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Effect of Conception Time and Maternal Age Upon Fetal Sex Ratio in Çukurova Population

Çukurova Populasyonunda Gebelik Zamanı ve Maternal Yaşın Fetal Cinsiyet Oranı Üzerine Olan Etkisi

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ABSTRACT

Purpose: This investigation was conducted to determine whether the month of conception, parental age, and environmental factors such as seasonal variation, consumption of alcohol and cigarette by parents, play a role on sex ratio at pregnancy in Çukurova region and surrounding area population (Turkey).

Materials and Methods: We have analyzed tha data of patients who were referred to our prenatal diagnosis laboratory for amniosynthesis with the purpose of karyotyping between the years of 2005-2007. We used Pearsen Chi-square, Fisher's exact and T-tests for statistical analyses.

Results: No association was established between the primary sex ratio and time for pregnancy. Differences in primary sex ratio among the months were not statistically significant, but the difference for the month of September was noted. For september, we have found statistically significant distortion of sex ratio toward male, (males:females ratio=1.8).

Conclusion: In conclusion, our speculation is that the climate change in September may affect the primary sex ratio under the summer/autumn photoperiod.

Key Words: Karyotyping, month of conception, primary sex ratio, prenatal diagnosis

ÖZET

Amaç: Bu çalışmanın amacı, Çukurova ve çevresindeki populasyonda konsepsiyon ayı, ebevynlerin yaşları, mevsimsel değişimler, ebevynlerin alkol ve sigara kullanım durumları gibi çevresel değişkenlerin fetal cinsiyet oranını etkileyip etkilemediklerini tespit etmektir.

Materyal ve Metod: Bu çalışmada, 2005-2007 yılları arasında amniyosentez maksadıyla prenatal tanı laboratuvarımıza yönlendirilen hastaların verilerini analiz ettik. Istatistiksel analiz için ki-kare, Fisher's exact ve T testlerini uyguladık.

Bulgular: Konsepsiyon zamanı ile primer cinsiyet oranı arasında bir ilişki tespit edilemedi. Aylara göre primer cinsiyet oranındaki değişimlerin istatistiksel olarak anlamlı olmadığı gözlendi. İstisna olarak eylül ayındaki değişim kaydedildi. Eylül ayında istatistiksel olarak anlamlı bir şekilde cinsiyet oranının erkeğe doğru değiştiği saptandı (erkek:kadın oranı=1.8).

Sonuç: Yaz/sonbahar fotoperiyodunda bulunan eylül ayındaki iklimsel değişimin, cinsiyet oranındaki bu farklılaşmayı etkilediğini düşünmekteyiz.
Anahtar Kelimeler: Karyotipleme, konsepsiyon ayı, primer cinsiyet oranı, prenatal tanı

INTRODUCTION

Is there any relation between the maternal age and the month of conception, and the fetal sex ratio? This question draws attention of many people, specially couples who want to have a child with a specific gender (boy or girl). For answering this question, there is a method developed by chinese, chinese calender method. According to this method, firstly, the maternal age and the date (month) of conception must be determined, and the date of conception must be converted into their lunar equivalents. So, a predictive value for having a boy or girl can be calculated. The properly applied Chinese Gender Chart gives couples at least a 75% chance of having a child of the desired sex. Some researchers have reported success rates up to 90%. Therefore, it's considered that there is a relation between offspring sex ratio and time to pregnancy[1].

The sex ratio at birth (SRB) is rarely 1.0 (males:females) for most vertebrates and humans[2]. In humans, the SRB is shifted towards boys by some 2–3%[3]. For most human populations the sex ratio at birth, defined as the number of male births per 100 female births, is around 105[4-7]. However, notable variations from this mean value have been observed in certain human populations[6,8,9]. In recent years, some published reports focused on whether some environmental factors affecting before and during periconceptional period, have an impact on sex ratio. At the same time, several biological mechanisms have been suggested to explain the remarkable constancy of this ratio. As a practical matter, the difficulties of measuring these biological factors have persuaded most researchers to rely on less direct, and more easily observable factors underlying the sex ratio[10]. This is the reason why variables such as the ages of the parents and the birth order have been widely studied.

A seasonal variation in human SRB values has been identified for the German population[11]. This investigation analyzed birth records and found a highly significant, albeit low-amplitude, annual rhythm, with the highest values (relatively the most boys born) between April and June and the lowest values in October. Seasonality and period effects are among the other factors that have drawn attention. Significant variations in the sex ratio by month of birth have been observed in certain populations[8,12,13,14] but these variations are generally very small.

Our investigation was conducted to determine whether the month of conception, maternal age, environmental factors such as seasonal variation, consumption of alcohol and cigarette by parents, and parental age play a role on sex ratio at pregnancy in Çukurova region, Adana and surrounding area population (Turkey).

MATERIALS and METHODS

We have analyzed tha data of patients who were directed from Gynecology and Obstetrics Department of Çukurova University to our Genetic Laboratory, at the Medical Biology and Genetics Department of Çukurova University, for amniosynthesis with purpose of karyotyping between the years of 2005-2007. Birth records (number of boys and girls born per month) were obtained from our prenatal laboratory records. We asked parents or the closest relative of parents about the alcohol and cigarette consumption of parents, ages of parents, and the time of conception. We also asked the mothers about where conception had been occurred. Since our hospital is a reference hospital for a large region, including subregions with different climate

conditions, we classified our patients according to subregions where conception had been occured to understand the climate's effect on sex ratio. This study was conducted on 2155 cases. Monthly average temperature, photoperiod and rainfall values were obtained from the National Climatic Data Center in Adana-Turkey for the period 1975–2006 (Table 1). Correlations were assessed for possible effects of temperature on the sex ratio at pregnancy (SRP). We have analysed the effects of all forementioned parameters on primary sex ratio (SRP), employing statistical methods. We used Pearsen Chi-square, Fisher's exact and t-tests for statistical analyses. This study has been approved by the local institutional review board.

Table 1. Monthly weather values for Adana city between years of 1975-2006 are presented *www.meteor.gov.tr* (June-2009).

Adana city-TURKEY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	**Sept**	Oct	Nov	Dec
	Average values for years between 1975-2006											
Average temperature(°C)	9.7	10.4	13.3	17.5	21.7	25.6	28.3	28.4	**26.1**	21.6	15.3	11.1
Average time with daylight (hour)	4.6	5.2	5.8	6.8	9.0	10.4	10.5	10.2	**8.6**	7.1	5.7	4.3
Averaga of days with rainfall	10.5	9.8	10.0	10.4	6.9	3.5	1.9	1.5	**3.2**	5.7	7.6	10.6
	Highest and lowest values for years between 1975-2006											
Highest temperature(°C)	23.0	25.0	32.0	36.8	40.6	41.3	44.0	43.8	**43.2**	39.4	33.3	27.4
Lowest temperature(°C)	-4.2	-6.4	-3.6	-1.3	5.6	13.7	16.8	16.8	**10.9**	4.8	-1.0	-3.5

RESULTS

In this study, we analyzed the effects of parameters; month of conception, maternal age, environmental factors such as seasonal variation, alcohol consumption and cigarette smoking on sex ratio at pregnancy in population of Çukurova region, Adana and surrounding area. In sum, we studied 2155 cases. But only for 893 cases we were able to obtain information including all mentioned parameters by directly interviewing with mothers or their close relatives. For other 1262 cases we evaluated their data retrospectively, so we could only get information about maternal age during pregnancy, month of pregnancy and subregion where pregnancy might occur. The mean age of the mother and father screened was 32.5 (range 17-48) and 36.1 years (range 20-65), respectively. In total, we calculated the value of sex ratio at pregnancy as male:female ratio=1.02 (49,5% of cases were recorded as female whereas 50,5% of them were male) (Table 2).

Table 2. Primary sex ratio by month

Month	male (%)	female (%)	Total	M/F ratio
1	76 (45,5)	91 (54,5)	167	0.84
2	92 (55,4)	74 (44,6)	166	1.24
3	83 (45,6)	99 (54,4)	182	0.84
4	95 (51,9)	88 (48,1)	183	1.08
5	77 (45,6)	92 (54,4)	169	0.84
6	87 (46,8)	99 (53,2)	186	0.88
7	88 (48,1)	95 (51,9)	183	0.93
8	101 (53,7)	87 (46,3)	188	1.16
9	**115 (64,2)**	**64 (35,8)**	**179**	**1.80**
10	123 (52,1)	113 (47,9)	236	1.09
11	80 (49,1)	83 (50,9)	163	0.96
12	72 (47,1)	81 (52,9)	153	0.89
Total	**1089 (50,5)**	**1066 (49,5)**	**2155**	**1.02**

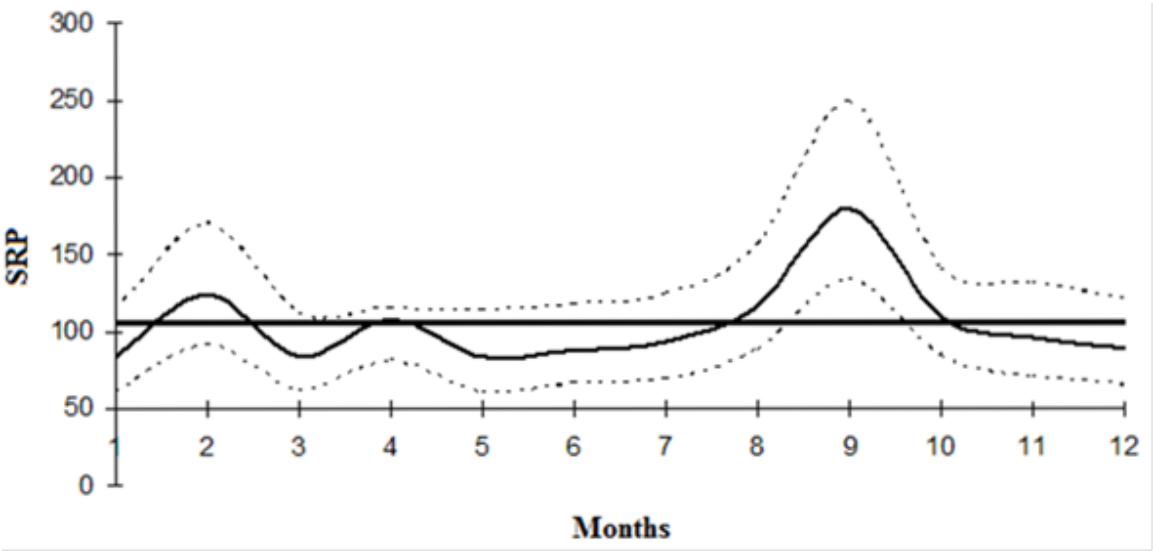

Figure 1. Primary sex ratio at pregnancy by month

We analyzed the effects of per months on primary sex ratio at pregnancy. Monthly values for the sex ratio of 2155 cases are shown in Figure 1 and Table 2. Differences among the months were not statistically significant, except marked difference for the month of September. The sex ratio is significantly higher than 105 for September (M/F ratio=1.80) (Tablo 2 and Figure 1). We statistically tested the effect of getting pregnant naturally and getting pregnant with treatment

categories on sex ratio at pregnancy. We performed non-parametric chi-square test for mentioned categories and we did not find any statistically significant difference from normal value of primary sex ratio at birth (p>0,05) (Tablo 3). For this analysis we utilized answers of question how and of which location pregnancy had occurred. In this regard, we classified our patients into three categories; getting pregnant in hometown, in seaside residence and in high altitude residence. For statistical analyses of these categories we also employed non-parametric chi-square test however we did not find any statistically significant difference from normal value of sex ratio at birth (p>0,05) for all categories (Tablo 3). Our patients came from three different subregions which have diferent climate conditions (Central anatolia region, southeastern region and mediterranian region). Therefore, we wanted to test whether there is an effect of different climate conditions on sex ratio at pregnancy. However, we did not find any statistically significant difference from normal value of primary sex ratio at pregnancy for all three subregions (p>0,05) (Tablo 3). We also wanted to test the effects of parents' alcohol and cigarette consumption on sex ratio at pregnancy. According to our analyses parental alcohol and cigarette consumption also did not have any effect on primary sex ratio at pregnancy (non-parametric chi-square test, p>0,05) (Tablo 3). Finally, we tested the effect of parental age on primary sex ratio, employing T test. We did not find statistically significant distortion of sex ratio at pregnancy from normal value of 105 under the effect of parental age (Tablo 3). In this study, for all parameters we tested with chi-square test, we also performed Fisher's Exact test. As a result, we did not find any statistically significant difference from normal value (105) of primary sex ratio at pregnancy for all mentioned parameters .

Table 3. Male and female distributions for constituted categories

How pregnancy had occured	Male	Female	P value
Naturally	439	413	0,338
With treatment	22	14	
Where pregnancy had occured			
Home	399	393	0,353
Seaside home	48	34	
Plateau home	9	10	
Subregion patients came from			
Mediterranian	1039	1030	0,445
Southeastern	41	30	
Central anatolia	7	6	
Mothers' cigarette consumption			
No	392	370	0,650
yes	64	67	
Mothers' alcohol consumption			
No	455	435	0,617
Yes	1	2	
Fathers' cigarette consumption			
No	217	191	0,259
yes	238	246	
Fathers' alchol consumption			
No	382	357	0,411
Yes	73	80	

DISCUSSION

We tested the effects of several candidate variables that could play roles upon sex ratio values independently, for the Çukurova and surrounding area population, Adana-Turkey.

For most human populations the sex ratio at birth, defined as the number of male births per 100 female births, is around 105[5-7] and the ratio is rarely 1.0 (males:females) for most vertebrates and humans[15]. We calculated the value of primary sex ratio at pregnancy as 1.02 (males:females) (50,5% of cases was recorded as male versus 49,5% of female, Table 2). It's well known that human semen contains equal amounts of X and Y bearing sperms. But, as expressed above more boys than girls are born. The reasonable explanations for such distortion of sex ratio at birth toward male has been argued. It's hypothesised that Y bearing sperms swim faster than X bearing sperms in the viscous surrounding of cervical mucus[16]. Therefore, swimming capability in viscous surrounding must be accepted as an phenomenon leading to distortion of sex ratio at birth[17].

Some variations in the sex ratio by month of birth have been observed in certain populations[8,12,13,14] but these variations are generally very small. Several biological mechanisms have been suggested to explain the remarkable constancy of this ratio. In the present study, we did not find any association between time to pregnancy and primary sex ratio and we did not find any statistically significant distortion from normal value (105 males for 100 females) of sex ratio at pregnancy for any month except for September. But, according to Chinese calender, it had been reported that there is a relation between the mothers' date of birth and the month of conception and sex ratio at birth. According to this method, firstly, the maternal age and the date (month) of conception must be determined, and the date of conception must be converted into their lunar equivalents. But, we used the sun calender (the calender now we are using) in our study. So, used calender difference might have caused this different result. We found an appearent and statistically significant distortion of sex ratio toward male, the highest values, rate of a boy is two times more than a girl (males:females ratio=1.8) in September. Our results supports those observed by Nonaka et al. (1999)[14] in their study of the sex ratio in the French-Canadian population. Their study showed slightly lower values for the February-April and May-July quarters, and slightly higher values for the August-October and November-January quarters. Lerchl (1998)[12] observed significantly higher values for the months of May and December, and lower values for March and October in a study of postwar Germany. In the United States, it appears that the ratio may be slightly higher at the beginning of summer, and lower at the end of autumn[8].

We observed significantly higher and lower values of climatic changes (temperatures, photoperiod and humidity) for September in our study (Table 1). We speculated that approximate climatic changes in this month can affect the primary sex ratio under the summer/autumn photoperiod. Photoperiodism and daylength affect hormonal mechanisms of living organisms and so, causes physiological and behavioral changes. A seasonal rhythm of human sex ratio has been described as inconsistent[18-20], its observed amplitude has been reported to be small (<0.5%)[12,18,19]. Relative humidity is another environmental factor that may affect offspring sex ratio (Table 1). Its effect varies among species, and the effect may change with temperature[21]. Computerized literature searches have yielded no publication concerning temperature effects on the sex ratio at birth (SRB) in humans. However, there are only two relevant reports in the literature with respect to temperature effects on sex ratios in mammals: a study in rats showed decreased SRB values (i.e., an excess of female offspring) when animals were held and bred at 57 C for 20 generations[22]. The other investigation in wild bat colonies revealed relatively high SRB values at high environmental temperatures. The underlying

mechanism responsible for these phenomena, however, remains unclear. It may be speculated that the effects are due to processes within the testes: it has been shown[23], for example, that increased temperatures affect the dissociation of X and Y chromosomes during meiosis in rats and mice . Since scrotal skin temperatures in men show seasonal variations caused by the environmental temperatures[24], it is very likely that intratesticular temperatures also vary seasonally. Variations in temperature, humidity, and photoperiod may affect offspring sex ratio because they are used as seasonal cues. It can only be speculated that effects of these factors (temperature, photoperiod and humidity) are direct or indirect.

We have not found any significant effect of parental age. As elsewhere, in the Çukurova region the parental age does not show any effect upon sex ratio. It has been reported that the paternal age have a greater influence than maternal age, older fathers having a tendency to produce fewer sons than younger fathers[9]. However, Tremblay et al.(2003)[25] note a slight positive influence of paternal age (between 35 and 45) and a negative influence of maternal age (between 30 and 37) in the Saguenay population when birth order and parental age difference are taken into account. Since birth order is closely tied to parental ages, some researchers have attempted to separate their relative contributions. It appears that the influence of parental age is diminished when birth order is taken into account[9,26,27]. Manning et al.(1997)[28] provide evidence of a positive relationship between parental age gap and the sex ratio for first births. However, other studies have not found a significant effect for spousal age difference[29-31]. Alternatively, hormones may play a role in this context as well[32]. According to our analyses parental (both mother and father) alcohol and cigarette consumption also did not have an effect on sex ratio at birth (p>0,05).

In conclusion, our findings showed that there is no any association between time to pregnancy, maternal age and the fetal sex ratio of fetuses. We found an appearent and statistically significant distortion of primer sex ratio toward male, highest values, rate of a boy is two times more than a girl in September. Our speculation is that climate changes in this month can affect the primary sex ratio under the summer/autumn photoperiod.

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