Open Access Original Article

The association of seasonal changes with conception and birth in a group of Iraqi women

DOI: https://doi.org/10.32007/med.1936/jfacmedbagdad.v60i3.6

Shaima K. Harmoosh* MBChB, MSc, PhD

Abstract:

Background: Temperatures and seasons have been suggested as environmental factors that influence fecundity in mammals. It has been reported that there is a link between human fertility and seasonal changes.

Objectives: The aim of the study was to assess whether the seassonal changes in tempreture, humidity, light intensity and light duration do influence fecundity and reproduction in the study group of Iraqi women who were from Baghdad.

Patients and Methods:This study was conducted on 1638 randomly selected womenn who were from Baghdad city and were normaly delivered at Al- Elwiyah Maternity Teaching Hospital during 2014. A detailed questionnaire form was filled through direct interview with the mothers shortly after delivery. The climate information were taken from the Iraqi Meteriological Department and Research Center of Solar Energy, Ministry of Science and Technology.

Results: Results obtained confirmed that there was a highly significant seasonal variations in birth and conception rates at different months of the year, The conception rates were significantly negatively correlated with mean temperature rates, light intensity and light duration and significantly but positively correlated with mean percent humidity.

Conclusion: These results confirm that there was a significant seasonal nfluence on human reproduction among the study group.

Keywords: seasonal, conception, birth, tempreture.

JFac Med Baghdad 2018; Vol.60, No .3
Received April. 2018
Accepted Oct. 2018
Published:Dec.2018

Introduction:

Baghdad has a hot, dry climate characterized by long, hot, dry summers and short, cold winters. The climate is influenced by Iraq's location between the subtropical aridity of the Arabian desert areas and the subtropical humidity of the Arab Gulf. The average temperatures in Iraq range from higher than 48 ºC in July and August to below freezing in January. The majority of rainfall occurs from December through April (1). Temperatures and seasons have been suggested as environmental factors that influence fecundity in mammals. It has been reported that there is a link between human fertility and seasonal changes (2). The breeding season is different for different animal species because each species has its own physiological, biological, biochemical and its own environmental characteristics that can determine its specific breeding time. In addition, different seasonal parameters like temperature, light, humidity...etc. can affect different species differently (3).

It has been suggested that melatonin which is affected by the photoperiod can regulate binding sites in the ovary indicate that melatonin has both direct (on ovarian receptors) and indirect action progesterone production, LH receptors, GnRH and GnRH receptor gene expression through melatonin receptor in human granulosa luteal cells.

**Al-Yarmook Teaching Hospital*
Email: dr_shemaa@yahoo.com

High levels of melatonin in human folicular fluid and melatonin (on hypothalamic receptors) on ovarian functions and so ovulation may be affected by season (4). In addition to that most reports demonstrated asignificant seasonal variation in some semen parameters, such as sperm concentration, total sperm counts and the percentage of spermatozoa with normal morphology (5). Also, in hot seasons hyperthermia may increase metabolic rate which may increase reactive oxygen species in the testis which may adversely affect semen quality and hence affect fertilization (6). Seasonal changes have been described for plasma concentrations of sex hormones such as testosterone and estradiol (7).. It is possible that hormone changes may be related to different individual physiological conditions and habits (i.e. duration of sleep, hours of light, melatonin levels and physical activity) (8 and 9).

Patients and Methods

This study was conducted on 1638 women from Baghdad city who concieved spontanously and admited for spontanous normal vaginal delivery at Al-Elwiyah Maternity Teaching Hospital for delivary during the period of 1st of January - 31st of December 2014. These 1638 women were randomly selected (by selecting 10% of deliveries each day). Information was collected i by direct interview with the mothers shortly after delivery and by direct

examination of the newly born babies using a special questionnaire form as shown below:

Mother
Name Age
Blood group and Rh
Occupation and Address during conception
Past medical history Past surgical history
Social and family history Reproductive history
Marriage conception period Contraception use and method prior to the current pregnany
Gravidity Parity Number of abortions
LMP EDD DUP
Conception date Conception month
Newborn baby
Date of birth Time of birth
Weight Sex
Gestational age Congenital malformation

The conception date and hence coception season was calculated according to the LMP (last menstrual period), early ultrasound reports and the clinically assessed gestational age of the newly born babies.

Exclusion criteria included:-

- Infertility history or treatment for infertility as assisted reproductive technique.
- Use of any method of contraception at least 6 months before the current conception.
- planned current conception due to any cause (i.e. the conception should be spontanous and not planned for).
- Travelling outside iraq during the current conceptin period.
- Chronic illness or invasive surgical operations during or 6 months before conception period.

Baghdad climate information regarding tempreture, humidity, light duration and intensity were taken from the Iraqi Meteriological Department and Research Centre of Solar Energy, Ministry of Science and Technology in Baghdad. According to the center's instrumental records, seasons are defined as winter (December, January and February), spring (March, April, and May), summer (June, July and August) and autumn (September, October and November). (10). Computerized statistical analysis was performed using the SPSS software (Statistical Package for Social Sciences) V. 14. Descriptive statistics for selected variables were calculated first, the statistical significance of association between different variables was tested using Chi square test, the relations between different variables were assessed using the correlation tests, $P<0.05$ was considered statistically significant.

Results

Table 1 shows the relative age distribution of the women in the study group, with those between 21 to 25 years representing 37% of the group, 20% were 20 years old or younger and 7% were over than 36 years.

Table 1: Distribution of the study group according to their ages.

Age groups	Percentage
<20	20%
21_25	37%
26_30	25%
31_35	11%
36_40	6%
>40	1%
Total	100%

Regardless of the season, the sex ratio for the newborns (male /female ratio) was 1.17:1 (54.1% males /46.9% females). The birth weight of the newborn babies was ≥ 2.5 kg. in 94.3% of cases, 86.4% were delivered at term (37 - 42 weeks), while 10.8% were preterm (<37 weeks). Results revealed that only 2.2% of the pregnancies were multiple pregnancies, and 0.6% had congenital malformations (table 2).

Table 2: Clinical data of the newborn babies.

Data of the newborn		**Percentage**
Sex	Male	54%
	Female	46%
Weight	≥ 2.5 kg.	94.3%
	< 2.5 kg.	5.7%
Gestational age	Term	86.4%
	Preterm	10.8%
	Postterm	2.8%
Multiple pregnancy	Single	97.8%
	Multiple	2.2%
Congenital malformation	None	99.4%
	Present	0.6%

Results showed that birth percentage was higher in hot months 58.9% and lower in cold months 41.1% while conception percentage was lower in hot months 44.8% and higher in cold months 55.2%, these differences were statistically highly significant ($P< 0.01$). (hot months were those in summer and autumn and cold months were in winter and spring) as in table 3.

Table 3: Conception and birth percentage of the newborn babies in hot and cold months

	Conception			Birth		
	Hot months	Cold months	Total	Hot months	Cold months	Total
No.	734	904	1638	965	673	1638
%	44.8	55.2	100%	58.9	41.1	100%

If the 1638 births were evenly distributed over the 365 days of the year, then Feb should have 7.7% of the births, months with 30 days should have 8.2% and months with 31 days should have 8.5%.. The same comment applies for the month of conception as shown in table 4.

Table 4: The monthly even and actual distribution of birth and conception percentage

Months	Birth			Conception		
	Even Distribution %	Actual Distribution %	Difference	Even Distribution %	Actual Distribution %	Difference
Jan	8.5	6.7	- 1.8	8.5	10.1	+ 1.6
Feb	7.7	5.2	- 2.2	7.7	9	+ 1.3
Mar	8.5	7	- 1.5	8.5	9.8	+ 1.3
Apr	8.2	6	- 2.2	8.2	9.5	+ 1.3
May	8.5	7	- 1.5	8.5	6.4	- 2.1
Jun	8.2	7.3	- 0.9	8.2	6.4	- 1.8
Jul	8.5	9.1	+0.6	8.5	4.5	- 4.0
Aug	8.5	10.4	+ 1.9	8.5	6.6	- 1.9
Sep	8.2	10.2	+ 2.0	8.2	9.6	+ 1.4
Oct	8.5	11.2	+ 2.7	8.5	7.9	-0.6
Nov	8.2	10.7	+ 2.5	8.2	9.8	+ 1.6
Dec	8.5	9.3	+0.8	8.5	10.3	+ 1.8

Correlating different seasonal parameters with the monthly conception percents, we noticed that the highest enviromental temperature means were associated with lowest conception percentage and the lowest temperature means were associatd with the highest conception percentage. The highest light intensity means were also associated with the lowest conception percentage and the reverse was true. For the mean light duration in hours, the more the duration was, the less the conception percentage were and vise versa. Concerning humidity, results revealed that the high enviromental percentage of humidity was associated with high conception percentage (Fig 1,2 and 3) There was a significant correlation at the level of 0.01 between each of the seasonal parameters (temperature, light intensity, light duration and humidity) with the monthly conception percents.

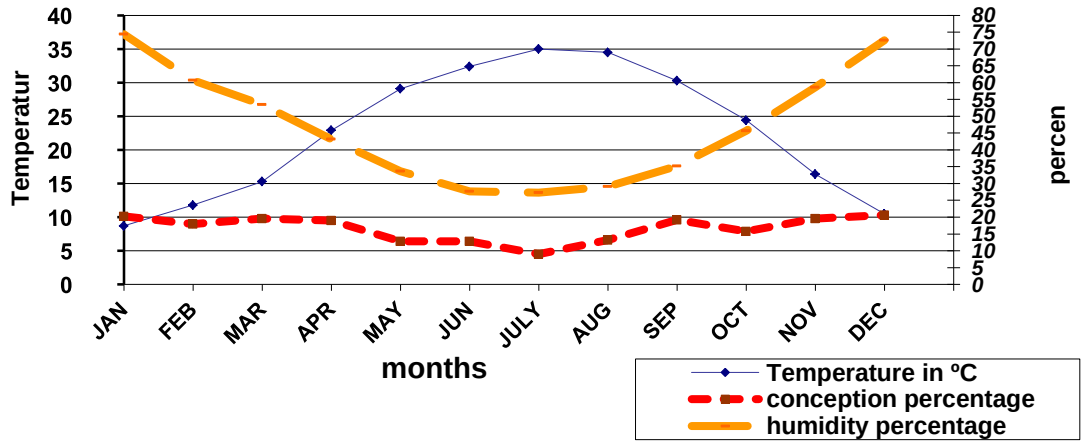

Fig. 1 Changes in the conception percentage associated with the monthly changes in ambient temperature and enviromental humidity percentage.

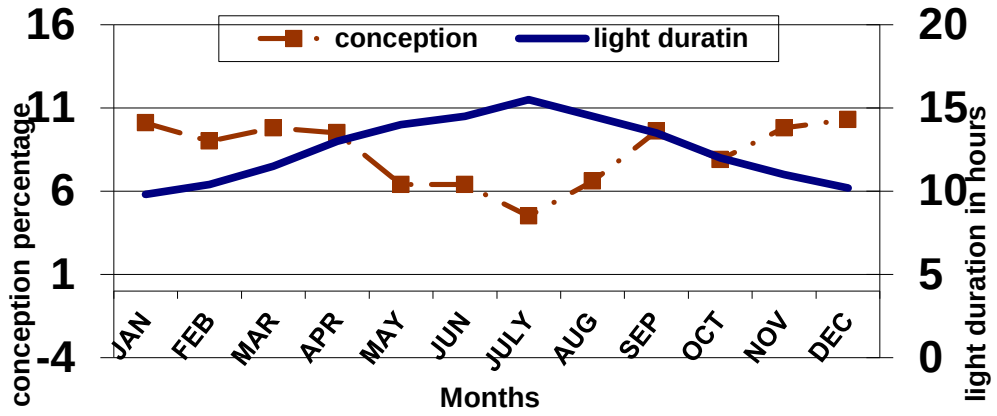

Fig. 2 Changes in the conception percentage associated with the monthly changes in light duration.

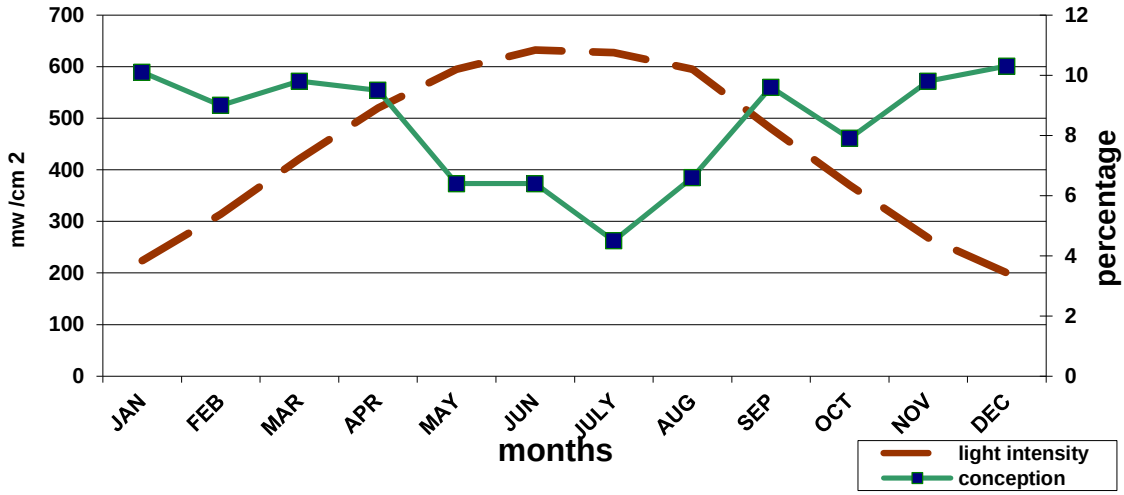

Fig. 3 Changes in the conception percentage associated with the monthly changes in light intensity.

Discussion:

The high percentage of mothers at the age of 21-25 and 26-30 years respectively may be explained on the ground that marriage in Iraq, generally speaking, is culturally preferred to be at young age, which may be due to the social trends in the country and to Islamic practices that encourage marriage at younger age. The highest conception percentage seen during winter, spring and autumn is negatively correlated with mean monthly temperature rates, light duration and light intensity means, while they were positively correlated with mean monthly humidity percents this is because of the dry summers in Iraq. These findings agreed with the results of several studies througout the world (11), such as rural parts of India (12), in Africa (13), in Gambia (14), in southern United States (15) and in Malaysia and China (16), while it disagreed with reports of authors in Sweden, Northern Europe, Canada and in northern United States (17 and 18) in which peak conceptions were reported in summer and least in winter. The reasons behind the significant difference in conception rates at different months of the year may be related to the seasonal fluctuation in Baghdad area in which mean temperature ranges from above 48º C in July to below freezing in January (10), light intensity ranges from above 700 mw/ cm2 in July to below 200 in January, light duration ranges from above 15 hours in July to below 10 in January and the humidity percent ranges from above 90 % in January to below 20% in July (10). In our country, the effect of summer ambient temperature which exceed the normal physiological body temperature (37°C) seems to override the effect of other seasonal parameters. High temperature may affect spermatogenesis by causing degeneration of most cells of the seminiferous tubules (19) causing least conception in summer. Hyperthermia in human has been recognized to be injurious to spermatozoa (20). Also high enviromental temperature has been reported to be associated with reduced spermatogenesis (21). The effect of occupational exposure to high temperature on male reproductive system may be due to a local effect on the testis causing tesicular impairement (22, 23). In addition, priorities of human physiology during summer in a country like Iraq is to provide means of maintaining life through getting rid of high heat load which may reach 20 to 25 °C by increasing heat loss through sweating, decreasing BMR (basal metabolic rate) suppressing the thyroid gland, decreasing water loss through urine and increase water intake (24). Systems of less importance in this, like reproductive system probably enjoyed less physiological support leading to decrease activity in terms of spermatogenesis, ovarian function and reproductive hormones production .....etc. (25). Several studies have also shown that photoperiodism associated with seasonal changes may be more important than ambient temperature in affecting human reproduction. However, these studies were performed in areas with very high seasonal photoperiod fluctuation from about 2-4 hours in winter to 18-20 hours in summer in northern Europe and northern United States (26). Photoperiodism is known to be associated with melatonin secretion from the pineal gland, which is stimulated by darkness and inhibited by light, so the more antigonadotropic effect of melatonin is seen during season of decreased light duration (27). All the above mentioned confirmed the biological baseline of birth seasonality. However, we can not ignore other factors that may disturb this finding like food availability, use of contraception, seasonality of marriage, religious and cultural beliefs, holidays and availability of leisure time, air conditioning (cooling and heating) of homes, fetal losses, psychological circumstanses and general circumstanses like wars....etc. These factors vary in different regions, and among families, religious and ethnic groups however seasonal changes in conception rates can not be ignored.

Conclusion:

These results confirm that there were significant influences of seasonal changes on human birth and conception.

References:

1. Shubbar R. M., Salman H. H. and Dong-In Leea: Characteristics of climate variation indices in Iraq using a statistical factor analysis: International Journal of Climatology 2016; 37(2).
2. Chandwani K. D, Cech I, Smolensky M. H, Burau K, Hermida R. C. Annual pattern of human conception in the State of Texas. Chronobiol Int. 2004; 21(1):73–93.
3. Wingfield, J.C., Hahn, T.P., Maney, D.L., Schoech, S.S., Wada, M. and Morton, N.: Effects of temperature on photoperiodically induced reproductive development, circulating plasma LH and thyroid hormones, body mass, fat deposition and molt in mountain white crowned sparrows, Zonotrichia Leucophrys Orientha. Gen. Comp. Endocrinol., 2003; 13 (2): 143- 158.
4. Woo, M.M., Tai, C.J., Kany, S.K., Nathwani, P.S., Pang, S.F. and Leung, P.C.: Direct action of melatonin in human granulosa luteal cells. J. clin. Endocrinol. Metab., 2001; 86 (10): 4789-4797.
5. aXin-Zong Zhang, aJin-Hao Liu, 1Hui-Qiang Sheng, 1Hong-Jun Wu, 1Ying Wu, 1Kang-Shou Yao, Jin-Chun Lu and Feng-Bin Zhang., Seasonal variation in semen quality in China. Andrology, 2013; 1, 639–643.
6. Hasan H. R. and Ena E. J.: Evaluation of some individual antioxidant in seminal plasma of fertile and infertile men. J. Fac Med Baghdad, 2005; 47, 2:190-4.
7. Moskovic DJ, Eisenberg ML, Lipshultz LI., Seasonal fluctuations in testosterone-estrogen ratio in men from the Southwest United States. J Androl. 2012; 33:1298–304.
8. Smith RP, Coward RM, Kovac JR, Lipshultz LI., The evidence for seasonal variations of testosterone in men. Maturitas. 2013; 74: 208–12.
9. Al Najar A. F.: Prevalence and pattern of endocrinological abnormalities in oligospermic and azoospermic patients. J. Fac Med Baghdad, 2010; 52, 4:402-4.
10. Iraq Meteorological Department and Research Centre of Solar Energy, Ministry of Science and Technology, 2014; Baghdad, Iraq.
11. Amariei A-M, Elisabeta J. Birth Seasonality - A comparison between five countries from 2004 to 2013. Macrotheme Rev. 2015;4:3.
12. Anand, K., Kumar, G., Kant.S. and Kapoor, S.K.: Seasonality of birth and possible factors influencing it in rural area of Haryana, India. Indian-Pediatrics., 2000; 37: 308- 312.
13. Osei, E., Agbemefle I., Kye-Duodu G. and Binka F. Linear trends and seasonality of births and perinatal outcomes in Upper East Region, Ghana from 2010 to 2014. BMC Pregnancy Childbirth. 2016; 16: 48.
14. Moore, S.E., Fulford, A.J., Streatfield, P.K., Persson, L.A. and Prentice, A.M.: Comparative analysis of patterns of survival by season of birth in rural Bangladeshi and Gambian populations. Int. J. epidemiol.,2004; 33(1): 137-143.
15. Martinez-Bakker M., Bakker K. M., King A. A. and Rohani P.: Human birth seasonality: latitudinal gradient and interplay with childhood disease dynamics. 2014; 281(1783): 2013.2438.
16. Holland, B.: Seasonality of births: Stability and change in a developing country. Hum. Biol., 1989; 61: 591-598.
17. Lam, D.A. and Miron, J.A.: Global patterns of seasonal variation in human fertility. Ann. N. Y. Acad. Sci., 1994; 709: 9-2 8.
18. Barreca, A., Deschenes O. and Guldi M.Temperature Shocks, Climate Change, and Dynamic Adjustments in Birth Rates. IZA, 2015; 9480,
19. Guyton, A.C. and Hall, J.E.: Reproduction and hormonal function of the male (and the pineal). Female physiology before pregnancy and the female hormones. In: Textbook of medical physiology. Guyton, A.C. and Hall, J.E. (eds.). A harcourt publishers international company Philadelphia. 2001; Pp. 929-1015.
20. Hjollund N.H, Storgaard L, Ernst E, Bonde J.P, Olsen J. Impact of diurnal scrotal temperature on semen quality. Reprod Toxicol. 2002;16(3):215–21.
21. Momen M. N., Ananian F. B., Fahmy I. M. and Mostafa T. Effect of high environmental temperature on semen parameters among fertile men. Fertil Steril, 2010; 93: 1884-1886.
22. Hamerezaee M., Dehghan S. F., Golbabaei F., Fathi A., Barzegar L. and Heidarnejad N. Assessment of Semen Quality among Workers Exposed to Heat Stress: A Cross-Sectional Study in a Steel Industry. Safety and Health at Work, 2018; 9(2): 232-235
23. Cortez O. D. Heat stress assessment among workers in a Nicaraguan sugarcane farm. Glob Health Action, 2009; 2:. 1-6Ganong, W.F.: Endocrinology, metabolism and reproductive function: The gonads development and function of reproductive system. General cellular basis of medical physiology. Circulation. In: Review of medical physiology. Ganong, W.F. (ed.), 21st ed. Lange Medical Books /McGraw-Hill, USA. 2003; Pp. 1- 458.
24. Berne, R.M. and Levy, M.N.: The reproductive gland. Interplay of central and peripheral factors in control of circulation. In: Physiology. 3rd ed. Mosby year book., Chicago, London and Philadelphia. 1993; Pp. 532-1024.
25. Levine, R.J., Shue, F., Brown, M.H. et al.: Air-conditioned environments do not prevent deterioration of human semen quality during the summer. Fertil. Steril., 1992; 57: 1075-1083.
26. Walton J. C., Weil Z. M. and Nelson R. J. Influence of Photoperiod on Hormones, Behavior, and Immune Function. Front Neuroendocrinol. 2011; 32(3): 303–319.
27. Gupta B. B., Spessert R. and Vollrath L. Molecular components and mechanism of adrenergic signal transduction in mammalian pineal gland: Regulation of melatonin synthesis. Indian journal of experimental biology. 2005 43(2):115-49 ·

تاثير العوامل الفصلية على الولادات والخصوبة لمجموعة من من النساء في العراق

د. شيماء كامل هرموش

ملخص:

خلفية البحث: لايخفى على احد ان للتغييرات الفصلية والعوامل المناخية تاثير كبير على الخصوبة والتكاثر للحيوانات اما على الانسان فالتاثير يحتاج الى بحوث لإثباته.

الهدف: ان الهدف من هذه الدراسة هو لرؤية ماذا كان للتغييرات الفصلية تأثير على الخصوبة والتكاثر لمجموعة من النساء في العراق.

الحالات وطرق العمل: شملت الدراسة 1638 من النساء الوالدات ولادة طبيعية في مستشفى العلوية التعليمي في بغداد. أمتدت الدراسة على مدى سنة كاملة (2014) وتم أختيار العينة بصورة عشوائية ولكن متجانسة على مدى أشهر السنة حيث تم اختيار 10% من النساء الوالدات حديثا في كل يوم. وقد تم إعداد إستمارات خاصة شملت أسئلة متنوعة عن الصحة العامة والإنجابية لجميع النساء الخاضعات للدراسة ومعلومات مفصلة عن أطفالهن المولودين حديثاً حيث تم أخذ هذه المعلومات من الأمهات انفسهن ومن خلال الفحص السريري لهن وللاطفال المولودين حديثا.اما العوامل المناخية والتغييرات الفصلية فقد تم اخذها من دائرة الانواء الجوية في وزارة العلوم والتكنلوجيا في الجادرية ببغداد.

النتائج : تراوحت أعمار النساء من 14 الى 47 سنة. أثبتت النتائج التي تم الحصول عليها وبأحصائية معنوية عالية جداً(اي انها نتائج ذات معنى احصائي) أختلافاً في نسبة الولادات والإخصابات في مختلف أشهر السنة حيث تم تسجيل أعلى نسبة إخصاب في أشهر الشتاء والخريف والربيع في حين كانت أقل نسبة إخصاب في أشهر الصيف مع نزول كبير في شهر تموز وأن هذه النسب كانت متناسبة سلبياً وبمعنوية عالية جداً مع المعدلات الشهرية لدرجات الحرارة وشدة وعدد ساعات الأضاءة ومتناسبة إيجابياً وبمعنوية عالية أيضاً مع المعدلات الشهرية للرطوبة النسبية. **الاستنتاجات:** أثبتت هذه الدراسة أن للعوامل المناخية تأثير معنوي كبير على تكاثر الأنسان في العراق وقد تكون هذه النتيجة مهمة من الناحية العملية عند أخذ التحاليل للسائل المنوي والهرمونات التكاثرية لأغراض تشخيصية حيث يفضل أن تؤخذ قبل أو بعد فصل الصيف خاصة بالنسبة للرجال قليلي الخصوبة وأيضاً عند أجراء الإخصاب المختبري (عمليات اطفال الانابيب) أوالتلقيح الأصطناعي لهؤلاء الأشخاص حيث يفضل أن تجرى مثل هذه العمليات قبل أو بعد فصل الصيف للحصول على نتائج أفضل.

مفتاح الكلمات: العوامل الفصلية، الخصوبة، الولادات، درجات الحرارة.