

**Original article:**

**DECLINED SEX RATIO AT BIRTH IN FALLUJAH (IRAQ)  
DURING IRAQ WAR WITH IRAN**

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**ABSTRACT**

The main objective of this study was to investigate whether the sex ratio at birth (SRB, male proportion) alter in Iraq during its war against Iran (1980-1988). Here we compared 785 births (348 males, 437 females) during 1980-1989 with 1144 births (655 males, 489 females) before 1980 and 2914 births (1496 males, 1418 females) after 1989 in Fallujah, Iraq. The SRB significantly decreased during 1980-1989 in comparison with the ratios before 1980 (OR=0.595, 95 % CI: 0.495-0.714,  $P<0.001$ ) and after 1989 (OR=0.755, 95 % CI: 0.644-0.884,  $P=0.001$ ). Considering that the Iran-Iraq war began at 1980 and ended in 1988, therefore it seems that the SRB decreased in Fallujah (Iraq) during the war.

**Keywords:** Iran-Iraq war; sex ratio; war

**INTRODUCTION**

Based on numerous studies, sex ratio at birth (SRB, male proportion) varies with many variables (James 1987; Ansari-Lari et al., 2004; Saadat 2005, 2008; James 2006, 2009; Masoudi and Saadat 2007; Saadat and Khalili 2009). The subject of changing in SRB during or shortly after wars was investigated by several researchers (James 2009). The results, however, are not consistent.

It is reported that conflicts or exposure to stressful conditions may have a negative effect on the SRB (Lyster 1974; Fukuda et al., 1998; Ansari-Lari and Saadat 2002; Catalano et al., 2005, 2006; Saadat 2006, 2008; James 2009). The SRB decreased in Iran during Iran/Iraq war (Ansari-Lari and Saadat 2002), during civil war in the Balkan (Zorn et al., 2002) several months after earthquakes in Kobe (Japan) (Fukuda et al., 1998) and Bam (Iran) (Saadat 2008), and in the few months after 11 September events in California and New York City (Catalano et al., 2005, 2006).

Several studies have been indicated that SRB increased in Bosnia-Herzegovina during civil war (Polasek et al., 2005; Polasek 2006), after the First and the Second World Wars (James 2009), during civil war in Tajikistan (Hohmann et al., 2010) and in Sardasht (north-west Iran) after chemical weapons attack by Saddam's regime on 27<sup>th</sup> July 1987 (Saadat 2006). Other studies indicating that the SRB did not alter during or after wars (McMahon and Pugh 1954; Polasek et al., 2005; Polasek 2006; Abu-Musa et al., 2008, 2009; James 2009).

Previously we reported that the SRB dramatically decreased in Iran during Iran/Iraq war (Ansari-Lari and Saadat 2002; Saadat 2006). It is suggested that stressful conditions may have some role(s) for the alteration of SRB in Iran (Saadat and Ansari-Lari 2004). There is no data on the secondary sex ratio in Iraq during its war with Iran. Therefore, the present study was done.

## METHODS

Between January 20<sup>th</sup> and February 20<sup>th</sup> 2010 a team of 11 researchers visited houses in an area of Fallujah, Iraq (some 50 miles west of Baghdad). They visited 711 houses and obtained responses to a questionnaire on cancer, birth defects, infant mortality, and sex of live births. The total population in the resulting sample was 4843 persons. The authors summarized the sex of participants in 5-years age groups in Table 1 of their article (Busby et al., 2010).

The war between Iran and Iraq began at September 1980 and ended in July 1988. To determine the possible effect of the war on the SRB, the total studied period was divided to three distinct parts as before, during, and after the war.

The SRB was expressed as the male proportion. The odds ratio (OR) was used as statistical analysis method. The odds ratio (OR) (the odds of being male) was calculated, considering the exposure to the war as a risk factor. An  $OR > 1.0$  shows an increase and an  $OR < 1.0$  shows a decrease in male proportion in comparison with the SRB in reference periods (before and/or after war).

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) (version 11.5). A probability of  $P < 0.05$  was considered statistically significant.

## RESULTS AND DISCUSSION

According to data presented in the article of Busby et al., (2010), we extracted 785 births (348 males, 437 females) during 1980-1989, 1144 births (655 males, 489 females), before 1980, and 2914 births (1496 males, 1418 females) after 1989 (Table 1).

**Table 1:** Offspring sex ratio at birth (SRB) in Fallujah, Iraq

Years	Males	Females	Total	SRB
Before 1980	655	489	1144	0.5725
1980-1989	348	437	785	0.4433
After 1989	1496	1418	2914	0.5133
Total	2499	2344	4843	0.5160

As mentioned in Table 1, the SRB in Fallujah were 0.5725, 0.4433 and 0.5133 before 1980, during 1980-1989 and after 1989, respectively. The SRB decreased during 1980-1989 in comparison with the ratios before 1980 ( $OR = 0.595$ , 95 % CI: 0.495-0.714,  $P < 0.001$ ) and after 1989 ( $OR = 0.755$ , 95 % CI: 0.644-0.884,  $P = 0.001$ ). Considering that the Iran-Iraq wartime was 1980-1988, therefore it seems that the SRB decreased in Fallujah (Iraq) during the war.

This finding is consistent with our previous finding indicating decrease in SRB in Iran during the Iran/Iraq war (Ansari-Lari and Saadat 2002; Saadat 2006) and other studies (Zorn et al., 2002; Catalano et al., 2005, 2006). It is possible that stressful conditions (war) have effect on decreasing the SRB.

The present finding must be considered limited due to several factors. First of all there is obviously no guarantee that the survivors living in Fallujah in 2010 had the same sex ratio as the births 20 to 29 years before. It should be noted that men could have been killed in larger numbers during the US assault in 2004, or could have emigrated because of the invasion. Second, we have no data on sex ratio at birth in other parts of Iraq. Third, the significant difference may occur by chance because the sample size was small.

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## CONFLICT OF INTEREST

Author declares that there is no conflict of interest.

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