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Hypothesis: Who is Responsible for Sex of Offspring?

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ABSTRACT

The fact that male gamete possesses either of sex chromosome, he is known responsible for gender of baby. In this hypothesis placing all facts on female reproductive tract, authors state man's lone role is "surrendering" semen into vagina. All changes to millions of his gametes in female system from killing many, lifting, transporting, activating, permitting for its motility like processes done by her genital tract are responsible for preference of either X or Y chromosome carrying spermatozoan for fertilization. Hypothesis concludes female as solely responsible for determining sex of offspring.

Key words: Hypothesis, male-female sex, gender, offspring

INTRODUCTION

In the natural process of sex selection of the offspring, male partner is responsible for fertilization by virtue of his contribution of either X or Y chromosome bearing spermatozoan. Y chromosome carrying spermatozoan fertilize an ovum to develop male and that of an X leads to female (Dutta, 2004). Though, the bioethical aspects of gender selection prior to implantation gained interest for non medical reasons (ASRM, 2001; Gleicher and Karande, 2002).

Present knowledge: Semen after deposition into vagina, clots, liquefies and spermatozoa make its entry into cervix. Motile spermatozoa pass through uterus and enter any one fallopian tube. Several reasons are shown for large requirement of number of spermatozoa for fertilizing one ovum. In an ejaculate some spermatozoa are non motile or dead; many are killed by low pH of vagina, several lose motility while travelling the whole length of female system. At the end, those surviving engage in separating cumulus oopherus to expose ovum and final preparation for the entry of one cell into it which is done by thinning oval membrane. Present knowledge is X or Y chromosome bearing spermatozoan determines sex of the child and so father is named as the deciding factor.

Hypothesis: The present hypothesis states mother is solely responsible for the sex selection of the offspring and not father.

Evidences supporting hypothesis: It is a common belief among different communities that mother is responsible for birth of a boy or a girl. It is observed some women repeatedly deliver children of same sex. Lord Krishna who is worshipped by billions of followers of Hindu religion, was the only son born to his mother, after giving birth to seven daughters. His birth was eagerly awaited by all believing the prediction that this boy would kill devilish king of that time. Several reports of repeated delivery with same sex babies are available in literature.

During sexual process male partner "surrenders" semen into vagina to decide by female the fate of his of millions of gametes. Woman is fully responsible for any change takes place on spermatozoa or seminal plasma in her system. Physiological analysis of the process and time spent by spermatozoa in female system proves the female accepts or rejects male gametes in her territory. Though, X and Y chromosome bearing spermatozoa are equal in number in semen, world population has more male. Interestingly, sex studies in naturally aborted fetus showed majority of them were male. In real male sex determining spermatozoa are preferred by women.

Initially ejaculate forms a clot in posterior fornix of vagina. Its liquefaction requires 15 min time (WHO, 2010). Liquefaction in vagina needs 5 min less time less than in laboratory due to accelerating action of enzymes present there (Treadway, 1975). Vaginal secretion, contain transudation of epithelial cells, old superficial epithelial cells, lactic acid, electrolyte, proteins and leucocytes (Dutta, 2008; Jeffcoates, 2001; Padubiri and Daftary, 2009). This environment is highly hostile for spermatozoa but initially they are protected inside semen clot. Though, at this level millions of them perish after released from clot mainly due to presence of low pH which differs at different length (range 3.5-5.5). Effect of difference in pH on spermatozoa motility is known (Goodall and Roberts, 1976). The pH varies during different phases of menstrual cycle and which depends on the level of female hormones (Dutta, 2003). It is at peak at the time of menstruation (Jeffcoates, 2001; Padubiri and Daftary, 2009).

Spermatozoa and seminal plasma bring several antigens to female genital tract. They are inactivated and functionally cleansed by female genital tract. Infertility follows whenever failure occurs on this process (Skandhan, 1979; Skandhan *et al.*, 1976, 1981).

Motility of spermatozoa is initiated in vaginal fornix where glycogen level is high (2.5-3 mg%) compared to lower region (0.6-0.9 mg%) (Dutta, 2003). Glucose is present in semen (Patel *et al.*, 1988). This is the major source of glycolytic energy for sperm metabolism (Mann and Rottenberg, 1966; Peterson and Freund, 1969, 1971). Thus, the glycogen present in vagina is for functioning of spermatozoa at this level. Other than pH, factors cyclically changing and affecting sperm motility in vagina are viscosity, osmolarity, temperature, elements, ions and suspending fluid (Luis, 1997). Effect of temperature on sperm motility is reported by Makler *et al.* (1981). A change in temperature anywhere throughout the length of female system may cause a change in sperm motility. Among animals ambient temperature is a deciding factor of sex determination (Warner and Shine, 2011).

The entry of survived spermatozoa into cervix is restricted to ovulation time and menstruation. During other timings, the biophysical properties of cervical mucus remains like a thick coagulum of fine filaments which prevents spermatozoal entry. Male gamets get trapped here (Tauber and Zanveld, 1976). Effect of pH on spermatozoa motility is known. Spermatozoa are susceptible to change in pH of vaginal fluid and cervical mucus. Sperm penetration is quicker during ovulation time when pH of mucus is high (Jeffcoates, 2001; Lamar *et al.*, 1980).

Semen is viscous in nature. Sperm motility decreases whenever viscousness rises. Experimental evidences reported spermatozoa move easily in serum than seminal plasma where viscousness is less (Rozin, 1960). Velocity of spermatozoa increases when specimen is diluted with its own seminal plasma or saline (Makler *et al.*, 1979). The viscousness of cervical mucus is an important factor in sex selection. Viscous cervical mucus increases chances for male offspring (Smith *et al.*, 2005).

Osmolarity changes in cervix depends on level of hormones and accordingly the motility of spermatozoa. Selection of X or Y chromosome carrying spermatozoa which is accelerated or inhibited by osmolarity of cervical mucus. The chemical and physical nature of it does not permit all spermatozoa to penetrate through. Microstructure of cervical mucus functioned as a filter and allowes only good quality spermatozoa to enter the upper tract (Jeuline *et al*., 1985). Cheretein (1979) indicates the selection of X or Y chromosome carrying spermatozoa is done by cervix. When they arrive at cervix spermatozoa are swollen and those not swollen are denied further passage. Decrease in cell volume is essential for further movement of spermatozoa (Yeung *et al*., 2003). Surrounding hypo osmolar medium permitting opening of ion channels whereby ions and water escape (Petrunkina *et al*., 2004; Yeung *et al*., 2005; Kelin *et al*., 2006).

The chemical composition of cervical mucus shows presence of sodium, potassium, calcium, magnesium, zinc, copper, iron, sulphate, bicarbonate, phosphate, magnesium, cadmium, silver and cobalt. According to the day of the cycle its concentration level changes (Fordeny, 1981). The different concentration of elements and metallic ions in cervical mucus are under study to know more on its effect on spermatozoa. Reports showing the effect of some electrolytes and metals on sperm motility by comparing levels of it in normal semen samples with that of oligoasthenozoospermic and asthenozoospermic (Gusani *et al*., 1988; Skandhan, 1979, 1981, 1992; Skandhan and Mazumdar, 1979; Skandhan *et al*., 1976, 1978, 1981, 2005, 2007, 2010). Experimentally it shows that, above a particular level calcium (Bredderman and Foote, 1971; Holland and White, 1980; Rosado *et al*., 1970), zinc (Skandhan, 1992; Rosado *et al*., 1970) cadmium (Holland and White, 1980) and copper (Holland and White, 1980; Ullmann and Hammerstein, 1972) inhibit motility of spermatozoa. Elements present at different level in female system may have same effect. Fordeny (1981) had shown that concentration of constituents in female genital tract change every day. Thus, the element influences sperm motility. Different elements, with changing concentrations in cervical mucus, may have an effect specifically, on X or Y bearing spermatozoan. Swimming behaviour of both X and Y spermatozoa differs. Employing calcium ion it was observed that a specific protein was responsible for this (Shankar *et al*., 1984).

It is mechanically not possible for spermatozoa to travel the length of 7.5 cm in female system in a short span of time with its velocity of 3 mm min^{-1} (Treadway, 1975). In spite many spermatozoa are capable to reach the target in ten minutes after coitus (Treadway, 1975). This is the mechanism of transport of spermatozoa caused by contraction of uterine muscle, lifting male gametes to upper part of the tract. The effect of many elements identified in cervical mucus, uterine and fallopian tubular fluid on sperm motility is known (Battersby and Chandler, 1997; Bredderman and Foote, 1971; Holland and White, 1980; Rosado *et al*., 1970; Skandhan, 1992). Knowledge about the movement of spermatozoa in its type, velocity and style beyond the level of cervix is known now. Spermatozoa are “activated” above the level of cervix and the process is christened as capacitation (Austin, 1951). Capacitated spermatozoa alone are eligible for fertilization (Eisenbach, 1999; Eisenbach and Kaspa, 1999). Many are not capacitated showing the discretory power of female system.

The composition of fluid at uterine and fallopian tubular levels is studied in detail. The survival and further proceeding of spermatozoa depended on uterine fluid. Change in its composition can alter accelerate or kill them at this level. It was recorded that many spermatozoa are shown as dead here.

Sperm activating and attracting function is considered as that of eggs where extra Ca^{++} enters sperm cell for its motility (Yoshida *et al*., 2003).

Acrosome reaction is a unique sperm process in female tract which is induced by progesterone and zona pellucida (Jackson *et al.*, 2002). As a part of it, regulated exocytosis of calcium takes place (Blas *et al.*, 2002). Multiple calcium channels are identified in plasma membrane and acrosome membrane (Felix, 2005) which requires small depolarisation to get activate (Preas-Reyes, 2003). Presence of progesterone is essential for this process (Gonazalez-Martinez, 2003; Jaiswal *et al.*, 1999). Progesterone is present in micro osmolar concentration in the vicinity of ovum in fallopian duct, where acrosome reaction takes place (Harper and Publicover, 2005).

Sucking action of fimbria bring the ovum alongwith cumulus oopherus and fluid to the tube. Several studies are conducted to determine whether ovum and extra content attracts sperm for fertilization (Diaz *et al.*, 1990). The product of ovulation is essential for sperm transport in oviduct. Ovulatory tubal ampulla contains significantly larger number of spermatozoa than contra lateral tube (Williams *et al.*, 1979). This confirms the tube or the follicular content where ovum is present attracts spermatozoa.

In vitro studies of follicular fluid with human spermatozoa, established chemotaxic action (Eisenbach, 1999). Progesterone which is present surrounding ovum is a chemo attractant, to spermatozoa (Diaz *et al.*, 1995). Progesterone probably causes human sperm accumulation mainly by inducing sperm hyperactivation like motility and as a consequence, sperm trapping (Jaiswal *et al.*, 1999). Chemotaxis for a specific type of sperm is not a rare possibility. Study on this line is in progress.

Caffeine increases the percentage of motile spermatozoa (Haesungcharern and Chulavatnatol, 1973; Makler *et al.*, 1980). Temperature influence on sperm motility extreme level of it makes spermatozoa motionless (Appell and Evans, 1977). Makler *et al.* (1981). In a study to assess the relative viability of X bearing spermatozoa in vagina. Women who suffers from Trichomons vaginalis significantly increase chance of delivering female children. Trichomonas increases the vaginal pH. pH has an effect on X and Y chromosome bearing spermatozoa (Minkoff *et al.*, 1985). Shione and Ramcharans (1982) when women who conceived after discontinuation of oral contraceptive pills by women leads to increase of male offspring in small excess. Failure of rhythm method as contraceptive measure also increases chances of male offspring. All indicates change in vaginal and cervical flora carries out specific selection of spermatozoa to pass through the female genital tract (Shione and Ramcharans, 1982).

Moiler (1996) regarded environmental factors as contributors for sex determination. Davis *et al.* (1998) reported a long term sustained reduction in ratio of male to female birth in several industrial countries. A hypothesis in this line for sex differentiation was proposed by Harrison *et al.* (1997).

CONCLUSION

Selective penetration of sperm in cervical canal was dependent on the physical and chemical characteristics of vaginal and cervical flora. It is the condition of female genital tract-cervical mucus, fluid of uterus and tubes-that determine which of two types of spermatozoa would successfully reach and fertilize an egg at the time of ovulation to decide the sex of the baby.

Effect of cyclical changes of hormone and effect of micro organism on the cervical mucus influenced entry of specific spermatozoan.

Since a decade, research workers had been trying to find out if a chemo taxis mechanism existed in female tract to attract male gamete to egg. Convincing evidence are available, presently showing tubular fluid operated on this line.

Reports shows oocyte and cells in cumulus secrete chemo attractants (Sun *et al.*, 2005). This report suggest chemo attractant present in the follicular fluid sperm and ovum attract for determining sex of the offspring.

As we conclude the female partner as responsible for deciding sex of the baby, in future it may be she who consumes a " male tab" or " female tab" on a particular day of her cycle for the desired sex of baby.

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