

A Review of Probiotics Role in Enhancing Sperm Quality

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Abstract

Introduction: Probiotics have been used widely in medical world, but its use in infertility, especially in male infertility, is yet still unbeknown. The aim of this paper is to review the usefulness of probiotics in enhancing sperm quality in order to treat male infertility. **Methods:** Narrative review on literature surfing in the Pub med database, as well as key words, that is probiotic, Lactobacillus, sperm quality, male infertility, sperm motility, sperm concentration, sperm morphology, sperm DNA fragmentation. **Results:** The results on literature surfing are mainly yielding to the positive effect of probiotics in enhancing sperm quality in animals, and in human, although there are some literature that shows conversely. The production of Gamma-Amino Butyric Acid and antioxidants by the probiotics are thought to be the main mechanism for the improvement of the sperm quality, especially in the enhancement of the sperm concentration, motility and the decrease of the DNA fragmentation. Contrarily, negative results left another mystery for researchers to solve. **Conclusions:** Although the probable mechanisms of probiotics role in enhancing sperm quality have been unveiled, still more researches should be performed to find more evidence in this issue.

Keywords: *Probiotic, Sperm quality, Sperm motility, Sperm concentration.*

Introduction

Infertility is defined as the inability to get a clinical pregnancy in twelve months or more, in sexually active couples, with unprotected intercourse [1]. Infertility affect up to 15% of the couple all around the world, and, the contribution of the male factor is estimated around 40-50% [2, 4]. Male infertility can be caused by many conditions, but in larger proportion, sperm quality is the main problem. Sperm quality depends on sperm concentration, sperm motility, sperm morphology, and sperm DNA fragmentation.

In the era of Assisted Reproductive Technology (ART), the low sperm quality could easily been solved by the technique called Intra Cytoplasmic Sperm Injection (ICSI). But, due to the high cost of this procedure [5], and the ethical problems, less couple will have the access to it. For the unfortunate couple that unable to undergo the ICSI procedure, another method for raising the chance of getting pregnant is

needed. Methods for increasing fertility, in regard of increasing sperm quality, through modernized medicine, herbal medicine, or translational medicine have once again find their place in the eye of scientists, such as probiotic. The relationship between probiotic and health related issues have been described years ago [6]. The aim of this paper is to review the role of probiotic in depth, and its relationship in the improvement of the sperm quality in order to treat male infertility.

Methods

The method used in this paper is narrative review on literature surfing. The literature obtained from surfing the Pubmed library, and other libraries with the keywords "Probiotic", "Sperm Quality", "Lactobacillus", "Sperm Motility", "Sperm Concentration", "Sperm Count", "Sperm Morphology", "Sperm DNA Fragmentation".

From the results, we selected the most current articles, from 2010 to 2017, and conduct a quick review of the abstract, and select some journal and literature that have the relevance with this paper.

Results

From the results of the literature surfing, we have found that researches on probiotic

enhancing sperm quality are already done in animals with various species, and with various outcomes. Meanwhile, the number research of the use of probiotic in the improvement of sperm quality is not huge in number.

We only found a few article in regard of human research in this topic, which summarized in Table 1.

Table 1: Researches of probiotic role in sperm quality

Author(s)/Year	Animal/Human	Sperm Quality Parameter	Outcome
Chen, et al. (2012) (7)	Animal – Rat	Viability, Motility, and DNA Fragmentation	Improvement of quality
Inatomi & Otomaru (2017) (8)	Animal – Chicken	Viability, and Sperm Concentration	Improvement
Sharawy, et al. (2015) (9)	Animal – Ram	Ejaculate Volume, Sperm Motility, Viability, Sperm Morphology, Sperm Concentration, Acrosome Integrity	Improvement
Haines, et al. (2015) (10)	Animal – Chicken (The probiotic is locally administered in the reproductive tract)	Sperm Motility	Impaired
Vílchez, et al. (2015) (11)	Animal – Eel	Sperm Concentration, Sperm Motility	Improvement
Barbonetti, et al. (2011) (12)	Human (in vitro test)	Sperm Motility	Improvement
Valcarce, et al. (2017) (13)	Human	Sperm Motility, and Sperm DNA Fragmentation	Improvement of quality

From the obtained articles, we have found the positive results of the effect of probiotic in animal, as well as in human. The probiotics used in these researches were *Lactobacillus spp*, *Bacillus spp*, yeast in Chen, et al [7]. *Bacillus amyloliquefaciens* in Inatomi & Otomaru [8]; *Saccharomyces cerevisiae*, *Lactobacillus acidophilus*, *Lactobacillus plantarum*, *Streptococcus faecalis* in Sharawy, et al [9]. *Lactobacillus rhamnosus* in Vilchez, et al [10].

Lactobacillus brevis, *Lactobacillus plantarum*, *Lactobacillus salivarius* in Barbonetti, et al [11]. and *Lactobacillus rhamnosus*, *Bifidobacterium longum* in Valcarce, et al [12]. Meanwhile, we do found an article by Haines, et al [13]. That wrote about the effect of *Lactobacillus spp* that impair the sperm motility. *Lactobacillus spp* is one of the microorganisms that can be regarded as a probiotic. However, the article wrote about the effect of this microorganism as a normal flora of the reproductive tract of avian. This emphasized the result of the earlier research, also by the same author in

2013 about the effect on *Lactobacillus* -in vitro- in the impairment of the avian sperm quality [14]. The sperm concentration and motility were the most frequent used sperm quality parameter to prove the improvement by the probiotics, in contrast to sperm morphology. While the sperm viability and DNA fragmentation were used by a few researchers. In addition, the acrosome integrity was used only by one researcher (Table 1).

Discussion

Although the term of probiotic has been used for year, but the definition itself was differently defined by many authors, until the redefinition was set by the Food and Agricultural Organization (FAO)/ World Health Organization (WHO) Joint Expert Consultation on 2002 as “live microorganisms which when administered in adequate amounts confer a health benefit on the host” [15]. It was already known that probiotics play an important role in various health conditions, but for male infertility treatment,

especially in improving sperm quality, a big curtain still yet to be unveiled. From the obtained articles, it was proved that probiotics do have positive effect in improving sperm quality in animals, and in human. The probiotics' mechanism of action in improving sperm quality is not known yet. In some species, such as *Lactobacillus* spp and *Bifidobacterium* spp, have already been researched that they produce Gamma-Amino Butyric Acid (GABA) [6].

And, GABA is a substance of neurotransmitter that plays an important role in physiologic bodily function, including sperm quality. And GABA is known can modulate sperm kinetic properties and increased hyperactivation [16], through its receptor on the plasma membrane of the spermatozoa [17].

It might be presumed that the GABA produced by these probiotics are transported to the epididymis by a transport protein [18, 20] and affecting the sperm maturation process in the epididymis. This mechanism explains how sperm motility increases. In addition, the antioxidant properties of probiotics which enable the decrease in oxidative stress and the damage induced is another mechanism that explains how the sperm concentration and sperm morphology improve [21, 22].

As have been described in other research for the role of free radicals and oxidative stress in sperm [23], antioxidant mechanism also explains how the sperm DNA fragmentation repaired. One of the antioxidant that has a protective effect of the fragmentation of sperm DNA is glutathione that produced by some species of the probiotics [21, 24].

Glutathione had been researched, and had been proven to improve sperm quality [4,25,26]. Another antioxidant produced by the probiotics is Super Oxide Dismutase (SOD) [21,24]. SOD also improves sperm quality, especially in sperm motility, sperm integrity, and sperm DNA fragmentation [27,28]. Nevertheless, up till now there was not any mechanism that explains how the acrosome integrity improved by the supplementation of probiotics yet.

In contrast, negative results left another enigma to researchers. It is assumed that variability and species-specific susceptibility to specific probiotic play a mysterious role in impairing the sperm motility. Or, there is a immunologic reaction (15), may be mucosal type, related to the ingestion of the probiotics in susceptible individuals, which was stated in the FAO/ WHO guideline. According to the author, it is one of the reasons why the research in human is limited.

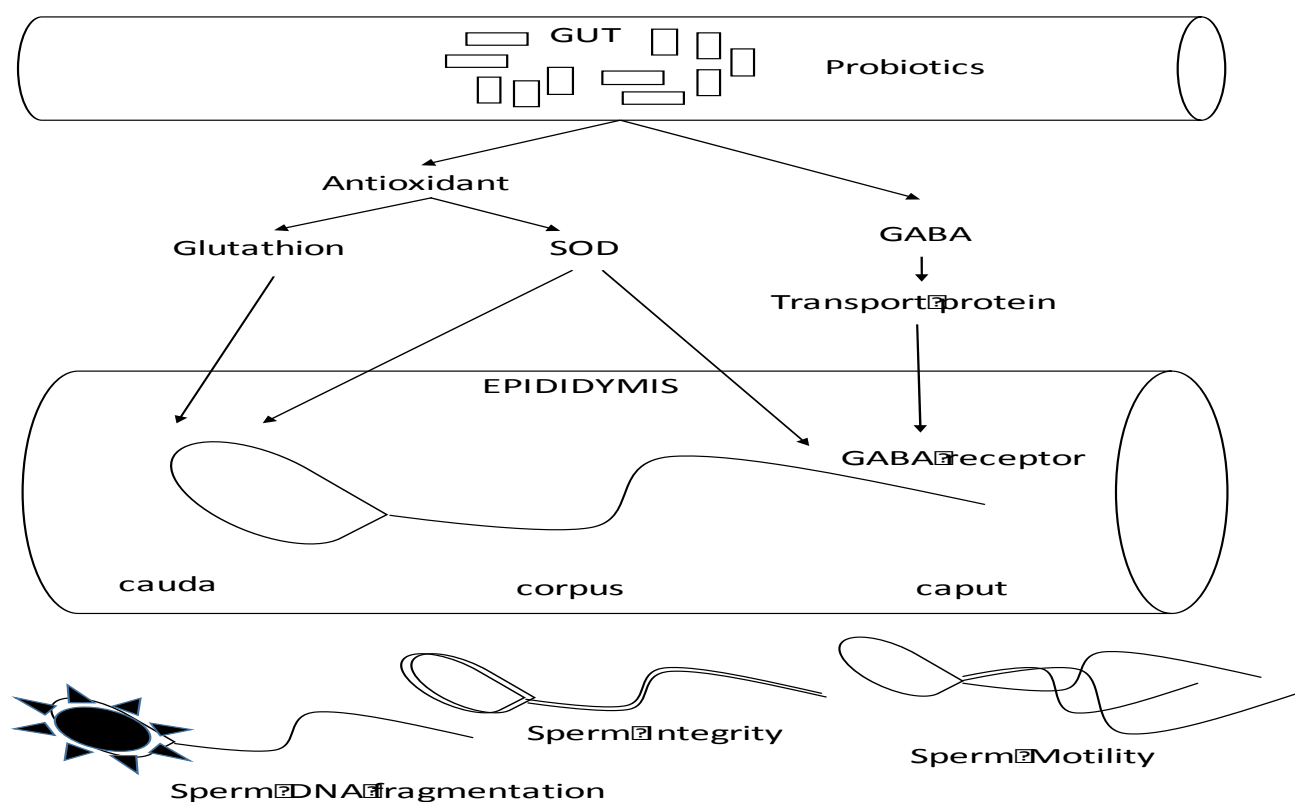


Figure 1: Schematic diagram explaining the role of probiotic in improving sperm quality

Conclusion

Probiotics are able to improve overall parameters of the sperm quality, through the GABA producing effect and antioxidant properties. The use of probiotic should follow the guideline, especially for daily routine in clinical setting, as it is not yet established. Further researches are still needed to confirm the finding in animal to be applied on human.

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