AJPS, 2018, Vol. 18, No.1 **Date of acceptance:11-1-2018**

The correlation between the sociodemographic characteristics and some hormones with the infertility of women and men

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DOI: https://doi.org/10.32947/ajps.18.01.357

Abstract:

Thirty-three infertile women were divided into two groups according to their BMI (21 obese and 12 overweight) there age ranges between (16-41) years, with their husbands twenty-one infertile men and twelve fertile men and their ages range between (23-46) years. In the present study we observed that several indicators affect the fertility such as BMI in infertile obese women which was 34.65 kg/m2. That is higher than that of overweight infertile women that recorded 24.87 kg/m2. obese housewives scored the highest percentage (85.71%) compared with the overweight group (25%), In addition the obese age group between 30-41 years scored (66.67%) compared with the overweight group whose members' age 16-29.9 years scored 75%. However, drinking cola (soft drink) percentage in obese infertile women was (85.71%) and the tea consumption was higher in overweight group (66.67%). The hormones FSH and LH decrease in obese women, but serum prolactin hormone increased twice about 29.27 ng/ml in comparison with overweight group. Testosterone hormone decreased in obese women but Leptin in obese women (19.52 µg/L) was higher than that of overweight women (11.03 µg/L). Infertile unemployed men got the highest percentage of 66.67%. Besides, the smoker infertile men were higher in percentage (80.95%) compared with fertile men 41.67%. The elevated LH, FSH and prolactin values are significantly high ($p<0.01$) (7.895 mlU/ml, 9.89 mlU/ml and 13.33 ng/ml) respectively, but the testosterone was significantly low (3.91 ng/dl) in comparison with fertile men(21.76ng/dl). While leptin significantly increased in infertile men more than the fertile ones. These changes in hormones have a great correlation with semen characteristics as the abnormalities in sperms increased to (64.52) and the percentage of rapid, progressive and non -progressive motility decreased, but the immotile motility was highly significant (65.71) in infertile men. As a result, this indicates that the reason of infertility is shared between the wife and husband**.**

Key words: Infertility in women and men, cola, tea, obesity, hormones, semen characteristics.

دور الخصائص الاجتماعية والديموغرافية وبعض الهرمونات للنساء والرجال في الخصوبة

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الخلاصة:

اجريت الدراسة في مستشفى كمال السامرائي على 33 أمراة عقيمة وقسمت الى مجموعتين حسب مؤشر كتلة الجسم BMI) 21أمرأة بدينة و 12من غير البدينات) مع ازواجهم 21 رجل عقيم و12 رجل غير عقيم وتم دراسة اوتقصي مدى مستوى العمر ،عمر الزواج ،العمل، شرب الشاي والمشروبات الغازية وكذلك تم دراسة مستوى بعض الهرمونات (FSH, LH, Prolactin, Testosterone, Leptin)لدى الطرفين . ولقد كان تأثير لكل من هذة العوامل على الخصوبة لدى النساء اذ وجد ان شرب المشروبات الغازية والسمنة كان لهما تأثير سلبي كذلك ارتفاع هرمون البرولاكتين كان لة تأثير سلبي لدى النساء العقيمات وذوات الاوزان الكبيرة عن النساء غير البدينات.

بالرغم من تركيز الحيوانات المنوية لدى الرجال العقيمين كان 20.33 مليون/مل حيث كانت متوسط الحيوانات المنوية الشاذة 64.52 وكذلك حركة الحيوانات المنوية كانت منخفضة وكانت غير المتحركة منها 65.71 مع انخفاض في ممستوى هرمون التستوستيرون لدى الرجال العقيمين 3.91 نانوجرام/ ديسلتر مع ارتفاع هرمون البرولاكتين لدى الرجال

الى 13.33 نانوجرام/ مل . وهذا ان دل على شي فانة يدل على ان الاسباب هذة مجتمعة لها تأثير على الرجال والنساء ومن الأثنين مشتركين كانت الاسباب.

الكلمات المفتاحية : العقم في الرجال والنساء، المشروبات الغازيةا، شاي، سمنة، هرمونات، الحيوانات المنوية.

Introduction:

Infertility is the failure to conceive a child for more than one year with regular intercourse. It has two types: primary infertility in which women has never had a child before, Secondary infertility in which women has a difficulty to bear a child, either due to difficulty getting pregnant or staying pregnant [1]. About forty percent of the issues involved with infertility are due to men, another forty percent is due to women, and twenty percent are caused by both male and female problems or by unknown problems [2]; However, it may be indicated earlier. It remains a major clinic and social problem affecting perhaps one in six couples. However, the incidence of infertility may vary from region to region [3]. It depends on many factors such as obesity, diet, weight, environmental pollutants, infections, life style, family and medical history [4]. Obesity affects the health of women as well as their offspring [5]. Infertility may be caused by an underlying medical condition that may damage the fallopian tubes, or causes hormonal changes[2].

Imbalanced hormones deficiencies of luteinizing hormone (LH), follicle stimulating hormone (FSH), prolactin, testosterone and leptin, even simple irregularities in the hormonal system can affect ovulation [6]. Ovulation problems are often caused by polycystic ovarian syndrome (PCOS) in which the eggs partially grow within the ovary and their male hormones (Androgens) rise. While the ovaries of other infertile women do not release egg. Primary infertility in women may result from biological malformations of the fallopian tube, infections (chlamydia or scar tissue), medical problems with the uterus, overweight, underweight, her old age as female fertility drop after the age of 35 or combination of many factors [7].

During the past years, attention have been drowned about the effects of soft drinks (cola) on human health, cola contains high amount of glucose sugar and high fructose corn syrup. Too much consumption of these soft drinks may lead to glycemic load, resulting in osmotic diuresis and hyperinsulinemia [8]. The cola affects pregnancy causing miscarriages, menstruation and ovulation, and semen in males causing reduction in semen quality. Although caffeine intoxication may be thought to play the most important role in causing hazards but another component of cola other than caffeine does, there is an increased risk of reproductive hazards in heavy cola consumers (> 1 L per day) [9].

This study aimed to know the effect of social and physiological factors on the fertility in men and women. This experiment has been designed so that the infertile women with their spouses were put under observation and analysis to reach the possible causes of infertility.

Materials &Methods

This study was conducted on 33 infertile women (primary and secondary) between (16-41) years old and 21 infertile men age between (23-46) years old and 12 apparently fertile males who attended the Kamal Al-Samarai hospital in Baghdad city from February to April 2017.

The exclusion criteria involved women who had previous ovarian surgery, women receiving sexsteroid or any drug known to affect ovarian function for at least two months. Personal information of each woman was obtained through a special designed questionnaire (Occupation, Age, Marriage years, Beverage type) and body mass index which was measured based on body weight in kilogram relation to height

square in meter. The infertile women were subdivided into two groups based on their BMI (WHO 2008), as below

Group 1: including 21 infertile women there BMI over 30 kg/m^2(obese).
Group 2: including 12 infertile women there BMI under 29.9 kg/m^2(overweight) (control)
Group 3: including 21 infertile men
Group 4: including 12 fertile men (control)
All women had their blood collected on the second day of the menstrual cycle for all testing; 5 ml of venous blood were collected in gel separator tubes. The sera were isolated (after 20 minutes of blood collection) by centrifugation at 3000 rpm for 10 minutes; after centrifugation the sera were transferred and divided upon six Eppendorf tubes, then saved at -30 ^oC until analysis. Measurement of serum hormone including FSH, LH, prolactin and testosterone were done by immune enzymatic assay by using mini VIDAS reader, leptin levels were measured by using DRG Leptin ELISA kit (Germany) specimen sample containing endogenous Leptin which is incubated in a coated well with a specific biotinylated monoclonal antileptin antibody.
In regard to infertile males we exclude any history of mumps orchitis, testicular trauma, treatment with cytotoxic drugs and undescended testes. After collecting information about the occupation, age, smoking, marriage years and the body weight and height. All men (21 infertile plus 12 fertile men) had their blood collected 5 ml separated to take the serum, then stored in refrigerator at -30 ^oC for biochemical analysis (LH, FSH, prolactin, testosterone and leptin). After that semen was taken from every man to analyze the sperm physical characteristic and count assay according to WHO 2011. For estimating abnormal sperm percentage, smears from freshly collected semen stained by watery eosin (5%) dried in air, were examined on the spot, accounting of 100 sperms was made in each slide. Also, mass motility was carried out by means of a microscope equip peal with a hot stage set on the temperature of 37–40 ^oC. The significant deference between the groups was tested using the student pair's t-test analysis in Tables 3&4&5. But in Table 2 complete randomize design (CRD) test was used and with least significant difference test (LSD) [10].

Result & Discussion

Table 1 shows the average values of anthropometric parameters: occupation, age, marriage period and beverage type. The highest percentage (85.71%) of obese infertile women were housewife, the lower percentage (14.39%) were working women. However, most overweight women were workers of highest percentage (75%). From these results we conclude that the housewife may be eating over the diet more than the worker woman who occupies itself at work and movement.

Table-1: Socio –demographic characteristics of the samples women

Parameters		Obese group n= 21(%)	overweight group n= 12(%)
Occupation	Housewife	18 (85.71%)	3(25%)
	Work	3 (14.39%)	9 (75%)
Age (year)	16-29.9	7 (33.33%)	9 (75%)
	30-41	14 (66.67%)	3 (25%)
Marriage period (in years)	Primary	12 (57.14%)	12 (100%)
	Secondary	9 (42.86%)	----------
Beverage type	Tea	3 (14.29%)	8 (66.67%)
	Cola	18 (85.71%)	4 (33.33%)

On the other hand, there was more difference between the obese women in the age between 16-29.9 years was (33.33%) and in the age between 30-41 years was (66.67%). On the contrary, the highest percentage in overweight women (75%) in age 16-29.9 years, but the lowest percentage (25%) was in women aged between 30-41 years, from these results we show that the elder women (30-41 years) were obese with the opposite of overweight aged between 16-29.9 years was the highest (75%). Female fertility starts to fall gradually after the age of thirty-five [11].

In the present study, according to marriage period high percentage in obese group (57.14%) and overweight group (100%) was due to primary infertility. Primary ovarian insufficiency causes ovulation problem, it occurs when women's ovaries stop working normally before she is 40years old, together with the obstruction of fallopian tube due to disfigurations, infections such as chlamydia or scar tissue. However, ovulation problems caused by polycystic ovarian syndrome (PCOS) in which the eggs only partially growth within the ovary is the most common cause for ovulation problems [7]. In the present study, beverage type represented 14.29% in obese group who drink more than 5 cups of tea that was lower than the group of overweight whose majority percentage (66.67%)drink tea. These results are in agreement with (Huang etal, 2012) who reported that high caffeine use (> 5-7 cups per day) has been associated with reduced natural fertility in some research. It has been observed in some studies that moderate to heavy caffeine use increased the average of pregnancy loss [13]. The study by Mostafa et al .,(2012) showed that 56.4% of primary infertile women drink tea or coffee. These modifiable lifestyle factors such as, diet, smoking and caffeine or alcohol consumption may affect fertility [15]. Furthermore, the result of consumption of cola in this study was 85.71% in infertile obese women but as low as 33.33% in overweight , cola may contain large quantities of glucose and high fructose corn syrup. Highly caloric carbohydrate soft drinks include large amount of caffeine ranging from 95 to 160 mg/L [9]. Consumption of caffeinated soft drinks was related to high risk of ovulatory disorders, women consuming at least 2 or more soft drink each day reducing uterine blood flow causing infertility [16]. Recent report indicates the relation between cola intake and infertility risks [9]. Mostafa et.al. (2012), showed that there was a significant increase in sugar consumption due to drinking beverage in the group under experiment compared to control group (2.32 vs 1.47 respectively). Mahboub (2013), Showed that women who consume cola had shorter fertility period than non-consumers, consumers also had lower number of babies and associated between the recurrence of cola consuming and late menarche.

Infertility is caused by insufficiency or imbalance of hormones, insufficiency in luteinizing hormone (LH), follicle stimulating hormone (FSH) and elevated prolactin, even simple irregularities in the hormonal system can have an impact on ovulation or lead to pathological problems within the uterus [6]. It is important to analyze FSH and LH to reach the main cause of infertility in women and men, to know specifically weather the reason is primary or secondary.

Table-2 shows that FSH and LH hormones in infertile obese women has significant difference ($p<0.05$) than overweight group. In addition, prolactin, Leptin hormones and BMI in infertile obese women were highly significant ($p< 0.01$) than overweight infertile women. These results agree with the results of Goswami et.al. (2009), who declared the correlation between prolactin and menstrual disturbances in infertile women together with Alaa et al (2015), who showed that sex hormones disturbance in obese women cause secondary infertility. Body fat influence human reproduction, it leads to

reproductive disadvantage, a body weight defect is one of the first possibility causes of reproductive failure in women [19].

Table-2: Comparison of BMI, serum LH, FSH, prolactin, testosterone and Leptin in the infertile obese a

Parameters	Obese group n=21	Overweight group n=12	P-value (0.05 and 0.01)	Normal average in women at follicular stage (1-10 day)
FSH (unit/L)	6.16± 0.123	7.61± 0.211*	0.445	2.9-12.0
LH(unit/L)	3.38± 0.021	3.96± 0.032*	0.082	1.5- 8.0
Prolactin(ng/ml)	29.27± 1.78	16.02± 1.98**	1.10, 2.21	5.0- 35.0
Testosterone(ng/dl)	0.525± 0.012	0.616± 0.014	0.185	0.1- 0.9
Leptin (µg/L)	19.52± 0.77	11.03± 0.667**	1.28, 3.85	12.7
BMI kg/m^2	34.65± 3.81	24.871± 2.23**	2.67, 4.85	

Value is mean ± SD, *p< 0.05 significant difference,
**p <0.01 highly significant difference

Women with hormonal imbalance will not produce enough follicles to ensure the development of an ovum [20]. Emokpae (2005) submitted that the increase in serum prolactin leads to amenorrhea, feedback of estrogen on LH causing the decrease in serum LH values [21] which was in line with our study. About 70% of women who are infertile as the result of body weight disorders will perceive spontaneously if their weight disorder is true through a weight–gaining or weight reduction diet as convenient [18]. Obesity affects approximately half of the general population and common problem among the fertile population. LH and FSH with each other are required for follicle development and estrogen production. Due to elevate of prolactin, the FSH and LH are decreased and causes infertility [22-23].

Table 3: Comparison between study group 3 (infertile) and control group 4 (fertile) groups as regard to occupation, age, smoking and marriage years in men.

Parameters		Infertile men n= 21 (%)	Fertile men (Control group) n=12(%)
Occupation	Employee	7 (33.33%)	4 (33.33%)
	unemployed	14 (66.67%)	8 (66.67%)
Age	20-29.9	9 (42.86%)	4 (33.33%)
	30-40	12 (57.14%)	8 (66.67%)
Smoking	Yes	17 (80.95%)	5 (41.67%)
	No	4 (19.05%)	7 (58.33%)
Marriage period (in years)	Primary	16 (76.19%)	
	Secondary	5 (23.81%)	

In table 3, The employee had higher percentage (66.67%) in infertile or fertile men when compared to the unemployed (33.33%). The majority cases of infertile men were smokers (80.95%)in comparison with control group (41.67%). Moreover, the primary infertile percentage was higher (76.19%) when compared with secondary percentage (23.81%). Also, there is no difference between fertile and infertile men regarding age. High levels of stress also showed evidence, work related factors such as prolonged working hours, physically demanding work, jobs requiring

long standing and night shifts seem to interfere [24]. Marriage age determines the age of conception, which reflects the years of active reproductive life. This might be one of the factors that highly affect fertility in Saudi Arabia because teenage marriage was common in the public [25]. Soto (2011) found that the age of male partner above 35 years were associated with decreased level of fertility. The study of Fakuda et al., (2011) showed that smoking of female or her husband was associated with decreased facundability and delay in conception. Smokers has 23% decreases in sperm concentration and 13% decrease sperm motility compared with non-smokers [26]. There were many factors associated with reduced fertility such as age, weight, smoking, and heavy caffeine consumption which have been linked with sub-fertility [26].

In table 4 we find that the mean value of semen concentration in infertile men was 20.33± 3.77 million per ml compared to 36.67± 4.11 million per ml in fertile group (control). This value in fertile men highly significantly (P< 0.01) than infertile men.

Table 4: some of semen characteristics in infertile & normal men.

Characteristics	Infertility n= 21	Fertile n= 12
Concentration million/ml	20.33± 3.77	36.76± 4.11**
Abnormality	64.52± 6.54	18.87± 2.23**
Motility		
A= Rapid	2.619± 0.19	38.55± 2.11**
B= Progressive	12.143± 1.91	45.67± 2.32**
C= Non-progressive	18.81± 1.88	10.02± 0.13**
D= Immotile	65.71± 2.44	5.76± 0.06**

Data expressed as mean± SD

**p<0.01: highly significant difference

The highest mean value of abnormal sperm was found in infertile men (64.52±6.54) while the lowest one was found in normal men (18.87±2.23). However, the rapid motility was low in value (2.619±0.19) the progressive motility (12.143±1.91) and non-progressive (18.81±1.88) but high record in immotile motility (65.71±2.44) in the semen of infertile men. On the contrary the rapid motility in fertile men was (38.55±2.11) and progressive motility (45.67±2.32), non-progressive motility (10.02±0.13) and immotile motility (5.76±0.06). From these result we show that the high value of abnormal sperm (abnormal head, double head and tail, large or small head … etc.) and immotile sperm in infertile men may be returned to damage in testes or cryptorchidism which is related to declining sperm quality or infections like mumps and this agrees with that report by Hyfa et al.,(2016) who showed that heavy metal pollution causes testes damage which results in male infertility . Reduced sperm cell count can result from inadequate secretion of LH and FSH or others hormone. In spite the concentration of semen in infertile men was 20.33±3.77 million and this is within the focus of the normal, but these sperm present with high immotile percentage and high abnormality.

Table 5: Comparison of BMI, serum LH, FSH, prolactin, testosterone and Leptin in the infertile and normal men.

Parameters	Infertile men n= 21	fertile men n= 12	Normal average
BMI (kg/m^2)	25.45 ± 1.34	26.11± 2.31	
LH (mLU/ml)	7.895± 0.85	2.12± 0.31**	1.1-7
FSH (mLU/ml)	9.89± 1.12	3.39± 1.45**	1.7-12
Prolactin (ng/ml)	13.33± 2.15	5.65± 3.34**	1.5-19
Testosterone (ng/dl)	3.91± 0.51	21.76± 1.45**	3-10
Leptin (µg/L)	9.40± 0.44	2.95± 0.35**	3.84± 1.79

Data expressed as mean±SD

** P< 0.01: Highly significant difference

Gonadotrophin-releasing hormone (GnRH) is released from neurons in hypothalamus, GnRH from hypothalamus stimulating the secretion of LH and FSH from the anterior pituitary gland, LH stimulates testosterone secretion from the interstitial cells of testes. FSH stimulates sustentacular cells of the seminiferous tubules to increase spermatogenesis and to secrete inhibin [30]. Table 5 shows that there is no significant difference between BMI in fertile (26.11±2.31) men or infertile (25.45 ±1.34) kg/m^2. But, there were obvious differences between serum LH and serum FSH. The mean serum LH level of these infertile men (7.895±0.85) mLU/ml compared to (2.12±0.31) mLU/ml of the fertile men. This result is more than three times of normal LH value and is significant. The serum FSH value was (9.89±1.12) mLU/ml in the infertile men in contrast with the levels in the control group who were lower (3.39± 1.45) mLU/ml. This result agrees with Shahroona et al., (2007) which showed that the serum FSH level was 26.40±11.43 mLU/ml in the test group in contrast with the levels in the control group was 3.71± 1.25 mLU/ml, there was a powerful linkage (r= 0.67) between serum FSH and the sperm count. Serum prolactin increases in the infertile men and reach to (13.33±2.15) ng/ml compared to the control group (5.65±3.34) ng/ml. This result agrees with Shahroona et al., (2007) who showed that the mean serum prolactin in test group was (18.01±1.28) ng/ml compared to (5.43± 2.02) ng/ml of the control group, this value is more than twice the control prolactin value and is highly significant (p< 0.01). Also, Monireh and Gholamhassan (2016) showed that the prolactin may impair the production of GnRH and subsequently result in testicular dysfunction with spermatogenic arrest and decreased serum testosterone concentration. On the other hand, Emokpae (2005) showed that defect at the hypothalamus or pituitary (hypogonadotropic- hypogonadism) which results in lower serum FSH & LH with increase in serum prolactin levels may possibly causes infertility. Hyperprolactinemia occur when excess secretion from lactotrophs in anterior pituitary [32]. Prolactin induce apoptosis in spermatogonal stage of the testes and then raise of FSH to these tissue cultures reverses these changes, as long as the hypersecretion of FSH can induce spermatogenesis, azoospermia is reversible [33].

The level of testosterone hormone (ng/ml) was low significant difference (3.91±0.51) ng/dl in test group in comparison with control group (21.76±1.45) ng/dl. This result agrees with Shahroona et al., (2007) who found that testosterone levels significantly lower (4.10±2.23) ng/dl in test group in comparison with the control group (14.02±2.48) ng/dl. low levels of testosterone hormone may be resulted from the conversion of testosterone to estradiol by the aromatase enzyme located in

adipose tissue and increased aromatase activity in obese males led to more androgens converting to estrogens, resulting in a higher level of estrogen and a decline of androgen in the serum [36]. Serum leptin has highly significant ($p<0.01$) increase in infertile (9.40±0.44) µg/L compared with normal men values (2.95±0.35) µg/L. Leptin is an important adipose tissue derived hormone, play a role in controlling body weight, immune function and reproduction [35], also leptin levels increases with obesity [36]. Emerging evidence that male obesity impact negatively on male reproductive potential not only reducing sperm quality, but in particular altering the physical and molecular structure of germ cell in the testes and ultimately mature sperm [37].

Conclusion

Women's fertility begins to decline in the late 20s with substantial decreases by the late 30s. Fertility for men is less affected by age but decline by the late 30s, also age at marriage and women education affects fertility. This research has reached to many causes of infertility in husband and wife, which are for example the bad habits of wives leading to obesity and the low sperm characteristics of men in addition to the impact of hormones in couples.

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