,7</sup> as compared to 2 other reports from Bahrain 16 years apart.<sup>2,3</sup>

Country	ABO Groups			Rh Groups	
	p(A)	q(B)	r(O)	D	d
<i>Saudi Arabia (1966)</i> <sup>7</sup>					
Sample 1 (Men)	12.01	14.99	73	81.45	18.55
Sample 2 (Men)	13.33	13.51	73.17	75.12	24.88
Other regions (Men)	13.44	12.37	74.19	74.99	25.01
<i>Saudi Arabia (2001)</i> <sup>1</sup>					
Sample 1 (Men)	16.39	11.68	71.97	73.81	26.19
Sample 2 (Men)	16.75	12.14	71.28	70.95	29.05
Men and Women (a)	16.63	11.97	71.40	71.89	28.11
<i>Bahrain (1985)</i> <sup>2</sup>					
Men	14.53	15.00	70.47	69.22	30.78
Women	13.93	16.58	69.49	75.23	24.77
All	14.23	15.64	70.13	72.17	27.83
<i>Bahrain (2002)</i> <sup>3</sup>					
Students	14.10	15.70	70.40	77	23
Blood Donors	11.80	15.20	73	73	27

ABO - blood groups A, B, and O  
p(A), q(B), r(O) - denotes the gene frequencies of  
blood groups A, B, and O  
Rh - rhesus, Rh group D - Rh positive, Rh group d - Rh negative

were fixed to 0.00001. I have also calculated 71.89 and 28.11 for the D and d Rh gene frequencies noting that the 2nd male sample of the Saudi study contains more d allele than the first sample.

The Saudi paper of 2001<sup>1</sup> compared the blood group frequencies in the Eastern region with other recent studies of the 1990s from the same region as well as other parts of KSA noting almost identical similarities. As blood group studies can always be used to anthropologically determine the origin of human migrations and genetic drifts it would have been more meaningful if an older study such as that of Maranjian et al<sup>7</sup> in 1966 was used for such comparative analysis. It would also have been useful if the results are compared with those of other AGCC countries, which share common traditional, historical and family ties with KSA. I wish in this regard to present the results of both Saudi studies and provide the data of 2 relevant studies<sup>2,3</sup> apart from Bahrain, an archipelago 40 km away from the Eastern Saudi region (**Table 1**).

The calculated Saudi gene frequencies of 2001 fell within the range of AGCC countries.<sup>2</sup> But a higher pA was observed in the 2001 study as compared to 1966 analysis<sup>7</sup> as well as the findings of 2 previous studies from Bahrain.<sup>2,3</sup> This change also marginally reflected on the qB. Nevertheless, changes in A and B frequencies have previously been reported in KSA<sup>4,8</sup> and this is expected in view of the dilution of the indigenous ethnic structure by cross-migration of population which accompanied the massive industrialization and urbanization of tribal and village societies of the Eastern region since the early 1970s. It is anticipated therefore that any future study into the blood groups gene frequencies in the region will demonstrate this change and it would seem here that the 1966 study of Maranjian et al<sup>7</sup> would still serve the only baseline of the pre-oil boom era.

There are differences in Rh gene frequencies between the Saudi and Bahraini studies.<sup>1-3,7</sup> These have previously been attributed to the possible influence of intermarriage of tribal families in the Arabian Gulf.<sup>2</sup> There is a need therefore to investigate the frequencies in these families.

Finally there are a number of editorial remarks to make other than the above critical points. Firstly, the lengthy passages in the "Introduction" section of the paper related to the history and discovery of ABO and Rh groups is superfluous and not related to the aims of the work. Secondly it would have been more helpful if Table 2 in Bashawri et al's study is reconstructed to show statistical significance, gene frequencies and reference numbers of the papers cited.<sup>1</sup>

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### *Reply from author*

We are very thankful to Dr. Al-Hilli as he took valuable time to calculate the allele frequencies of the blood group genes p (A), q (B) and r (O), and to compare our results with other relevant studies. We would like to comment on some of the points mentioned in Dr. Al-Hilli's letter.

Dr Al-Hilli started his critique by an unfounded comment based on the assumption that lack of statistical analysis throws doubt on the design, sample blood procedures and interpretation of the results. Regarding the duplication of entries, we are confident that this is completely eliminated as each donor in our blood bank has a specified card that carries his name and a serial number. As we all know in this country the donor's are predominantly males. Females rarely come forward for donation of blood. Even in Bahrain the female donors are still in the minority compared to males as seen in Dr. Al-Hilli's own figure of 3.5% of all donors. We agree with Dr. Al-Hilli's opinion with regards to the borderline statistical results regarding the comparison of males to female donors and the results reflect lack of homogeneity between the 2 groups. This makes the calculation meaningless.

The expression of the blood group frequencies as a percentage is widely accepted both in KSA and elsewhere. The calculation of gene frequencies using equations such as these of Morant are acceptable; however, the expression of ABO frequencies in percentage is also widely recognized and has been in use in most studies in the Gulf area as well as internationally. Therefore we do not agree with his comment that using percentages is misleading and cannot be used to compare data on frequencies of the ABO blood group in different communities.

Assuming that the allele frequencies p (P), q (B), r (O) and Rhd in the critique are correctly calculated using the Morant formula, we thank Dr. Al-Hilli for going through this trouble and for the meaningful comparison with other results particularly those of Al-Hilli<sup>2</sup> Arrayed et al<sup>3</sup> and Maranjian et al<sup>7</sup> who have all been cited in our paper except for the former.

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## References

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## Erratum

In manuscript "Impaired renal function among children in Alexandria, Egypt" Saudi Medical Journal 2002; Vol. 23 (5) 572-576, Table 1, column one should have appeared as follows:

28 days  $\leq$  1 year  
 >1 year  $\leq$  6 years  
 >6 years  $\leq$  12 years

## Erratum

In manuscript "Use of antiplatelets and lipid lowering therapy in patients with peripheral vascular disease" Saudi Medical Journal 2002; Vol. 23 (5) 585-588, the title should have appeared as "Use of antiplatelets and lipid lowering therapy in patients with peripheral vascular disease undergoing surgery"

## Erratum

In manuscript "Adult lead poisoning from a herbal medicine" Saudi Medical Journal 2002; Vol. 23 (5) 591-593, Figure 1 should have appeared in color.

