MANKIND QUARTERLY 2021 61:4 1025-1034

Gender Differences in Intelligence on the Standard Progressive Matrices in the Dhofar Region of Oman

Nasser Siad Gomaa Abdelrasheed,
Khalid Muslem Aslam Almashikhi,
Yussef Ahmed Bakhiet Albaraami
Department of Education, College of Arts and Applied Sciences, Dhofar University, Sultanate of Oman

Edward Dutton
Asbiro University, Łódź, Poland

Nagda Mohamed Abdu Elrahim
Sudan University of Science & Technology, Khartoum, Sudan

Salaheldin Farah Attallah Bakhiet*
King Saud University, Riyadh, Saudi Arabia

* Corresponding author. Email: bakhiet@ksu.edu.sa

According to Lynn's developmental theory of sex differences, male and female children have approximately the same IQ. Females, entering puberty earlier, pull ahead for a period in early adolescence before males ultimately reach a permanent IQ advantage, commencing in the late teens. This has also been found in some Arab countries, though there are a number of exceptions, including Saudi Arabia. In order to further test Lynn's model, we administered the Standard Progressive Matrices (SPM) to a geographically representative sample of 2,090 school pupils aged 6 to 18 in the Omani region of Dhofar. We found that, in line with Lynn's model, males reached a small IQ advantage by their late teens. However, our findings were not precisely congruent with what Lynn's model would predict. We argue that Oman's relative liberalism towards females, as well as sampling differences, explain our divergence from the Saudi Arabian sample.

Key Words: Raven test; Standard Progressive Matrices; Oman; Saudi Arabia; Intelligence; Sex differences

There has been considerable recent discussion over the issue of sex differences in IQ. Flynn (2012) concludes, based on a systematic literature review, that male and female IQ in adulthood are essentially equal. Lynn (2017a) avers that during childhood and adolescence females display approximately the same or sometimes higher IQ scores than do males. This is especially noticeable during adolescence, claims Lynn, because females, on average, begin puberty earlier than males, and puberty is associated with rapid cognitive development. However, Lynn argues, males catch up with females after they have entered puberty, and by the age of around 18 they overtake them, meaning that adult males have a modest IQ advantage over females. It is argued by Lynn that males overtake females because although they enter puberty later, male growth, including cognitive growth, continues until they attain a cognitive advantage.

Congruous with this perspective and the conclusion that males ultimately attain higher IQ than females, van der Linden et al. (2017) have shown that brain size reliably predicts IQ and that adult females' brains are, on average, smaller than those of adult males, with differences in the size of specific parts of the brain predicting exactly the male-female IQ differences which they show in their study to exist, at least based on their interpretation of available data. Flynn (2017) argued that when you employ only substantial representative samples of adults on Raven's Progressive Matrices, a non-verbal reasoning test, adult male and female IQ are approximately the same even though the female standard deviation is not as wide as the male one, at least in developed countries. Lynn (2017b) retorted that this result was caused by the outlier of Argentina, where women score higher than men for some reason that remains unclear, possibly because it is actually a developing country. However, in adolescence, females, on average, outscore males. In developed countries, this becomes increasingly conspicuous from the age of around 11 onwards. For example, on one administration of the SPM in England, girls aged 12 scored 0.4 SD higher than boys. In New Zealand it was 0.28 SD, while in Ireland it was 0.17 SD (Lynn & Irwing, 2004).

That said, these results are drawn from studies in developed countries. Far less is known about sex differences in IQ in developing nations, though this has been explored in Yemen (Bakhiet et al., 2015), the United Arab Emirates (Khaleefa & Lynn, 2008), Oman on a child sample (Khaleefa et al., 2012), and in Sudan (Bahkiet & Lynn, 2014). Dutton et al. (2018) have conducted a meta-analysis of the studies, demonstrating that the average IQ of school girls in Arab Muslim countries is generally higher than that of boys until the age of 10, after

which it becomes equal before a slight male advantage is attained in the late teens. However, they emphasize that there is much national variation within the Arab world. The sex differences on the national samples are sometimes substantial. For example, in Sudan, 9-year-old girls outscored 9-year-old boys on the Coloured Progressive Matrices (CPM) by 12.15 IQ points, reversing a male advantage at the age of 6. Dutton et al. (2018) have proposed that in the case of Saudi Arabia, girls' superior performance, even in the late teens, may be in part due to the fact that their activities are far more restricted than those of boys. In line with this, the female advantage is greater in Riyadh, where Wahhabism (a highly conservative form of Sunni Islam) is particularly strict, than in Jeddah, where it is more liberal (Valentine, 2015).

Here we wish to develop our understanding of sex differences in IQ scores — and the potential veracity of Lynn's model — by examining sex differences in IQ in the Sultanate of Oman. Oman is an Arab sultanate facing the Arabian Sea. It is bordered to the west by the United Arab Emirates, Saudi Arabia and Yemen. It has a population of roughly 4 million of which 1.75 million are expatriate workers rather than Omanis. Dhofar, the region in which we conducted our research, has a population of approximately 164,000. It is worth noting at this stage, as such knowledge is crucial to making sense of what follows, that the Omani government provides free education for pupils between the ages of 6 and 18. Primary school is composed of two 'Cycles'. Cycle 1 is for pupils aged 6 to 9 and classes are mixed-sex. Cycle 2 is for pupils aged 9 to 13 and classes are single-sex. Secondary education, which is also single-sex, then lasts up to the age of 18 although pupils can graduate at any time, so long as they attain the required standard.

School attendance is not compulsory in the sultanate. In 1985 only 18% of Omani girls attended secondary school, a figure which grew to 78% by the year 2000 (Haghighat-Sordellini, 2010). Nevertheless, there is no substantial sex difference in the likelihood of school attendance. According to data from the school year 2016/2017, which is the most recent data available, of 234,843 children in primary education (ages 6 to 10) in Oman, 119,142 (50.7%) were male. Of the 297,381 pupils in secondary education (ages 11 to 18), 152,704 (51%) were male (*Muscat Daily,* 13th August 2017). This slight over-representation of boys is congruous with the skew in sex ratio at birth, whereby worldwide, around 53% of children born are boys, with this decreasing to about 51% closer to the equator (Navara, 2009).

Khaleefa et al. (2012) explored sex differences in IQ in Oman on the Coloured Progressive Matrices. None were found to exist, but the sample only went up to the age of 11. Our sample, however, goes up to the age of 18, permitting us to properly test Lynn's model in Oman. Based on Lynn's model, we

hypothesize that by the age of around 11 females should be scoring higher than males but that this advantage should reverse in favor of males in the late teenage years.

Method

The sample consisted of 1046 male and 1044 female school students aged 6 to 18 from different schools in the Dhofar region in the south of Oman. 1087 students (52%) were from rural schools while the rest were from urban schools. There are a number of minority languages spoken in Dhofar, such as Harsusi and Jibbali or Shehri. However, all of the students in our sample were native speakers of Arabic. Data were collected from pupils in public schools in Dhofar. The sample was tested in the autumn semester 2018/2019 using Raven's Standard Progressive Matrices (SPM) test (Raven et al., 1998).

The SPM assesses IQ through 60 abstract non-verbal reasoning items. It is aimed at subjects between the ages of 8 and 65. It is comprised of sixty problems. These all involve correctly understanding a pattern. The total score provides a relatively reliable measure of general intelligence (*g*) or at least of reasoning ability. The test is aimed at subjects between the ages of 8 and 65. The *g*-loadedness of Raven's is about 0.5 (see Gignac, 2015). The SPM was administered to the participants in groups in their classes. The time allowed for the test was 60 minutes. Prior to commencing the data collection phase, ethical approval was obtained from the University Research Board (URB) of Dhofar University and from the Technical Office for Studies and Development (TOSD) in the Ministry of Education to conduct the study at public schools.

The sample was randomly chosen by lot, such that it represents a cluster random sample. In this respect, a selection of schools was randomly chosen, representing the rural and urban areas, different educational stages, males and females and different environments in Dhofar Governorate, in addition to different grades. A group of classes were chosen randomly from each school. Prior to applying the test to the sample, the consent of students and their parents was obtained. The test was administered by psychologists, sociologists and educational supervisors at the General Directorate of Education in Dhofar Governorate, where two workshops were held on how to apply the test, distribute it to pupils, and record their responses.

Results

Before conducting the statistical analysis, the normality of the data was tested. Although parametric statistics assume a symmetric, bell-shaped distribution, in reality, data are always skewed and kurtotic to at least some extent. A small departure from zero is acceptable as long as the measures are not too

large compared to their standard errors. One common practice is to divide the measures by their standard errors. This gives a z-value, which should be somewhere between -1.96 and +1.96. To calculate the skewness z-value, we divided the skewness statistic by its standard error and to calculate the kurtosis z-value we divided kurtosis by its standard error. Table 1 shows the z-values for males, females, and the complete sample.

Table 1. *Skewness, kurtosis, and their z-values for males, females, and the combined sample.*

	Males	Females	Total sample
Skewness	0.235	0.152	0.228
Standard error	0.370	0.216	0.391
z-value	0.64	0.70	0.58
Kurtosis	- 0.456	- 0.501	- 0.411
Standard error	0.815	0.651	0.532
z-value	- 0.56	- 0.76	- 0.77

It is clear from Table 1 that skewness and kurtosis for males, females and the total sample were low and the six z-values are within -1.96 and +1.96. It can be concluded that these data do not deviate significantly from normality. To be more stringent, the Kolmogorov-Smirnov test and Shapiro-Wilk test were employed to test for normality. This can be seen in Table 2.

Table 2. *Kolmogorov-Smirnov[a] and Shapiro-Wilk normality tests.*

	Kolmogorov-Smimov			Shapiro-Wilk		
	Statistic	df	p	Statistic	df	p
Male	.036	1046	.081	.772	1046	.217
Female	.026	1044	.115	.651	1044	.298
All	.032	2090	.095	.725	2090	.261

[a] with Lilliefors significance correction

It is clear from Table 2 that the Shapiro-Wilk test and also the Kolmogorov-Smirnov test was not significant. This means that the null hypothesis is accepted and normal distribution of the data is assumed. The results of our SPM administration can be seen in Table 3 and Figure 1.

Table 3. *Sex differences on the SPM in Oman.*

Age	Male		Female		*d*
	N	Mean ± SD	N	Mean ± SD	
6	74	21.38 ± 5.00	82	19.89 ± 4.95	0.29
7	80	21.11 ± 5.18	85	19.01 ± 5.40	0.39**
8	98	23.18 ± 7.10	66	20.32 ± 6.08	0.43***
9	71	23.75 ± 6.34	89	23.60 ± 6.52	0.02
10	89	26.73 ± 7.00	87	22.95 ± 5.63	0.59***
11	86	26.56 ± 8.43	64	26.44 ± 6.99	0.01
12	63	24.68 ± 7.50	114	26.11 ± 6.60	-0.20
13	102	29.88 ± 7.25	89	27.93 ± 6.69	0.27*
14	101	28.72 ± 8.53	95	30.93 ± 8.80	-0.25
15	82	30.46 ± 8.77	57	30.42 ± 8.61	0.00
16	86	35.62 ± 9.19	92	28.92 ± 7.44	0.80***
17	74	37.31 ± 6.61	90	32.74 ± 7.96	0.62***
18	40	38.50 ± 6.90	34	31.88 ± 7.75	0.90***
Total	1046	27.97 ± 9.01	1044	26.06 ± 8.18	0.22***

* $p < .05$; ** $p < .01$; *** $p < .001$

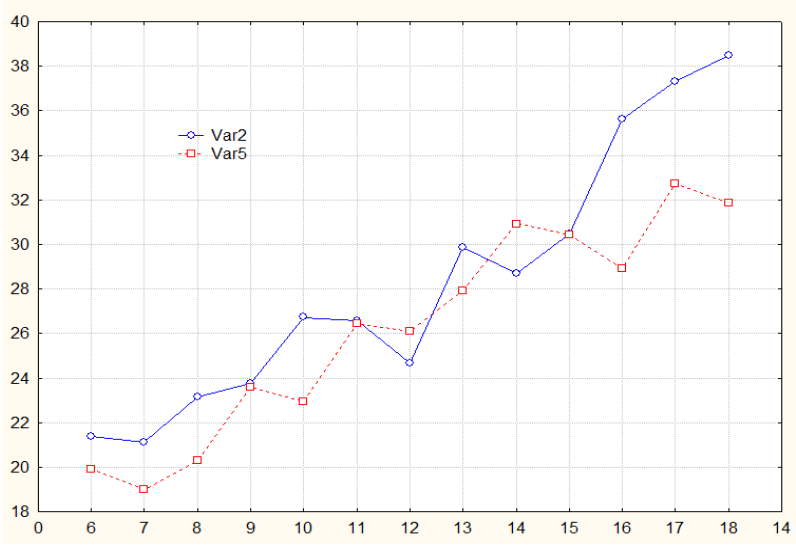

Figure 1. *Sex differences on the SPM in Oman. Var2 is males, and Var5 is females.*

Before puberty, between the ages of 6 and 10, males tend to score higher than females and in 3 out of 5 age cohorts this difference attains statistical significance. The difference, calculated from the *d* values across this age range, is nearly 5.2 IQ points. Male and female scores are essentially the same during puberty, between the ages of 11 and 15, when the sex difference is a trivial 0.5 IQ points favoring females. Finally, between the ages of 16 and 18, males outscore females by the equivalent of 11.6 IQ points. Averaged over the entire 6 - 18 years age range, males have a higher average IQ than females, with a difference of almost 2 raw score points on the SPM. This is equivalent to 3.3 IQ points. It can be seen that the effect sizes are different at different ages, and that overall the effect size is weak, which is what we would expect as the sex difference in IQ is only suggested to be small according to Lynn's model.

Discussion

Our results provide only partial confirmation of Lynn's developmental model of sex differences in intelligence. In line with Lynn's model, males begin to achieve an IQ advantage over females from their late teens. During early adolescence the average intelligence of males and females is about the same, with females outscoring males in some age groups, though not sufficiently to attain statistical significance. This may possibly reflect the earlier maturation of females. However, Lynn's model would predict that females should generally be outscoring males during this age range and this is not what we have found. In addition, these findings are not in line with those of certain Arab countries, such as Saudi Arabia, where it has been found either that there is no sex difference or that the sex difference is consistently in favor of females throughout the period of schooling.

A germane factor in explaining the difference between Dhofar and Saudi Arabia in terms of sex differences is possibly the nature of Oman's form of Islam. Saudi Arabia practices Wahhabi Islam, in which females are under strict *purdah,* meaning they are veiled, chaperoned, and their activities are generally heavily regulated (Valentine, 2015). The capital, Riyadh, is more religiously conservative than coastal cities such as Jeddah. On this basis, Dutton et al. (2018) argue that females are more restricted, relative to males, in Riyadh than they are in Jeddah, which may explain why, in teenage years, there is a female IQ advantage in Riyadh but not in Jeddah. Riyadh females, it is speculated, in effect have little to do other than to study, elevating their IQ. By contrast, 75% of Omanis follow Ibadi Islam, a very early split from Islam, earlier even than the Shia-Sunni schism (Ghubash, 2014). In Dhofar, most people are Sunni as in Saudi Arabia, but it is not generally Wahhabi (Minahan, 1996, p.148).

In terms of women's rights, Oman is far more liberal than many of its neighbors, including Saudi Arabia. Women enjoy a high degree of equality under the law: their court testimonies carry equal wait, it is prohibited to discriminate against them in employment practices, they have the same rights of property ownership as men, they can legally marry without parental consent, and women currently constitute the majority of university students. Oman was also one of the first Middle Eastern countries to give women full political rights (Al-Talei, 2010). This would potentially imply that the experience of being a female in Oman is closer, in some respects, to the Western experience of being a female than the Saudi experience is to the Western one. On this basis we might expect, although this is speculative, that Oman's sex differences on the SPM might be more in line with differences found in Western countries than they would be with Saudi Arabia's. Our results are testimony to the possible correctness of this expectation.

It would be possible to test this hypothesis, either in Oman or in Saudi Arabia, by looking at the relationship between the religiousness of the pupil's family and the pupil's IQ. We predict that in a sample of children from very religious families, females will score as highly or higher than males, while among children from less religious families there will be higher average scores for males than females. Such a study would be an interesting contribution to the study of the relationship between religiosity and IQ, which has been an active area of research for some time (e.g. Dutton, 2014). Likewise, future researchers should develop our findings by testing a large and nationally representative sample of Omani school pupils as although our sample is representative of Dhofar, it is not necessarily representative of Oman as a whole. But, overall, we have only been able to provide partial confirmation for the veracity of Lynn's model based on a sample from Dhofar.

Acknowledgement

The authors of this article are thankful to all psychologists and social workers in the schools of Dhofar region who tested the children with the Standard Progressive Matrices.

References

Al-Talei, R. (2010). Oman. In: S. Kelly & J. Breslin (eds.), *Women's Rights in the Middle East and North Africa*, pp. 337-358. Rowman & Littlefield.

Bakhiet, S. & Lynn, R. (2014). Regional differences in intelligence in Sudan. *Intelligence* 50: 150-152.

Bakhiet, S., Al-Khadher, M. & Lynn, R. (2015). Study of means and sex differences on Raven's Standard Progressive Matrices Plus in Yemen. *Mankind Quarterly* 55: 268-277.

Dutton, E. (2014). *Religion and Intelligence: An Evolutionary Analysis.* London: Ulster Institute for Social Research.

Dutton, E., Bakhiet, S., Madison, G., Essa, Y. & Rageh, M. (2018). Sex differences on Raven's Standard Progressive Matrices within Saudi Arabia and across the Arab world. *Personality and Individual Differences* 134: 66-70.

Flynn, J. (2012). *Are We Getting Smarter? Rising IQ in the Twenty-First Century.* Cambridge: Cambridge Univ. Press.

Flynn, J. (2017). Male and female balance sheet. *Mankind Quarterly* 58: 43-68.

Ghubash, H. (2014). *Oman: The Islamic Democratic Tradition.* London: Routledge.

Gignac, G.E. (2015). Raven's is not a pure measure of general intelligence: Implications for *g* factor theory and the brief measurement of *g*. *Intelligence* 52: 71-79.

Haghighat-Sordellini, E. (2010). *Women in the Middle East and North Africa.* Basingstoke: Palgrave Macmillan.

Khaleefa, O. & Lynn, R. (2008). A study of the intelligence of the United Arab Emirates. *Mankind Quarterly* 49: 58-64.

Khaleefa, O., Al-Kudri, K. & Lynn, R. (2012). Intelligence in Oman assessed by the Colored Progressive Matrices. *Mankind Quarterly* 53: 238-244.

Lynn, R. (2017a). Sex differences in intelligence: The developmental theory. *Mankind Quarterly* 58: 9-42.

Lynn, R. (2017b). Sex differences in intelligence: Reply to comments. *Mankind Quarterly* 58: 145-156.

Lynn, R. & Irwing, P. (2004). Sex differences on the Progressive Matrices: A meta-analysis. *Intelligence* 32: 481-498.

Minahan, D. (1996). *Nations without States.* Greenwood Press.

Muscat Daily. (13th August 2017). Nearly 750,000 Students in Sultanate's Schools. https://muscatdaily.com/Archive/Oman/Nearly-750-000-students-in-sultanate-s-schools-52rk

Navara, K.J. (2009). Humans at tropical latitudes produce more females. *Biology Letters* 5: 524-527. https://royalsocietypublishing.org/doi/10.1098/rsbl.2009.0069

Raven, J., Raven, J.C. & Court, J.H. (1998). *Manual for Raven's Standard Progressive Matrices*. Oxford Psychologists' Press.

Valentine, S. (2015). *Force and Fanaticism: Wahhabism in Saudi Arabia and beyond.* Oxford University Press.

Van der Linden, D., Dunkel, C. & Madison, G. (2017). Sex differences in brain size and general intelligence (*g*). *Intelligence* 63: 78-88.