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RESEARCH ARTICLE

Prevalence of the Infertility Among Couples in Ouagadougou (Burkina Faso): a Population-based Survey

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Abstract:

Background:

Worldwide, 10 to 15% of couples are infertile. In Burkina Faso, there has never been a population-based prevalence study regarding infertility.

Objective:

To determine the prevalence and risk factors of infertility in Ouagadougou (Burkina Faso).

Method:

We conducted a cross-sectional study with prospective data collection on 480 households from March to May 2014 in Ouagadougou. In each household, both the men and the women of childbearing-age were interviewed by an investigator using a questionnaire. The main outcome was infertile men or women living in Ouagadougou.

Results:

The participant-reported infertility prevalence was 9.3% (95% CI: 7.0; 12.2) and 10.4% (95% CI: 7.9; 13.5) for men and women, respectively. The primary and secondary infertility prevalence rates were 4.8% (95% CI: 3.2; 7.2) and 4.4% (95% CI: 2.9; 6.7) respectively for men and 6.8% (95% CI: 4.8; 9.4) and 3.6% (95% CI: 2.2; 5.7) for women. Considering only infertile participants, primary infertility concerned 52.3% (95% CI: 37.2; 67.0) and 65.3% (95% CI: 50.6; 77.6) of men and women respectively.

The medically-diagnosed infertility prevalence was 2.9% (95% CI: 1.7; 4.9) in both men and women groups. The male and female-related infertility represented 35.7% (95% CI: 13.7; 66.0) and 42.9% (95% CI: 18.3; 71.6) of the cases respectively and the dual-factor-related infertility 21.4% (95% CI: 5.9; 54.0).

Conclusion:

Though lower than the global and Sub-Sahara African region's prevalence, the infertility prevalence in Ouagadougou was still high. Compared to previous data in the same country, we saw a shift from predominant secondary infertility to predominant primary one. Infections remained the leading cause of infertility.

Keywords: Burkina faso, Cross-sectional study, Infertility, Prevalence, Risk factor, Sub Saharan Africa, Survey.

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INTRODUCTION

According to the World Health Organization (WHO), infertility is the inability to bear a child during a period of one year for a woman or a man of childbearing age, having regular sexual intercourses without any contraception. Infertility is considered as primary when the couple has never born a child and secondary when it becomes unable to conceive during a 12-month period of trial after having born at least one child in the past. Worldwide, 10 to 15% of couples are infertile. Infections are the most frequent cause of infertility fueling more than 64% of female infertility in sub-Saharan Africa (SSA) and more than 38% elsewhere in the world [1, 2]. Infertility causes worrying, suffering and stigma for the couples who experience this problem. Mostly it is often a big challenge to manage for health professionals. In many communities, the burden of infertility relies on the woman inside the couple. The subsequent stigma can lead to depression, divorce, ostracism or economical vulnerability [2, 3]. In SSA where the main reason of marriage is often childbearing, these consequences can be worse.

The source of infertility can be attributed to the woman (25-37%), the man (8-22%) or both (21-38%) [1]. The prevalence of infertility in SSA compared to the rest of the world, is higher and can reach 30% or more in some areas [2, 4, 5]. In this region, infertility is often secondary [5].

In Burkina Faso, there is a paucity of data on infertility. To the best of our knowledge, no study has been conducted on the epidemiology of infertility in population in Burkina Faso. However, infertility represented 15% of all visits in gynecology at the university teaching hospital of Ouagadougou, Burkina Faso in 1991 [6] and was primary in 65.6% of the cases [7] with infections as the leading risk factor. Our objective was to determine the prevalence and risk factors of infertility in Ouagadougou the capital city of Burkina Faso.

MATERIAL AND METHODS

Study Design and Concepts Definition

This study was a cross-sectional study with prospective data collection on households in Ouagadougou (Burkina Faso), from March to May 2014. We considered as primary infertility, couples who had never had a live birth to avoid the bias of misreporting of first semester pregnancies or voluntary terminations of pregnancies. The desire of a child was assumed to be a proxy of regular unprotected sexual activities without any contraceptive use. The secondary infertility prevalence was calculated as the primary one, but considering only couples who had already born a child.

Sample Size and Sampling

We selected a multiple step systematic random cluster sample with a proportional probability to the cluster size. To determine the sample size, we considered the formula for sample size calculation in prevalence surveys, a 95% confidence interval, an alpha error of 5% and an infertility prevalence of 15% [8]. We estimated the cluster effect at 2 to determine the final sample size of 461 households to which we added 5% (total sample size was 480) to address potential non responses. The 480 households were distributed into 40 enumeration areas or clusters considering that we surveyed 12 households per cluster. Usually, a cluster should include from 12 to 30 units. The smaller the number of units in a cluster the higher the number of clusters to be surveyed and the better the quality of the data.

Each investigator had to select 12 households plus 3 (for replacement purpose) per cluster. Then, we divided the total number of eligible households in each cluster by 15 to determine the pace of the sample in that cluster.

We enumerated during a pre-survey all eligible clusters, considering some selection criteria such as living in Ouagadougou since at least 12 months, in the same house with his/her partner, being between 18 and 55 years for men and between 18 and 45 years for women and willing to participate to the survey. Then each investigator had to randomly select a number between one and the pace to select the first and the subsequent households to be surveyed. Once we had the 15 households per cluster, we proceeded to the selection of the 3 replacement households, considering a pace of 5 (15/3) and following the same procedure.

We excluded all couples in which one partner was unable to bear a child because of known causes such as hysterectomy, vasectomy, tubal ligation, sexual impotence or castration happening as a complication of a traffic or other incident, or a history of prostate cancer or cancer therapy (chemo and radiotherapy).The collected variables included basic socio-demographic characteristics, data on the couple infertility, the medical and/or obstetric history and the couples' lifestyle and sexual activities.

Data Analysis

To analyze the data, we ran a univariate analysis to describe our sample population, determining parameters such as means (continuous variables) and proportions (categorical variables) with a 95% confidence interval. In some table, some variables data were not applicable to both sexes like testicular trauma that was reported only for men. In these cases, we juste mentioned the note "not applicable" (N/A) in the corresponding cells. We did not report (N/R) smoking data in women because they were inconsistently collected with a lot of missing data. To avoid information bias (*e.g*. underreporting of polygamous men who may forget that they have an infertility issue, because they born children with other wives), we calculated infertility prevalence considering separately the responses of the men and women to determine what we named the "participant-reported infertility" as opposed to the "medically-diagnosed infertility". The primary participant-reported infertility prevalence among women was calculated as the number of childbearing age women who have never born a child and who had been seeking a child for more than 12 months divided by the number of surveyed women which represented also our total sample size. The primary medically-diagnosed infertility prevalence among women was calculated as the number of the primary participant-reported infertile women who's infertility had been confirmed by a physician's investigation, divided by the number of surveyed women. The same method was applied to determine males' primary participant-reported infertility prevalence. The male and female secondary infertility prevalence were calculated in the same way considering participant-reported and medically-diagnosed infertility. However, in the numerator, we considered as secondary-infertile men or women those men or women who have been seeking again a child for more than 12 months after having already born at list one child.

We further defined as male-related, female-related and dual-factor infertility all couples 'infertility with the source/cause in men, women or both partners simultaneously. In all these prevalence calculation, the denominator was the total sample size of 480 participants.

We built logistic multivariate models separately for male and female partners, to explore risk factors for infertility. The dependent variable was infertility inside the couple (yes or no). The dependent variable combines all type of participant-reported infertility including primary and secondary, male and female-related infertility. We first run a bivariate analysis to identify all factors associated with infertility at a p-value of 20% that we included in an initial regression model. That model included the following independent variables: marital regime (poly or monogamous), religion, income, smoking status, duration in smoking, number of cigarettes per year, history of sexually transmitted disease, sexual activity disorders, knowledge of the woman's period recurrence, past pregnancies'outcome. Further, using the backward step selection strategy, we selected our final model at a 5% p-value level. Though the tests were not significant, we forced some variables into the models due to their known relation with the infertility as reported in the litterature. Instances of such variables include sexually transmitted infection, male sexual activity disorders and the knowledge of the partner's period.

Ethics

The study protocol obtained the Burkina Faso national ethic committee's clearance and the protocol was implemented according to the Helsinki declaration. All participants were included after they have signed an informed consent form.

RESULTS

Participants' Baseline Characteristics (Table 1)

To recruit the households, we randomly selected 40 out of 1223 clusters including 172 673 households and 1 247 699 people as of 2006 enumeration data (the most recent one). The 40 clusters included 9 358 households and 44 387 people that we examined for eligibility.

Overall 2324 households were confirmed eligible. We included 480 households interviewing the man and the wife in each household. The mean age was 38.6 (95% CI: 37.9 - 39.3) and 30.8 (95% CI: 30.2; 31.4) years for male and female participants respectively (Table **1**). In the male group 81% were married and 95% of the married were living under monogamy regime; 19.5% had been to high school or to university; 81.5% lived with a maximum of $172.5 per month. In the female group these statistics were similar except for education and income where 9.8% had gone to high school or university and100% had a maximum income of $172.5 per month.

Infertile men were older, less educated, with smaller income and fewer under monogamy regime compared to the

men from the general population. Infertile women presented similar characteristics but were younger with the same income than the general women population.

Table 1. Socio-demographic characteristics of the the infertile women and men and the general population.

	General male population (95% CI) (N=480)	Infertile male partners (95% CI) (N=44)	General female population (95% CI) (N=480)	Infertile female partner (95% CI) (N=49)
Mean age (years)	38.6 (37.9 - 39.3)	38.7 (36.7; 40.7)	30.8 (30.2; 31.4)	29.9 (28.0; 31.7)
Categories of ages (years)				
≤25	3.3 (2.0; 5.4)	2.1 (0.3; 14.2)	23.5 (19.9; 27.6)	31.4 (19.9; 45.7)
>25; ≤35	30.2 (26.2; 34.5)	20.8 (11.3; 35.1)	48.7 (44.2; 53.2)	45.1 (31.7; 59.2)
>35	66.5 (62.1; 70.6)	77.1 (62.6; 87.1)	27.7 (23.9; 31.9)	23.5 (13.6; 37.5)
Marital status				
Married	80.8 (77.1; 84.1)	85.4 (71.8; 93.1)	81.2 (77.5; 84.5)	84.6 (71.6; 92.3)
Living together but not married	19.2 (15.9; 22.9)	14.6 (6.9; 28.2)	18.7 (15.5; 22.5)	15.4 (7.7; 28.4)
Matrimonial regime				
monogamy	94.7 (92.2; 96.5)	86.0 (71.5; 93.8)	94.9 (92.4; 96.7)	85.4 (71.8; 93.1)
Religion				
Muslim	59.0 (54.5; 63.3)	77.1 (62.6; 87.1)	55.4 (50.9; 59.8)	71.1 (57.0; 82.1)
Christian	40.6 (36.2; 45.1)	22.9 (12.9; 37.4)	44.4 (40.0; 48.9)	28.8 (17.9; 41.0)
animist	0.4 (0.1; 1.7)	0	0.2 (0.0; 1.5)	0
Education level				
Never been to school	15.8 (12.8; 19.4)	12.5 (5.6; 25.8)	30.2 (26.2; 34.5)	34.6(22.7; 48.9)
Primary school	33.5 (29.4; 37.9)	29.2 (17.8; 44.0)	35.0 (30.8; 39.4)	26.9 (16.3; 41.0)
Middle school	22.1 (18.6; 26.0)	27.1 (16.1; 41.8)	17.3 (14.1; 20.9)	13.5 (6.4; 26.2)
High school	11.0 (8.5; 14.2)	8.3 (3.0; 20.8)	5.4 (3.7; 7.8)	5.8 (1.8; 17.1)
University	08.5 (6.3; 11.4)	6.2 (1.9; 18.3)	4.4 (2.9; 6.6)	5.8 (1.8; 17.0)
Other	9.0 (6.7; 11.9)	16.7 (8.3; 30.5)	7.7 (5.6; 10.5)	13.5 (6.4; 26.2)
Mean income per month (USD*)				
≤ 86.3	44.2 (39.8; 48.7)	56.2 (41.6; 69.9)	93.3 (90.7; 95.3)	94.1 (82.7; 98.2)
>86.3; ≤172.5	37.3 (33.1; 41.7)	29.2 (17.8;44.0)	6.6 (4.7; 9.3)	5.9 (1.8; 17.3)
>172.5;	18.5 (15.3; 22.3)	14.6 (6.9; 28.2)	0	0

NB: data are means and percentages *USD: United State Dollar.

The Participants' Clinical History and Infertility Prevalence (Table 2)

Among the participants, 91.2% (95% CI: 88.3; 93.5) and 90.3% (95% CI 87.3; 92.7) of men and women respectively had children. Ten per cent (95% CI: 7.6; 13.1) of men and 10.9% (95% CI: 8.4; 14.1) women were seeking a child. The men have been seeking a child for a mean duration of 11.2 years and the women for 11.3 years. The participant-reported infertility prevalence was 9.3% (95% CI: 7.0; 12.2) and 10.4% (95% CI: 7.9; 13.5) for men and women respectively. The primary and secondary infertility prevalence rates were 4.8% (95% CI: 3.2; 7.2) and 4.4% (95% CI: 2.9; 6.7) % respectively for men and 6.8% (95% CI: 4.8; 9.4) and 3.6% (95% CI: 2.2; 5.7) for women. Primary infertility concerned 52.3% (95% CI: 37.2; 67.0) and 65.3% (95% CI: 50.6; 77.6) of all infertile men and women respectively. Among the participant-reported infertile couples, 73.7% (95% CI: 47.6; 89.6) and 51.8% (95% CI: 32.5; 70.7) of the men and women respectively had a medical diagnosis of infertility. The prevalence of medically-diagnosed infertility was 2.9% (95% CI: 1.7; 4.9); 1.0% (95% CI 0.4; 2.5) diagnosed as male-related infertility and 1.3% (95% CI: 0.6; 2.8) as female-related, and 0.6% (95% CI 0.2; 1.9) attributed to both males and females. Considering only medically-diagnosed infertility, the proportion of male and female-related infertility represented 35.7% (95% CI: 13.7; 66.0) and 42.9% (95% CI: 18.3; 71.6) of the cases respectively and the dual-factor-related infertility 21.4% (95% CI: 5.9; 54.0).

Table 2. Clinical characteristics and infertility prevalence(N=480).

	Male Partnersn (95% CI)	Female partners (95% CI)
All participants	**N=480**	**N=480**
Mean age at first marriage (years)	28.3 (27.8; 28.7)	20.7 (20.4; 21.0)

(Table 2) contd.....

	Male Partnersn (95% CI)	Female partners (95% CI)
All participants	**N=480**	**N=480**
Categories of ages at first marriage (years)		
≤20	3.5 (2.2; 5.6)	56.0 (51.5; 60.4)
>20 ; ≤25	25.8 (22.1; 29.9)	33.7 (29.6; 38.1)
> 25 ; ≤30	43.3 (38.9; 47.8)	8.5 (6.3; 11.4)
>30; ≤35	19.4 (16.1; 23.2)	
>35	7.9 (5.8; 10.7)	1.7 (0.8; 3.3)
Had children	91.2 (88.3; 93.5)	90.3(87.3; 92.7)
Seeking children	10.0 (7.6; 13.1)	10.9 (8.4; 14.1)
Participant-reported infertility		
Prevalence of Participant- reported infertility	9.3 (7.0; 12.2)	10.4 (7.9; 13.5)
Prevalence of primary participant-reported infertility	4.8 (3.2; 7.2)	6.8 (4.8; 9.4)
Prevalence of secondary participant-reported infertility	4.4 (2.9; 6.7)	3.6 (2.2; 5.7)
Participants seeking children	**N=48**	**N=53**
Mean duration of seeking children (months)	133.9 (93.5; 174.3)	135.4 (100.1; 170.7)
Intervals of durationss in seeking children		
≤12 months	8.9 (3.2; 22.1)	8.2 (2.0; 20.4)
>12 ; ≤60 months	33.3 (20.8; 48.8)	28.6 (17.4; 43.2)
> 60 months	57.8 (42.5; 71.7)	63.3 (48.5; 75.9)
Couples visiting a physician to seek a child	39.1 (25.8; 54.3)	53.8 (39.9; 67.2)
Infertile participants	**N=44**	**N=49**
Medical diagnostic of infertility among participant-reported infertile couples	73.7 (47.6; 89.6)	51.8 (32.5; 70.7)
Prevalence of medically- diagnosed infertility among all participants	2.9 (1.7; 4.9)	2.9 (1.7; 4.9)
Prevalence of male and female-related medically-diagnosed infertility	1.0 (0.4; 2.5)	1.3 (0.6; 2.8)
Prevalence of dual-factor medically-diagnosed infertility	0.6 (0.2; 1.9)	0.6 (0.2; 1.9)
Male and female contribution to medically-diagnosed infertility	35.7 (13.7; 66.0)	42.9 (18.3; 71.6)
Contribution of the dual-factor to medically-diagnosed infertility	21.4 (5.9; 54.0)	21.4 (5.9; 54.0)
Mean duration of medically-diagnosed infertility	167.3 (48.4; 286.2)	
Intervals of durations (months) of medically-diagnosed infertility		
≤24 months	36.8 (17.3; 61.9)	
>24 ; ≤60 months	15.8 (4.6; 42.2)	
> 60 months	47.4 (25.0; 70.8)	

NB: data are means and percentages

Description of the Infertility Risk Factors (Table 3)

The clinical history of the participants (Table **3**) showed that sexually transmitted diseases (STDs) were the most common event in both sexes (15.3% (95%CI:12.3; 18.8) of the men and 26.6% (95%CI:22.8; 30.8) of the woment) with a clear predominance in women., among infertile men, 24.9%, and 10% of infertile women were past or current alcohol drinkers.

More infertile males experienced STDs, testicular trauma, cirrhosis, a family history of infertility and sexual disorders than the general population men. Fifty-four per cent of the infertile men were past or current smokers compared to 36.9% in the general population. 89.6% (95% CI: 76.7; 95.7) of the infertile men had less than four sexual intercourses per month compared to 45.5% (95% CI: 41.1; 50.0) in the general population. None of the infertile men had more than 12 intercourses per month.

In infertile women population, the proportions of ectopic pregnancies, past abortion and still-births were higher than in the general women population. However, there was less history of infertility in the infertile women's family than in the family of their general population's counterpart. Among men and women, 17.9% and 25% respectively stated that they knew their partners' or their own menstrual cycle (in order to know the fertile period). After checking the accuracy of the statement by comparing the answer to the question "what day in the menstrual cycle is the day of ovulation?" to the true answer, 3.3% and 10.4% of men and women respectively did know the correct menstrual cycle.

Table 3. Potential causes and risk factors of male and female infertility.

	General male population 0000% (95% CI) (N=480)	Infertile male partner % (95% CI) (N=44)	General female population % (95% CI) (N=480)	Infertile female partner % (95% CI) (N=49)
Clinical history of the participant				
Chryptorchidy	0.6 (0.2; 1.9)	0	Not Applicable (N/A)	N/A
Varicocel	0.4 (0.1; 1.7)	0	N/A	N/A
Sexually transmitted disease	15.3 (12.3; 18.8)	22.9 (12.9; 37.4)	26.6 (22.8; 30.8)	29.4 (18.3; 43.7)
Cirrhosis	0.6 (0.2; 1.9)	2.1 (0.3; 14.2)		
Testicular torsion	0.6 (0.2; 1.9)	0	N/A	N/A
Testicular trauma	3.6 (2.2; 5.6)	4.2 (1.0; 16.2)	N/A	N/A
Disorders of ejaculation or erection	19.2 (15.9; 22.0)	22.9 (12.9; 37.4)	N/A	N/A
No pregnancy	N/A	N/A	6.8 (4.8; 9.4)	65.3 (50.6; 77.6)
Ectopic pregnancy	N/A	N/A	1.7 (0.8; 3.3)	1.9 (0.2; 13.2)
Tubal surgery	N/A	N/A	1.9 (1.0; 3.6)	1.9 (0.2; 13.2)
Past abortion	N/A	N/A	1.9 (1.0; 3.6)	7.7 (2.8; 19.3)
Still-birth	N/A	N/A	2.1 (1.1; 3.8)	7.7 (2.8; 19.3)
Died immediately after birth	N/A	N/A	4.4 (2.3; 8.4)	0
History of infertility in the family	13.6 (10.8; 17.0)	17.0 (8.5; 31.1)	19.0 (15.7; 22.8)	15.4 (7.7; 28.4)
Gonad toxin exposition	5.2 (3.5; 7.6)	0	5.0 (4.2; 8.6)	0
Life habits and menses period knowledge				
Smoking status				
Never smoked	63.0 (58.6; 67.3)	45.8 (31.9; 60.4)	98.9 (97.5; 99.6)	N/R
Current smoker	24.4 (20.8; 28.5)	25.0 (14.5; 39.6)	0.8 (0.3; 2.2)	N/R
Past smoker	12.5 (9.8; 15.8)	29.2 (17.8; 43.1)	0.2 (0.0; 1.5)	N/R
Number of cigarettes/day				
≤5	56.7 (49.1; 64.0)	65.4 (44.3; 81.8)	Not Reported (N/R)	N/R
>5; ≤10	43.3 (36.0; 50.9)	34.6 (18.2; 55.7)	N/R	N/R
Duration in smoking (years)				
≤5	14.1 (9.6; 20.3)	15.4 (5.5; 36.3)	N/R	N/R
>5; ≤10	24.7 (18.7; 31.8)	30.8 (15.4; 52.0	N/R	N/R
>10; ≤15	24.1 (18.2; 31.2)	11.5 (3.5; 32.1)	N/R	N/R
>15	37.1 (30.1; 44.6)	42.3 (24.2; 62.8)	N/R	N/R
Alcohol drinking				
Never drunk	70.4 (66.2; 74.4)	75.0 (60.4; 85.5)	90.0 (86.9; 92.4)	92.3 (80.7; 97.2)
Current drinker	25.0 (21.3; 29.1)	18.7 (9.8; 32.9)	8.1 (6.0; 11.0)	5.8 (1.8; 17.0)
Past drinker	4.6 (3.0; 6.9)	6.2 (1.9; 18.3)	1.9 (1.0; 3.6)	1.9 (0.25; 13.2)
Number of intercourses per month				
≤4	45.5 (41.1; 50.0)	89.6 (76.7; 95.7)	44.1 (39.7; 48.6)	44.2 (31.0; 58.2)
>4; ≤12	46.5 (42.1; 51.0)	10.4 (4.26; 23.3)	47.7 (43.2; 52.2)	44.2 (31.0; 58.3)
>12	8.0 (5.8; 10.8)	0	8.2 (6.0; 11.0)	11.56 (5.1; 23.9)
Know the partner's menses period	17.9 (14.8; 21.7)	22.9 (12.9; 37.4)	25.0 (21.3; 29.1)	15.4 (7.7; 28.4)
Checking of the correct period	3.3 (2.0; 5.4)	6.2 (1.9; 18.3)	10.4 (6.1; 17.20)	

Risk Factors Analysis (Table 4)

The bivariate analysis showed that the polygamous couples were significantly more at risk of infertility than the monogamous ones with an unadjusted odd ratio (UOR) of 3.9 (95% CI: 1.5; 10.0) and 3.6 (95% CI: 1.3; 9.6) for women and men respectively. Stillbirth and abortion or miscarriages were significant risk factors for couple infertility at both unadjusted and adjusted analysis for both female and male partners with adjusted ORs of 13.6(95% CI: 3.81; 48.4) and 14.4 (95% CI: 3.9; 52.9) respectively. Being a past smoker or having a history of STD was also significant risk factors for men.

Table 4. unadjusted and adjusted multivariate logistic regression of infertility risk factors among women and men considered in separate models.

		Women		Men
	Unadjusted OR* (95% CI)	**adjusted OR* (95% CI)**	**Unadjusted OR* (95% CI)**	**adjusted OR* (95% CI)**
Marital regime				
Monogamy	1		1	
Polygamy	3.9 (1.5; 10.0)		3.6 (1.3; 9.6)	
Religion				
Muslim	1		1	
Christian	0.5 (0.2; 0.9)		0.4 (0.2; 0.8)	
Income per month				
≤ 86.3	1		1	
>86.3; ≤172.5	0.9 (0.3; 3.0)		0.6 (0.3; 1.1)	
>172.5	No data		0.6 (0.2; 1.4)	
STI man**				
Yes			1	1
No			0.6 (0.3; 1.1)	0.3 (0.1; 0.9)
STI woman**				
Yes	1	1		
No	0.9 (0.4; 1.6)	1.1 (0.4; 3.0)		
Smoking				
Never smoke			1	1
Current smoker			1.5 (0.7; 3.1)	1.5 (0.5; 4.5)
Past smoker			3.9 (1.8; 8.1)	3.3 (1.0; 11.3)
Number of cigarettes per day			0.7 (0.3; 1.6)	
None			1	
>0; <=10			2.7 (1.4; 5.3)	
>10			1.8 (0.8; 4.1)	
Ejaculation or erectile disorders				
Yes			1	1
No			0.8 (0.4; 1.6)	0.9 (0.3; 2.7)
Pregnancy outcome				
Normal delivery	1	1	1	1
Stillbirth	10.0 (1.8; 56.1)	12.2 (2.0; 72.9)	10.2 (1.8; 56.7)	13.3 (2.1; 83.1)
Born alive but died immediately after	1.9 (0.2; 15.8)	2.2 (0.3; 18.3)	1.8 (0.2; 14.7)	2.2 (0.3; 18.5)
Abortion /miscarriage	9.7 (3.05; 30.6)	13.6 (3.81; 48.4)	9.8 (3.1; 30.9)	14.4 (3.9; 52.9)
Knowledge of partners menses cycle	1.2 (0.5; 2.6)		0.8 (0.4; 1.6)	

*odd ratio **sexually transmitted infection

DISCUSSION

The Prevalence of Infertility in Ouagadougou (Burkina Faso)

In Ouagadougou (Burkina Faso) 9.3 and 10.4% of men and women respectively were found infertile. In our study the infertile males and females' mean age was 38.7 (95% CI:36.7; 40.7) and 29.9 (95% CI:28.0; 31.7) years respectively. This was comparable to to two Nigerian studies that found a mean age of 39.1±6.0 for the male [9] and 31.1 years for the female partners [10]. Infertility was concentrated among women aged 25 to 34 in Nigeria [10] like in our study.

It is generally admitted that around 15% of the global population is affected by infertility [8, 9, 11 - 13]. We found a lower prevalence. However, this global average masks interesting variability according to geographical areas. Another study found a prevalence of 14% (no conception after 2 years of trying) in Aberden [14], 17% in Shropshire [15], 26% in Somerset [16] (no conception after 1 year). A recent review of studies concluded to a median prevalence of 9% in a study reporting results from 25 population surveys [17]. Other studies in the 1990s reported prevalence of 2.2% [16]

and 3.5% [14] for unresolved infertility (those who probably underwent medical diagnosis).

Worldwide the prevalence of the primary infertility is between one and five per cent and is estimated at around 3% in developing countries. Highest rates of primary infertility are found in Central Africa [18]. Along the same lines but with an important difference in Africa, a UNDP/UNFPA/WHO/World Bank research between 1980 and 1986 in different African, Asian and Latin-American countries found that infertility rates ranged between 1.1 and 3.6% in the five Asian countries, 1.9% in Brazil, but up to 12% in Africa [18]. In 2010, according to a study compiling data from 277 demographic and reproductive health surveys, the primary infertility was 1.9% (95% CI/ 1.7; 2.2). The prevalence levels in 1990 were 2% (95% CI: 1.9;2.2) for primary infertility and 10.2% (95% CI: 9.3; 11.1) for secondary infertility one. These statistics did not change in 2010 [19]. The ranges spanned from 1.5% (95% CI: 1.2%, 1.8%) in the Latin America/Caribbean region to 2.6% (95% CI: 2.1%, 3.1%) in the North Africa/Middle East region. Within the SSA region, the prevalence varied from 1.0%-1.1% in East and Southern Africa to 2.5% or greater mostly in central SSA. However, this study used the demographic definition of infertility (that considers 5 years without conception). In our study, primary infertility represented 52.3% (95% CI: 37.2; 67.0) and 65.3% (95% CI: 50.6; 77.6) of all infertility cases in men and women respectively. At the contrary of our finding, a hospital-based study realized in Ouagadougou from January 1996 to June 1997 found that secondary infertility cases were predominant (65.6%). We need to find satisfactory explanation to this shift occurring almost 20 years later.

The secondary infertility rate was determined at 10.5% (95% CI: 9.5; 11.7) at the global level and 11.6% (95% CI: 10.6%, 12.6%) in the SSA region [19]. This prevalence is higher than ours. This is probably due to country variability. The levels of secondary infertility ranged between 7.5-15.3% in Thailand and Vietnam and higher at up to 24% in Pakistan [18]. Studies in Benin, Cameroun and Tanzania found a secondary infertility rates between 7% and 33% and up to 35.0% in Nigeria [10].

Regarding the origin of infertility, a meta-analysis of global data showed that infertility related to male factors represented 20-70% of all infertility and 2.5-12% of the general population [8]. The male contribution to all infertility is in the same range in our study (42.9% (18.3; 71.6)). However the prevalence we calculated was lower. In this study that used the WHO clinical definition of infertility like us, male infertility in SSA is estimated between 2.5-4.8% while the all-cause infertility ranged from 12.5%-16%. The highest levels of infertility were in North and West Africa while the rates in Central and East Asia were similar to our findings [8]. Yet in this sixteen-article meta-analysis published in 2015, most of the compiled studies were population-based studies like our work and the SSA's findings were deemed an underestimate due to underreporting. These results were from different meta-analysis or systematic reviews and data were missing often regarding male or female contribution to infertility. The authors filled the gaps, using the Sharlip method [20] of calculation, which is based on the assumption that in general, in couple infertility, 50% of the cases are related to female factors, 20-30% to male factors and the remaining 20-30% is a combination of both male and female factors. We therefore believe that some of these hypotheses might have not held.

A study in Nigeria [10] found 42.4%, 25.8%, 20.7%, and 11.1%),for male only, female only, both partners and unexplained infertility respectively. Compared to our study, the rates of male and both partners' contribution looked similar while we had a higher contribution of female partners (42.9% (95% CI: 18.3; 71.6)). We did not identify any unexplained case of infertility, probably because of the small absolute number of the medically-diagnosed cases (n=14). In Teheran, the male factors represented 23.7% and the male-female factor was 19.3% [21].

The Risk Factors of Infertility in Ouagadougou (Burkina Faso)

With respect to the causes of infertility, it is admitted that everywhere, there is a core of about 5% of infertility that is associated to biological (including genetic, endocrinological, and immunological problems) and anatomical factors. The remainder are infertile because of preventable conditions including infections, environmental risk factors and healthcare practices and policies. In this list, reproductive tract infections and particularly STDs play a leading role [4]. In our study, sexually transmitted diseases in the history of infertile men and women represented 22.9 and 29.4% respectively as opposed to 15.3 and 26.6% in the general population. Globally it is estimated that 27-64% of women infertility could be attributed to infectious causes [18]. We found much lower prevalence with regard to the other etiologies of infertility including varicocele and cryptorchidism [11, 22] probably related to underreporting.

The main risk factor was smoking and varicoceles in Teheran [21] and varicoceles and testicular surgery in the United States of America [23]. In our study, 54.2% of infertile men were past or current smokers while among the general population only 36.9% had ever smoked. Our finding is consistent with the proportion of one third of the global

population aged over 15 years that smokes [24]. Smoking effect would virtually shift all male semen parameters (count, motility, morphology) away from their normal values and there would be no safe amount of cigarette smoke intake with regard to semen quality [24]. Interestingly, in our study, there were less alcohol drinkers among infertile people.

At the multivariate analysis, we found that having a history of STD and being a past smoker were significant risk factors for male infertility while having a history of abortion or stillbirth were significant risk factors for both males and females. A study in Nigeria identified also recurrent penile discharge (OR 7.8; 95%CI 2.9-21.5), recurrent pain on micturition (OR 2.2; 95%CI: 1.02-4.71, $p<0.04$) and genital ulcers (OR 8.8; 95%CI 3.7-9.2) as risk factors. Another risk factor for men in that study was a heavy consumption of alcohol and a history of previous induced abortions, vaginal discharge and previous pelvic inflammatory disease for women [25].

LIMITATIONS OF THE STUDY

The diversity of definitions of infertility was a challenge making the comparability between studies often unrealistic. We did our best to consider as far as it was possible, the same definition than the one that drove our study. A criticism of the one-year latency period we adopted in our definition of infertility is that it does not prevent the study from the biases related to short time separation, postpartum sexual abstinence and lactation amenorrhea. This definition is fit for clinical practice to allow an early detection and treatment of the reproduction issues of young couples while the WHO epidemiological definition (2-year without conception) was particularly appropriate for the definition of the secondary infertility. Further, we excluded from our sample all separated, divorced or widowed women. However, we should recognize that this option may have been a source of selection bias since infertile women may be more prone to be divorced or separated. We believe that these weaknesses did not much altered the population parameters we estimated because the quality of our data/sample was good enough to allow a good representativity of our population in Ouagadougou (Burkina Faso).

CONCLUSION

To the best of our knowledge, this population-based study was a first one with respect to the prevalence of couple infertility in Burkina Faso. Though lower than the global prevalence and in SSA as well, the couple infertility prevalence in Ouagadougou was still high enough to be paid attention. Compared to past data in the same country, we saw a shift from predominant secondary infertility to predominant primary one. Infections remained the leading cause of couple infertility.

This study raised important issues regarding the need to update the epidemiological and clinical data regarding couple infertility in Burkina Faso in order to accurately answer the questions regarding the current etiologies and improve the clinical management of the cases including a focused diagnosis and treatment.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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