

Ethical considerations in sex selection

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ABSTRACT

Advances in modern medicine are resulted from unrestricted and unlimited research disregarding many essentials of a research including ethical issues. Following ethical issues, many of unwanted pregnancies and abortions can be avoided. Several factors such as medical issues including X linked disease, has encouraged couples to select traditional or modern techniques in selecting the gender of their children. Some of these methods are corrected Swim-up method or washing of spermatozoa, Percoll gradient sperm separation method, grass wool column filter method method, albumin separation method, microsort method using FISH (Fluorescence in situ hybridization), free electrophoresis method, Ph adjustment method, pre implantation genetic diagnosis (PGD)/fluorescence in situ hybridization. This technology is confronted with many ethical issues. Ethical considerations PGD in the SEX SELECTION differ in different religions and their perspectives on this issue. In this this review, electronic databases, books and Internet sites were completely searched and full articles including required keywords and techniques were obtained and reviewed. The rites and religions, were different and had legal perspectives and opinions about PGD. In some non-Islamic countries there are strict rules to control the use of technology. Some of these methods are costly and even risky. They also involve ethical issues such as legitimacy of the conceived fetus; recommending final touches in sex selection is still considered a taboo and a big issue in some cultures or mono-sexual families. Islamic views and beliefs are more flexible and the use of these technologies are allowed to preserve the health and lives permit. Islam strongly favors humanity and supports different issues if they are not in conflict with the primary concept of legitimate reproduction and are beneficial to human beings.

Key words: Disadvantages of sex selection method, ethics, Islam view

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INTRODUCTION

A practicing physician must apply some values and judgments to the practise of the medicine. Ethics in medicine is a necessity in each field of medicine but in gynecology and infertility it becomes more complicated. Sex-selection experts often argue that this is an expression of reproductive rights, and allowed the couples to make a well-informed and well-planned family, and prevented outcomes of un-intended pregnancy and abortion. In this case the child neglect is minimized and so is the intimate partner violence. Post-conceptual choice by preimplantation testing (PGD) also involves privileged use of embryos, and cessation of pregnancy for gender selection also raises many ethical questions of the abortion consideration.

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In this review, there is a brief overview of the ethics in PGD and point of view of Islam about sex selection.

Background

Ethics in sex preference

Since last fifty years, consideration of ethics in research has become an important issue. Most of the discoveries which have caused major and significant improvement in medical sciences were a result of fully authorized research without consideration of ethical issues. Ethics should be cornerstone of every research and specified rules were regulated for protection of humans in biochemical and behavioral researches. Genetic research has largely improved since past two decades, but ethical issues in this research field are of a great importance in appliance of these researches in diagnosis and treatment of genetic disorders.^[1] Ethical issues are always considered in sex selection and preference and prenatal genetic diagnostic techniques rearranging spermatozoa are always considered. In fact selecting the gender of a child before birth is controversial, because as it is pointed out in human rights, racial preference is strongly prohibited, so can be gender preference considered an approved decision, as it is in favor of a gender over another, while diminishing the opposite sex's value in society.^[2] Sex selection and gender preference is considered a sexual discrimination and prejudice, and one of its unwanted effects is gender imbalance. In some Asian countries this imbalance is in favor of male gender, and this issue is seldom seen in western European and North American countries.^[3] Sex selection is often discussed seriously and always a question arises that whether use of modern technologies in fertility for selecting the gender of future child is ethical or not? Those who believe in this issue, usually consider this issue as disobedience of God, and therefore interfering in natural process of reproduction.^[4]

History of sexual preference

Historically sex preference in past was with help of some manners and techniques which was successful in some instances, for example Greeks thought that left testicle of a man had a main role in determining the gender of the conceived embryo. Jews have a belief that if woman ejaculates before man, the baby would be a boy, else the fertilized ovum would be a girl.^[5] Many methods and timing in copulation and even consuming a special diet have been effective in determining the gender conceived egg.^[6] Diets with high levels of sodium and potassium and low in calcium and magnesium (banana, cherries, grapes, orange, plum, watermelon, broad beans, cabbage, celery, tomatoes, and corn) will often result in conception of male gender. Nowadays, with aid of new technologies in field of fertility and conception, many different methods have been created and invented that are used worldwide for selecting the gender of child.^[7-9] Parents with a girl or boy often try to select the gender of their next child to create a balance in their children so that they have both a girl and a boy. In some communities male gender is preferred to be the gender of the to-be-born child because of inheritance related issues.^[10] According to a Jewish law, in a household with two children, one of the

children must be male. And for this obligation, preconception determining the gender of the embryo for nonmedical reasons with help of separation of X and Y spermatozoa with different methods is very essential.^[11] Now this question arises that whether all these new techniques used for sex preference of the embryo are ethical? Father and mother, can definitely use these techniques to choose the desired gender of the child, but whether this preference is ethical? Hence regarding these issues, spermatozoa separation techniques should be performed through ethical framework, and prenatal counseling about the necessity of this decision. These issues indicate that performing these actions is only permitted for certain circumstances in Iran because of strict ethical issues and the rights of the conceived fetus. In prenatal counseling, both parents should be made aware of possible complications and even failure of the selection protocol. So by regarding ethical issues in sex selection of the embryo in all methods for this purpose, number of pregnancies and unwanted pregnancies and abortions can be reduced.

Some of spermatozoa isolation techniques and their ethical issues

Since long ago gender of children is an important subject for parents. Since 1600 A.D, many scientific methods have been used to determine the gender of the conceived zygote produced by different methods of fertilizing and conceiving.^[12] Different factors such as cultural, religious, economic and finally medical such as presence of X-linked disease couples are encouraged to select the gender of their child.^[13,14] Some of these methods are corrected Swim-up method or washing of spermatozoa, Percoll gradient sperm separation method, grass wool column filter method, albumin separation method, microsort method using FISH (Fluorescence *in situ* hybridization), free electrophoresis method, Ph adjustment method, PGD (pre implantation genetic diagnosis/fluorescence *in situ* hybridization). Though some of these methods such as Percoll method and corrected Swim-up method, albumin separation method and Ph adjustment method have few complications and cost less but are not definite and successful but other methods such as PGD which is used for X-linked disease such as hemophilia.^[15] Is an interesting method because it is completely successful. But many consider it unethical because they believe an embryo is a human being and according to ethical obligations should be safe from life threatening and malicious attempts. Also a fetus has autonomic rights and no one has the right to intervene with its life.^[16,17] In fact it is believed that PGD causes creation of unisexual creatures and destroys opposite sex. Sex selection because of non medical causes, leads to imbalance in gender of the population and male:female ratio. Why sex selection is not allowed according to social ethics? It is said that this approach can be a model for positive racial improvements. But in most of western countries when sex selection is done for medical purpose, is allowed.^[16] On the other hand controlling the gender of the embryos by separation of X and Y spermatozoa with flowcytometry as a medical technique for prevention of X linked disorders. Although this technique results in normal births, because of using mutational agents such as ultraviolet rays and fluorochrome stain, caution should be taken.^[18] Also

some of potential hazards of PGD/IVF should be considered in making decision about PGD.^[19] Ovum fertilization with intra-cytoplasmic sperm injection (ICSI). This method is most used in male infertility,^[20,21] PCR and Fluorescent *in situ* hybridization are most commonly used methods for genetic evaluation of embryo in PGD.^[20,22,23] Safety of PGD and IVF is still unclear and further researches should be made. Although according to reports from children born from PGD, because of removing one or two embryonic cells, are not at increased risk of fetal abnormalities and complications.^[24,25] It is not completely discovered that removal of embryonic cells in initial stages of development has what long term effects on the child's health^[26] Till to this day, best present evidence shows that birth defects in children born with help of assisted reproductive technology (ART) is controversial. This risk is reported to be 30%-40% higher than prevalence of these defects in normal births.^[27] Present studies show that present defects are due to IVF, but data and evidence on using PGD are scant but present data show that frequency of birth defects in infants born with PGD is same as defects present in those with IVF without PGD.^[2] In fact PGD is a complex process, which needs hormonal stimulation and IVF. Using hormones to evoke and stimulate ovaries causes important and long lasting effects such as ovarian hyper-stimulation syndrome.^[28] It has been shown that IVF results in birth of multiple pregnancies which is another potential source of risk for mother and fetuses. Children born from IVF (single or multiple pregnancy) are at increased risk complications and birth defects in comparison with children born from normal pregnancy such as low birth weight (LBW).^[29,30] In addition to increased risk of peripartum birth defects, other complications in IVF are also significantly increased such as preeclampsia, pregnancy induced hypertension (PIH), placental abruption, placenta previa and preterm delivery. All patients undergoing IVF should be counseled regarding these increased risks prior to treatment.^[31] One of main problems of PGD is that it can't assure absence of genetic or congenital disorders in born infant, and the infant is devoid of those disease that were tested.^[32] So it is ethical that according to the subjects mentioned above, all the harms and risks of the techniques should be described completely to the couple. During description of the risks and hazards, different factors effect understanding and conception of patients, which can effect on obtaining informed consent. To obtain an informed consent, all the acceptable main risks of the procedure should explained to the patients. Ethical considerations and human rights should be considered as a main point in advance of technology. On the other hand another ethical consideration is about the cost of PGD and flow cytometry. PGD is highly costly and most insurance companies don't offer appropriate coverage for them.^[33] So it is necessary that in case performance of these techniques is not necessary, and they can be avoided or if they are necessary, patients should be aware of the costs.

Different moral views about PGD

To perform genetic experiments on humans have Four traditional moral principle of autonomy and choice, benefit,

willful damage and justice are essential.^[34] Perspectives and different ideas are about ethic in sex selection techniques like PGD. PGD aims to reassure and allay concerns about reproductive risk couples.^[35] Countries and different religions have different attitudes about PGD. Christians and the Catholic Church forbid sex determination of embryos, even for applications medicine. Christians know PGD eugenics. In Catholic theology, practical use of stem cells is considered bad and evil.^[11] In Jewish law, Halacha, if there is no other way for a pregnant woman Therapeutic insemination with husband's sperm is allowed.^[11] The religious use of PGD for sex determination of the fetus in order to prevent the birth of baby hemophilia is still not legal.^[36]

Islam's point of view on sex selection

According to Islam, sex selection is only recommended when a couple desires to have a child (girl or boy) according to their preference by medical means.^[11] Societies with different ethnicity resulting from genetic differences have different male:female ratio.^[37] At present different laboratory methods are present for determine the gender of the child prior to conception. Modern technologies are widely used in different parts of world and beginning to spread widely in Islamic nations. In most communities religious values are determinant and effective in people's behaviors.^[38] Since some of these techniques are very costly or even risky, and also involve ethical issues, i.e. legitimacy of created embryo. Because selecting the gender of the fetus in mono-sexual families and special cultures is still a big question. So it is necessary that before any attempt, all of the legal and ethical aspects should be considered and reviewed. Islam is not a strict religion and is quite flexible according to de novo circumstances, different conditions and places. Islam can adjust and accommodate with righteous viewpoint unless it is in contrary with the primary sources^[39-42] Holy Quran says that Islam is an relaxed religion, not a hard one.^[43] In Islam efforts to treat infertility is not only restricted but also it is compulsory^[11], and if in IVF both gametes are from husband and wife it is acceptable, but it doesn't allow to use the gametes provided from a gamete donor (sperm or ovum) or fetuses or uterus are not acceptable.^[44] International center of Islamic studies and population research approved PGD in year 2000 (AD).^[45] Islam emphasizes all the procedures and processes which result in a healthy state of infants. In Islam every effort for racial optimization and sex discrimination is prohibited. Islam allows PGD in a condition that sperm and ovum are from a husband and wife.^[46] According to Islam sex selection is only allowed for X linked diseases.^[47] thus implication of PGD is illegal at national levels, but is legal for individuals seeking help Islam doesn't agree with transgenic humans. In Islamic religion equity of human beings despite differences in skin color and other general physical properties is emphasized.^[48] Islam allows PGD only under state Islamic Law (the conditions in which the couple would be HALAL to each other according to the Islamic Clerk in Judiciary office).

MATERIALS AND METHODS

The articles about sex determination and the moral issues associated with PGD were searched in internet with including key words of prenatal genetic diagnosis, Islamic view, ethical issues, ethical aspects. Online electronic databases, Roman and Persian language databases including Google Scholar, iGoogle Scholar, Pubmed, ISI, EBM reviews, Ovid, Cochrane systematic review and Islamic books and verses of the Noble Qur'an were used. All the original papers, review articles and abstracts were searched and 75 articles were found. The articles that were not associated with the topic were omitted and a total of 48 articles with direct association with our topic were included.

CONCLUSION

Accordingly, different opinions about PGD and its applications in different countries are present. As it is observed non-Islamic religions are very strict and have inflexible strict conditions for termination of pregnancy using PGD, even if it leads to having incurable ill children with dangerous disease. While Islam is a simple religion with no limitations and simple enough to adapt new situations and different standards is Islam's flexibility. Various technologies used for conception including IVE, ICSI, ZIFT, GIFT, IUI, are more flexible according to Islamic views and beliefs and are allowed to preserve the health and permit the assisted reproduction. While in other religions, this may not be permitted so and prenatal genetic diagnosis is restricted, and on the other hand Islam strongly supports reproduction and different issues of human creation if they are not in conflict with the primary concept of human creation and are beneficial to humans, furthermore prenatal genetic diagnosis is permitted in Islam which is advantageous in many cases and can be preemptive for x-linked diseases.

Islam, allows PGD is allowed for every x linked condition in which ovum and sperm are from husband and wife, and doesn't help for transgenic humans, and treatment of x-linked disease is permitted in Islam with help of PGD which is preemptive in many cases.

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REFERENCES

- Azizi F. Clinical Research Ethics. *J Med Ethics* 2008;2:33-48.
- Sermon KD, Michiels A, Harton G, Moutou C, Repping S, Scriven PN, *et al.* ESHRE PGD Consortium data collection VI: Cycles from January to December 2003 with pregnancy follow-up to October 2004. *Hum Reprod* 2007;22:323-36.
- Macklin R. The ethics of sex selection and family balancing. In *Seminars in reproductive medicine*. New York, Beijing: © Thieme Medical Publishers; 2010.
- Benagiano G, Bianchi P. Sex preselection: An aid to couples or a threat to humanity? *Hum Reprod* 1999;14:868-70.
- Shushan A, Schenker JG. Prenatal sex determination and selection. *Hum Reprod* 1993;8:1545-9.
- Carson SA. Sex selection: The ultimate in family planning. *Fertil Steril* 1988;50:16-9.
- Fugger EF. Clinical experience with flow cytometric separation of human X- and Y-chromosome bearing sperm. *Theriogenology* 1999;52:1435-40.
- Fugger EF, Black SH, Keyvanfar K, Schulman JD. Births of normal daughters after MicroSort sperm separation and intrauterine insemination, in-vitro fertilization, or intracytoplasmic sperm injection. *Hum Reprod* 1998;13:2367-70.
- Robertson JA. Preconception gender selection. *Am J Bioeth* 2001;1:2-9.
- Seidel GE Jr, Johnson LA. Sexing mammalian sperm-overview. *Theriogenology* 1999;52:1267-72.
- Schenker JG. Gender selection: Cultural and religious perspectives. *J Assist Reprod Genet* 2002;19:400-10.
- Michelmann HW, Gratz G, Hinney B. X-Y sperm selection: Fact or fiction? *Hum Reprod Genet Ethics* 2000;6:32-8.
- Schulman JD, Karabinus DS. Scientific aspects of preconception gender selection. *Reprod Biomed Online* 2005;10(Suppl 1):111-5.
- Holt WV, O'Brien J, Abaigar T. Applications and interpretation of computer-assisted sperm analyses and sperm sorting methods in assisted breeding and comparative research. *Reprod Fertil Dev* 2007;19:709-18.
- Malpani A, Malpani A, Modi D. Preimplantation sex selection for family balancing in India. *Hum Reprod* 2002;17:11-2.
- Robertson JA. Extending preimplantation genetic diagnosis: The ethical debate Ethical issues in new uses of preimplantation genetic diagnosis. *Hum Reprod* 2003;18:465-71.
- Dahl E. Ethical issues in new uses of preimplantation genetic diagnosis should parents be allowed to use preimplantation genetic diagnosis to choose the sexual orientation of their children? *Hum Reprod* 2003;18:1368-9.
- Catt SL, Sakkas D, Bizzaro D, Bianchi PG, Maxwell WM, Evans G. Hoechst staining and exposure to UV laser during flow cytometric sorting does not affect the frequency of detected endogenous DNA nicks in abnormal and normal human spermatozoa. *Mol Hum Reprod* 1997;3:821-5.
- Land JA, Yarmolinskaya MI, Dumoulin JC, Evers JL. High-dose human menopausal gonadotropin stimulation in poor responders does not improve *in vitro* fertilization outcome. *Fertil Steril* 1996;65:961-5.
- Basille C, Frydman R, El Aly A, Hesters L, Fanchin R, Tachdjian G, *et al.* Preimplantation genetic diagnosis: State of the art. *Eur J Obstet Gynecol Reprod Biol* 2009;145:9-13.
- Van Steirteghem AC, Nagy Z, Joris H, Liu J, Staessen C, Smits J, *et al.* High fertilization and implantation rates after intracytoplasmic sperm injection. *Hum Reprod* 1993;8:1061-6.
- Coonen E, Dumoulin JC, Ramaekers FC, Hopman AH. Optimal preparation of preimplantation embryo interphase nuclei for analysis by fluorescence in-situ hybridization. *Hum Reprod* 1994;9:533-7.
- Mullis K, Faloona F, Scharf S, Saiki R, Horn G, Erlich H. Specific enzymatic amplification of DNA *in vitro*: The polymerase chain reaction. *Cold Spring Harb Symp Quant Biol* 1986;51:263-73.
- Soini S, Ibarreta D, Anastasiadou V, Aymé S, Braga S, Cornel M, *et al.* The interface between assisted reproductive technologies and genetics: Technical, social, ethical and legal issues. *Eur J Hum Genet* 2006;14:588-645.
- Cieslak-Janzen J, Tur-Kaspa I, Ilkevitch Y, Bernal A, Morris R, Verlinsky Y. Multiple micromanipulations for preimplantation genetic diagnosis do not affect embryo development to the blastocyst stage. *Fertil Steril* 2006;85:1826-9.
- Newson AJ. Ethical aspects arising from non-invasive fetal diagnosis. In *Seminars in Fetal and Neonatal Medicine*. Netherlands: Elsevier; 2008.

27. Hansen M, Bower C, Milne E, de Klerk N, Kurinczuk JJ. Assisted reproductive technologies and the risk of birth defects-a systematic review. *Hum Reprod* 2005;20:328-38.
28. Simoncelli TM. Pre-Implantation genetic diagnosis: Ethical guidelines for responsible regulation. The international centre for technology assessment. Available from: <http://www.icta.org/doc/pgd%20guidelines.pdf> [Last accessed on 2008 April 18].
29. Schieve LA, Meikle SF, Ferre C, Peterson HB, Jeng G, Wilcox LS. Low and very low birth weight in infants conceived with use of assisted reproductive technology. *N Engl J Med* 2002;346:731-7.
30. Hansen M, Kurinczuk JJ, Bower C, Webb S. The risk of major birth defects after intracytoplasmic sperm injection and *in vitro* fertilization. *N Engl J Med* 2002;346:725-30.
31. Mukhopadhaya N, Arulkumaran S. Reproductive outcomes after in-vitro fertilization. *Curr Opin Obstet Gynecol* 2007;19:113-9.
32. Botkin JR. Ethical issues and practical problems in preimplantation genetic diagnosis. *J Law Med Ethics* 1998;26:17-28.
33. Preimplantation genetic diagnosis. Wikipedia. Encyclopedia. Available from: <http://www.en.Wikipedia.org/wiki/Preimplantation-genetic-diagnosis>. [Last accessed on 2010 Jul 15].
34. Thornhill AR, deDie-Smulders CE, Geraedts JP, Harper JC, Harton GL, Lavery SA, *et al.* ESHRE PGD Consortium 'Best practice guidelines for clinical preimplantation genetic diagnosis (PGD) and preimplantation genetic screening (PGS)'. *Hum Reprod* 2005;20:35-48.
35. Eisenberg VH, Schenker JG. Pre-embryo donation: Ethical and legal aspects. *Int J Gynaecol Obstet* 1998;60:51-7.
36. Grazi RV, Wolowelsky JB. Preimplantation sex selection and genetic screening in contemporary Jewish law and ethics. *J Assist Reprod Genet* 1992;9:318-22.
37. Jacobsen R, Møller H, Engholm G. Fertility rates in Denmark in relation to the sexes of preceding children in the family. *Hum Reprod* 1999;14:1127-30.
38. Jalal Abbasi-Shavazi M, McDonald P. Fertility decline in the Islamic Republic of Iran: 1972–2000. *Asian Popul Stud* 2006;2:217-37.
39. AGH GE-H. *In Vitro* Fertilization and test tube baby. Dar El Iftaa, Cairo: Egypt. 1980;1225:3213-3228.
40. Gad El Hak A, Serour G. Some gynecological problems in the context of Islam. The International Islamic center for population studies and research. Cairo, Egypt: Al Azhar University; 2000.
41. Serour GI. Religious perspectives of ethical issues in ART 1. Islamic perspectives of ethical issues in ART. *Middle East Fertil Soc J* 2005;10:185-90.
42. Serour G. Ethical considerations of assisted reproductive technologies: A Middle Eastern perspective. *Middle East Fertil Soc J*, 2000;5:13-8.
43. Sura AL Bakara, H.Q. 2:185.
44. Schenker JG. Women's reproductive health: Monotheistic religious perspectives. *Int J Gynaecol Obstet* 2000;70:77-86.
45. Serour GI, Dickens BM. Assisted reproduction developments in the Islamic world. *Int J Gynaecol Obstet* 2001;74:187-93.
46. Fasouliotis SJ, Schenker JG. Ethics and assisted reproduction. *Eur J Obstet Gynecol Reprod Biol* 2000;90:171-80.
47. Nasim A. Ethical issues of biotechnology and genetic engineering: An Islamic perspective. Proceedings of 11th IAS conference on biotechnology and genetic engineering for development in Islamic world. Morocco, Rabat: 2002: p. 1-12.
48. Larijani B. Medical genetic ethics Islamic view and consideration in Iran. *DARU J Pharm Sci* 2006;14(Supple 1):48-55.

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