

# Students' knowledge of determinants of fertility and assisted reproductive techniques

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## Abstract

Having children and experiencing motherhood and fatherhood are basic desires of most people. However, there are factors, i.e. common anti-health behaviours and occupational hazards, which reduce male and female fertility.

Fertility disorders are a result of many factors, which are not usually realised by young people of reproductive age. Chemical, biological, and physical determinants as well as occupational and lifestyle factors can impair fertility. The concentration or intensity of these determinants is remarkably important [1,2,3,4,5].

Dissemination of the knowledge of the harmful impact of the factors on fertility can contribute to greater awareness and improvement of pro-health behaviours among the population of young people of reproductive age [2,5].

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## Aim

The aim of the study was to assess students' knowledge of the determinants of human fertility, assisted reproductive techniques and to reveal potential relationships between the year of study and the level of knowledge.

## Introduction

Fertility (fecundity) is defined as an ability to reproduce and a capability of two humans (woman and man) of conceiving a child and sustaining the pregnancy as a result of a natural and regular sexual intercourse (currently – ca. 3 sexual intercourses a week over 12 months). Fertility is expressed numerically by the number of past pregnancies [6].

Human fertility consists in the ability to produce gametes, a sexual intercourse, joining of the gametes, and development of the embryo and its implantation in the endometrium. Disturbances in each of these stages can prevent conception. The stage of production of gametes, i.e. the ovum in females and the sperm in males, proceeds independently in both sexes [7].

The basic elements that determine the number of children born by a woman in the period from puberty to menopause are related to the biological sphere. The potential number of children than a woman can have in the procreation period is determined by:

- physiological anovulation in the first years after puberty,
- periods of waiting for potential fertilisation,
- anovulation after childbirth and miscarriages,
- physiological anovulation before menopause [8].

Postpartum anovulation lasts on average 2 months; however, it can be prolonged up to a year by breastfeeding [9].

The conception-waiting period is on average 3-6 months and is dependent on partners' age. The reproductive potential of an 18-45-year-old woman has been estimated mathematically, taking into account biological factors, at on average 15 live births. Currently, the average number of children born by one

woman does not exceed 2 in developed countries and is 6 in the developing countries in Africa and South America [4].

Over the last 200 years, the number of children born by one woman has decreased substantially. This is determined by socio-economic factors [10].

An important role is played by conscious contraception, abortions, reduced numbers of infant and child mortality, promotion of breastfeeding, and a model of family that is popular and widely accepted in society [8].

Factors that determine the number of children in a relationship include the education and income level, marriage at a later age, place of residence, and attitude to religion [11].

Age is the primary determinant in limitation of fertility. The aspiration to achieve economic stability and involvement in professional development prompts women to postpone the decision to have children. Additionally, information provided in the media about assisted reproduction techniques encourages women to postpone the decision by giving them hope of having a child at any period of their lives [4]. Late motherhood is becoming an increasingly frequent phenomenon in developed countries. Marriages are concluded at an older age and the rate of divorce is growing. The maximum fertility in women is ascribed to approximately 20-25 years of age; it gradually declines after this period. After 35 years of age, female fertility decreases significantly. A key role in reduced fertility associated with biological aging of the female organism is played by deterioration of the quality of oocytes and neuroendocrine changes, which degrade the quality of ovum cells. The adaptability of the uterus does not change significantly in this period, which ensures full-term pregnancies. Female fertility eventually disappears with menopause (final menstrual period) when the organism stops producing gametes [12].

In males, production of reproductive cells does not stop with age, unlike in post-menopausal females. However, minimal changes in spermatogenesis in terms of the number and quality of sperm can be observed. This is reflected in an increasing number of genetic defects and genetic diseases in the offspring. The defects are identified in 2% of children of

20-year-old fathers and 2.6% of children of 50-year old males [13]. With age, men develop dysfunctions in regular sexual intercourses. Erectile dysfunction and, hence, the inability of initiation and completion of a satisfactory sexual intercourse is reported by 20-50% of ca. male population around 50 years of age. These disorders can significantly reduce fertility of males at this age [14].

A group of diseases that have a direct effect on female and male fertility includes infections of reproductive organs. These infections, most frequently transmitted sexually, are responsible for approximately 28-35% of infertility cases in European countries. The most common pathogens are *Chlamydia trachomatis* and *Neisseria gonorrhoeae* [15]. Importantly, infection with *Chlamydia* is asymptomatic in ca. 2/3 of women affected with the disease. Some importance, especially in developing countries, is still ascribed to tuberculosis mycobacteria. Pelvic inflammation caused by these microorganisms very often leads to fallopian tube damage. The degree of the damage is associated with patient's immunity and pathogenicity of the bacterial strains. It is assumed that each successive episode of pelvic inflammatory disease increases the probability of infertility.

Similarly, inflammation caused by infections reduces male fertility. Most frequently, it results from post-inflammatory duct obstruction. Infections also affect sperm quality by reduction of sperm motility and fertilisation ability. One of the most frequent virus infectious agents causing orchitis is the mumps virus (viral parotitis). Bilateral orchitis often leads to infertility, while the ca. 3-month long suppression of spermatogenesis in the case of appropriately treated unilateral orchitis subsides and normal reproductive functions are regained. In bacterial cases of the disease, the initial acute course with extreme tenderness and enlargement of testicles often turns into the chronic form, which recurs as inflammation of the testes and epididymis. Despite proper medical treatment, spermatogenesis inhibited during the acute phase rarely returns to normal function and the image of sperm usually indicates profound impairment of fertility [10].

Bacteria, and rarely viruses, are the most common cause inflammation of testicles. Bacterial infections typically affect men over 40 years of age. They are often combined with simultaneous urinary tract or prostate gland infections. Men under 35 years of age are more commonly diagnosed with orchitis caused by chlamydia, mycoplasma, or gonorrhoea. This is associated with higher levels of sexual activity and frequent change of partners [16].

Systemic diseases that significantly reduce fertility in women include hypothyroidism, hyperthyroidism, and diabetes mellitus. However, properly controlled diabetes and adequately treated thyroid diseases do not prevent conception. Other conditions in this group are kidney failure, liver failure, and autoimmune diseases [15].

Epidemiological and experimental studies suggest that chemical substances can affect fertility in women and men at all stages of reproduction [3].

Chemicals can impair fertility by damaging both male and female reproductive cells, which ultimately may even lead to infertility, affect embryogenesis and organogenesis, influence the course of delivery, and affect the health of the neonate after birth and at later stages of growth. Harmful agents may cause permanent infertility or reduced fertility, manifested by a longer period of waiting for pregnancy. Reduced fertility may be transient and subside after elimination of the exposure to the harmful factor [17].

In terms of reproductive toxicology, such chemical substances as metals, pesticides, insecticides, fungicides, solvents, and drug chemicals can exert a detrimental effect on reproduction [3].

Physical factors can also contribute to fertility disorders; however, exposure to a harmful factor does not necessarily mean that they will occur. The greater the severity of the harmful factor is, the greater the chances of the occurrence of disorders. Physical factors that may have an adverse effect on reproduction in both sexes have not been fully explored. It is known, however, that they can affect reproduction at any stage. Factors affecting fertility include ionising radiation, electromagnetic field, temperature, noise, and vibrations [3].

## Research methods

The study was conducted over three months from January to March 2016. It involved 75 1<sup>st</sup> year grade I students and 75 1<sup>st</sup> year grade II students of biology (Tab. 1) at Maria Curie-Skłodowska University in Lublin. All respondents were informed about the objective of the survey and gave their consent to participate in the study.

In total, 150 questionnaires were distributed among the students and all of them were accepted for the statistical analysis.

The questionnaire was comprehensible to the respondents. The empirical material was subjected to quantitative statistical analysis and the results are presented below in integers and percentages.

The questionnaire consisted of two parts. The first part contained questions concerning students' age, gender, year of study, marital status, place of birth, place of residence during university studies, and social and living conditions. The second part of the questionnaire asked questions about general knowledge of the determinants of male and female fertility and assisted reproductive techniques.

The results were statistically analysed. The values of the measurable parameters were presented as a mean value and standard deviation, while the non-measurable parameters were shown as numbers and percentage.

The Chi<sup>2</sup> test was used to detect differences between the compared groups in the case of unrelated qualitative parameters. The differences were

evaluated with the Mann-Whitney U test. Differences or correlations were statistically significant at a level of  $p < 0.05$ . The database and statistical analyses were performed using Statistica 9.1 software (StatSoft, Poland).

## Results

The present study shows that 70.67% of the surveyed 1<sup>st</sup> year grade I students and 65.33% of the 1<sup>st</sup> year grade II students were aware of the fact that health-related behaviours had a positive and negative impact on health.

As shown by the survey, 13 1<sup>st</sup> year grade I students (17.33%) sought information about determinants of fertility and 62 respondents (82.67%) did not search for information about this issue ( $\text{Chi}^2=1.016$ ,  $\text{df}=1$ ,  $p=0.313$ ) (Tab. 2).

Among the 1<sup>st</sup> year grade II students, 18 respondents (24.00%) sought information about factors that determined fertility and 57 students (76.00%) did not seek the information.

1<sup>st</sup> year grade II students accounted for the greatest percentage of respondents who were interested in finding information about factors affecting female and male fertility ( $n=18$ ; 24.00%). In turn, 1<sup>st</sup> year grade I students represented the greatest percentage of respondents that did not look for information about this problem ( $n=62$ ; 82.67%).

No statistically significant correlations were found between the number of respondents who

**Table 1.**

Characteristics of the surveyed group in terms of the sex and the year of study

Sex		1 year I°	1 year II°
Female	N	57	65
	%	76,00%	86,67%
Male	N	18	10
	%	24,00%	13,33%
Total		75	75

$\text{Chi}^2=2,810$ ,  $\text{df}=1$ ,  $p=0,093$

searched for information about the determinants of fertility and the year of study ( $p=0,050$ ).

Generally, the respondents do not seek information about factors affecting female and male fertility.

As shown by the survey, 73 of the 1<sup>st</sup> year grade I students (97.33%) believe that fertility disorders affect both females and males and only 2 students (2.67%) think that the problem affects men ( $\text{Chi}^2=4,000$ ,  $\text{df}=2$ ,  $p=0.135$ ) (Tab. 3).

Among the 1<sup>st</sup> year grade II students, 73 respondents (97.33%) chose an answer that impaired fertility can affect both females and males, while 2 respondents (2.67%) believed that fertility disorders affect females.

There were no statistically significant differences between the level of knowledge of fertility disorders and the year of study ( $p>0.05$ ). Both 1<sup>st</sup> year grade I and 1<sup>st</sup> year grade II students have knowledge of fertility problems.

**Table 2.**

Relationship between search for information about factors influencing female and male fertility and the year of study

Search for information about factors influencing fertility		1 year I°	1 year II°
Yes	N	13	18
	%	17,33%	24,00%
No	N	62	57
	%	82,67%	76,00%
Total		75	75

$\text{Chi}^2=1,016$ ,  $\text{df}=1$ ,  $p=0,313$

**Table 3.**

Relationship between knowledge of fertility disorders and the year of study

Fertility disorders affect:		1 year I°	1 year II°
Females	N	0	2
	%	0,00%	2,67%
Males	N	2	0
	%	2,67%	0,00%
Both females and males	N	73	73
	%	97,33%	97,33%
Total		75	75

$\text{Chi}^2=4,000$ ,  $\text{df}=2$ ,  $p=0,135$

The survey determined students' knowledge according to the year of study (Tab. 4) and the way of acquiring information (Tab. 5).

Questions 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 23 were taken into account to count the scores; in questions 14, 15, 19, and 22, 1 point was given for ticking all correct factors and 0,5 point for choosing half of the correct answers, etc.

The analysis of the table shows no statistically significant differences between the levels of knowledge presented by the 1<sup>st</sup> year grade I students and 1<sup>st</sup> year grade II students. The 1<sup>st</sup> year grade I students achieved only a slightly lower score (8.80 points, which accounts for 67.70% of the maximum possible result than the 1<sup>st</sup> year grade II students (9.14 points, i.e. 70.28% of the maximum result).

Table 5 presents comparison of respondents that search for information about fertility disorders and

those that are not interested in finding such information. The difference between these two groups is statistically significant ( $Z=1.998$ ;  $p=0.046$ ). This indicates that the respondents who searched for the information achieved a statistically significantly higher level of knowledge (73.08% of the maximum score) than the other respondents (67.92% of the maximum score).

## Discussion

An increasing number of couples postpone reproduction. Older age, improper lifestyle, and occupational hazards result in a growing number of infertile couples and complications during the periods of pregnancy, childbirth, and postpartum and have an adverse effect on the health of offspring. The impact

**Table 4.**

Assessment of students' knowledge in relation to the year of study

	1 year I°	1 year II°	z	p
Mean score	8,80	9,14	-1,308	0,191
Standard deviation	1,75	1,79		
% of maximum score	67,70%	70,28%		

**Table 5.**

Assessment of students' knowledge in relation search for information

	Yes	No	z	p
Mean score	3,16	2,47	1,998	0,046*
Standard deviation	1,44	1,35		
% of maximum score	73,08	67,92		

\* statistically significant difference

of factors with the adverse effect on procreation sometimes raises controversies. Their impact on human fertility is often debated [1,4,12].

Health-related behaviours include customs and habits that affect health. According to Borzucka-Sitkiewicz [2], pro-health behaviours have a positive effect on health.

Bielawska-Batorowicz [1] and Semczuk [16] indicate that the impact of the environment in addition to diseases and used drugs can adversely affect fertility. While Domitrz [14] reported that pollution has a significant impact on the reproduction of the population which is manifested build-up of male infertility. Most authors [1,3,7,15] is of the opinion that the significant factors affecting fertility are age, sexually transmitted diseases, drugs, toxic substances and certain medications. The study showed that the students have a slight knowledge of the subject.

Many authors [1,3,10,11] reported that exposure to endocrine factors fertility are also present in the work environment. They are not exposed to people working in the industry: hairdressing, chemical industry, construction, medical services. Bielawska-Batorowicz [1] reported that women every year may reduce the quality of oocytes. The peak fertility is in the range of 20-24, and over 35 drops significantly. Along with the menopause women's fertility fades as a result of the cessation of production of oocytes. Sołtysik [11] reported that diet can affect fertility. Women suffering from eating disorders can occur dysmenorrhea. Analysis own research has shown that women have a significantly higher level of knowledge than men.

Most authors [3,7,10,15,17] is of the opinion that stimulants such as drugs, alcohol, cigarettes, coffee and tea can cause a decrease in fertility. Woman abusing alcohol and drugs, and smoke cigarettes have more difficulty getting pregnant and give birth to children with lower birth weight.

According Pisarski and Szamatowicz [10], systemic diseases such as diabetes, renal disease, thyroid disease, autoimmune diseases of the liver and are important in reducing fertility. High impact on fertility have infectious diseases genitals. In women cause postinflammatory obstruction of the fallopian tubes and intrauterine adhesions, while in men cause

obstruction of the lead-out seed. Impair the quality of the sperm [13].

Many authors [3,10,13,16] reported that the factors adversely affecting male fertility related to the working environment toxic substances, contact with X-rays, prolonged exposure to high temperatures and tight underwear and a sedentary lifestyle (eg. drivers). The study shows that people seeking information on factors affecting fertility have a higher levels of knowledge than the students who declared no search for such information.

## Conclusions

1. The year of study does not determine the level of knowledge of factors affecting female and male fertility. The 1<sup>st</sup> year grade I students exhibit only a slightly lower level of knowledge than the 1<sup>st</sup> year grade II students.
2. The sex of the respondents determined their knowledge of factors affecting female and male fertility. The women were characterised by a higher level of knowledge than the men.
3. The respondents who sought information about factors affecting female and male fertility exhibited statistically significantly higher levels of knowledge of the issue than the students who declared no search for such information.

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