

# **Low sex ratio in children of professional basketball players in Spain**

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## **SUMMARY**

The aim of this study is to ascertain the variations of reproductive sex ratio value (number of males/number of females) of professional basketball players in Spain. This is a retrospective cross-sectional study based in a survey that was conducted in the leagues of Spanish professional basketball season (2009-2010). A total of 172 professional basketball players filled out an anonymous survey. The results showed that forty seven of the respondents had offspring; a total of 61 children: 70% females and 30% males with a sex ratio value of 0.42. Thirty-three basketball players were caucasian (CAU) with 44 children, 9 males and 35 females (sex ratio=0.26). Fourteen were black, of African heritage (AFR), with 17 children, 9 males and 8 females, (sex ratio=1.12). Statistical differences ( $p < 0.01$ ) were found when comparing offspring sex ratio values of all basketball players (sex ratio=0.42) and CAU group (sex ratio=0.26) with Spanish population (sex ratio=1.06). In conclusion a significant increase in the sex ratio value towards female offspring was observed in the group of CAU professional basketball players.

## **INTRODUCTION**

The ratio of male/female at birth in Western European countries, ranged from 1.03 to 1.07. In the United States, over the period 1970–2002 was 1.05 for the white non-Hispanic population, 1.04 for Mexican Americans, 1.03 for African Americans (Mathews, Hamilton 2005).

Changes in the ratio of males to females at birth have been used to assess the impact of environmental factors on the endocrine system and reproductive health of humans (Mathews, Hamilton 2005). The variations of human sex ratio have been related to cycle day of insemination, side of ovulation, coital rate, gestation period, diet, parasitic infections, chemical exposures and parental occupations among other factors (James 2004).

Our study is based on an epidemiological survey on the population of professional basketball players in Spain about the sex ratio of their children.

## **MATERIAL AND METHODS**

A personal questionnaire was sent to each team belonging to ACB (first division) and LEB Oro (second division) Spanish basketball leagues. Players were asked about age, ethnicity, number, sex and date of birth of their children, as well as whether

pregnancy was carried to term or not. They were also asked about vacation periods and time of lower physical activity because of injuries or diseases. Only children born during professional activity were included. The month of conception was calculated from the date of birth subtracting the weeks of pregnancy. The year was divided in quarters taking as reference the vacancy period (June-August). Chi-square test was achieved to compare sex ratio values between ethnic groups and period times of conception.

## **RESULTS**

Surveys were sent to 14 basketball teams, 8 belonging to LEB Oro and 6 to ACB. A total of 172 players were surveyed. 47 of respondents had offspring (27%), totaling of 61 children. The number of children, sex distribution and a race classification (CAU and AFR) were shown in table I. Statistical differences ( $p < 0.01$ ) were found when comparing offspring sex ratio values of all basketball players and CAU group with Spanish population (sex ratio=1.06) (Instituto Nacional de Estadística. <http://www.ine.es/>). The ratio of males and females births between CAU and AFR basketball players, were also different (Table I).

According to this study the percentage of children conceived by basketball players varied between two groups: conceptions in CAU were higher during first and third quarters, while children conceived by AFR reached the maximum on the third quarter (Table I). Seasonal sex ratio in AFR (Table I) remained stable along the year. Higher seasonal variation of the sex ratio was observed in CAU players, the first quarter showed higher sex ratio reaching the highest value in December (sex ratio=1).

No relation was found between injuries or diseases and sex ratio probably due to the low number of cases.

## **DISCUSSION**

The obtained sex ratio values, with a general increase in the proportion of daughters, matches with other studies in populations of men like professional divers, pilots of high-performance aircraft and spacecraft (James 2004) (James 2001). Two main hypotheses surround these findings, one related to the unbalanced hormone levels produced by the strong psychophysical component (James 2006) and other related to competitive stress that has been associated with the elite sport

(Martinez et al. 2010). The elite basketball player has several features that fit to both hypotheses: they are athletes with high performance in physical training, which could mean effects on testosterone as well as chronic competitive stress, evaluated by cortisol. In addition, environmental factors that affect testosterone regulation could induce changes in the sperm production cycle which has been proposed to be of 74 days length (Heller, Clermont 1964). A study of hormonal levels in basketball players in Spain (Martinez et al. 2010) shows a coincidence between the peak level of testosterone (October to December) with the maximum sex ratio found in our study in the first quarter of the year (sex ratio=0.66). The highest sex ratio was reached in December (sex ratio =1) also coincident with the sperm that began its creation in October. This seasonal testosterone levels in players does not coincide with the seasonality of testosterone levels in males of general population which present peaks of testosterone from June to September (Smals, Kloppenborg & Benraad 1976). In this way, the higher sex ratio, obtained in AFR players (average sex ratio=1.12) could be in accordance with higher testosterone levels observed in young black males, until 30 years old (Gapstur et al. 2002).

The differences found in the highest number of conceptions reached during the year, between basketball players (June to August) and Spanish population (October to December) (Instituto Nacional de Estadística. <http://www.ine.es/>) lead us to think of an influence of this sport competition on the seasonality of the physiology of reproduction.

## **CONCLUSIONS**

A significant increase was found in the sex ratio value with tendency towards female offspring in the group of CAU professional basketball players. Basketball players have several features that fit the hypothesis of parental hormonal conditions at coital time and its influence in sex ratio; however more research is needed to prove our findings.

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Time of conception	TOTAL (n=61)				CAU (n=44)				AFR (n=17)			
	No. births (%)	♂	♀	Sex ratio	No. births (%)	♂	♀	Sex ratio	No. births (%)	♂	♀	Sex ratio
1 <sup>st</sup> quarter Dec-Jan-Feb	17(27,9%)	7	10	0,70	15(34,1%)	6	9	0,66	2 (11,7%)	1	1	1,00
2 <sup>nd</sup> quarter Mar-Apr-May	11(18,0%)	1	10	0,10	9 (20,4%)	0	9	0	2 (11,7%)	1	1	1,00
3 <sup>rd</sup> quarter Jun-Jul-Aug	22(36,1%)	7	15	0,47	13(29,6%)	2	11	0,18	9 (53,0%)	5	4	1,25
4 <sup>th</sup> quarter Sep-Oct-Nov	11(18,0%)	3	8	0,37	7 (15,9%)	1	6	0,17	4 (23,6%)	2	2	1,00
Total	61	18	43	0,42	44	9	35	0,26*	17	9	8	1,12*

Table I. Sex ratio of basketball players, CAU and AFR players in different periods of conception. First column of each group shows seasonal fertility.

CAU: Caucasian basketball players; AFR: African black basketball players; No. Birth (%): number of births (percentage of births over total); ♂: number of males; ♀: number of females; Sex ratio: number of males/number of females

\* Proportion of males and females births between CAU and AFR basketball players were different (p=0.03).