

Opioids and cannabinoids influence mobility of spermatozoids

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A PhD thesis from the University of the Basque Country has concluded that there are opioid and cannabinoid receptors in human sperm and that these influence the mobility of spermatozoid. The research by Mr Ekaitz Agirregoitia opens the door to more effective treatment of fertility problems.

Freshly released spermatozoids cannot achieve fertilisation, they must undergo some changes for this to occur. Amongst other, such changes take place due to receptors situated in the plasmatic membrane (the layer covering the cells) and opioid and cannabinoid receptors are two of these. On coming into contact with these, physiological reactions are generated in the body which are similar to, for example, sedation, analgesia and low blood pressure. Moreover, according to the research undertaken to date, both substances have an influence on the process of fertilisation. It is known that the consumption of external opiates (heroin, methadone) reduces the mobility of spermatozoids and that external cannabinoids (hachis) causes changes in the reproductive process. Also, the body itself generates internal opioids and cannabinoids, secreted to enable us withstand pain or stress situations, and it is also known that this phenomenon affects the reproduction process.

Despite all this being previously known, there has been no thorough study of the opioid and cannabinoid receptors in the human sperm such as this one, carried out by Mr Ekaitz Agirregoitia Marcos for his PhD thesis, defended at the Faculty of Medicine and Odontology of the

University of the Basque Country (UPV/EHU) and entitled in Basque, Opioide-hartzaileak eta kannabinoide-hartzaileak giza espermatzoideetan espresatzen dira eta haien mugikortasunean eragiten dute (Opioid receptors and cannabinoid receptors are expressed in human spermatozooids and influence their mobility). The aim was to define this expression and the location of three opioid receptors and two cannabinoid receptors, as well as to analyse the influence of their activity in the mobility of spermatozooids. Mr Agirregoitia has a degree in Biology, specialising in Health Sciences. He is currently working as a substitute lecturer in the Department of Physiology, giving classes in Medical Biophysics and General Physiology. His PhD work was led by Dr. Jon Irazusta Astiazaran from the same Department and was undertaken in collaboration with Dr. Carmen Ochoa of the Euskalduna Clinic and Dr. Manolo Guzmán from the Complutense University in Madrid.

Pinpointing the receptors

This PhD has shown, for the first time, that all the types of opioid and cannabinoid receptors are found in human sperm. To date, only the MU opioid receptor has been found in equine sperm, and the presence in human sperm of the CB1 cannabinoid receptor was only discovered this year. Dr. Agirregoitia has used a number of techniques to find three opioid receptors (DELTA, KAPPA and MU) and two cannabinoid receptors (CB1 and CB2) in the human sperm. According to his research, all these are found at the head, the middle and the tail of the spermatozooids.

How is mobility influenced?

After defining the expression and location of the opioid and cannabinoid receptors, Dr. Agirregoitia initiated an analysis of their influence on the mobility of the spermatozooids. These receptors act like a kind of lock

catch mechanism to which the opioids and cannabinoids attach themselves. Some of these substances (agonists) are capable of activating the cells, just like a key opening a lock. Others (antagonists), although fitting perfectly into the “locks”, are not capable of opening them and have the effect of blocking the receptor. Mr Agirregoitia studied both processes, incubating human sperm with agonist and antagonist synthetic substances to this end.

From this PhD thesis, presented at the UPV/EHU, it was concluded that, for the movement of the spermatozoids to be maintained, a minimum number of DELTA receptors must remain active. On the other hand, it is pointed out that the activation of the MU opioid receptor inhibits the mobility of the spermatozoids, i.e. it causes them to slow down. Finally, the PhD concludes that the KAPPA opioid receptor participates in another process which has nothing to do with mobility.

As regards the cannabinoid system, the activation of the CB1 y CB2 receptors causes the percentage of spermatozoids with rapid and progressive mobility to be reduced. Even so, as a consequence of the activation of the CB1 receptor, the number of slow spermatozoids rises, while the activation of CB2 increases the number of spermatozoids with progressive but slow movement.

The most effective diagnoses and treatments

It is known that opioids and cannabinoids regulate the function of reproduction through the central nervous system and, according to this PhD thesis, they are also able to control the process through the receptors located in the spermatozoids themselves. Thus, the type and concentration of internal opioids and cannabinoids found in the spermatozoid on its way to the egg will condition its mobility.

This work opens the door – in the medium to long term – to the

diagnosis and treatment of numerous pathologies. For example, an analysis of the components of the system of opioid and cannabinoid receptors would enable us to better understand fertility problems due to currently unknown causes, exhibited by both spermatozooids as well as the female reproductive organ. Also, when designing treatment aimed at fomenting the mobility of spermatozooids, it will enable the prescribing of treatment that activates or inhibits the appropriate receptor in order to benefit the process of fertilisation.

Source: the University of the Basque Country

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