Oxidative dna damage pdf

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Conference delegates in Spain yesterday heard about new research from Ireland that found diabetes in men had a direct effect on male fertility because of higher damage to sperm DNA. The study was the work of Dr Con Mallidis from Queen’s University, Belfast, and colleagues, and was presented at the 24th annual conference of the European Society of Human Reproduction and Embryology that finished yesterday, 9th July, in Barcelona. The press statement did not mention whether the study is to be published in a journal. “We have shown for the first time that diabetes adversely influences male fertility at a molecular level,” Mallidis told conference delegates. Diabetes causes DNA damage in sperm, Mallidis said, adding that worldwide concern about male fertility coincides with rising numbers of diabetics diagnosed at a young age. Scientists already knew that lower quality of sperm DNA is closely linked to lower embryo quality and implantation rates, as well as higher rates of miscarriage and serious childhood diseases, and cancer in particular. Various suggestions have been made as to what might cause DNA damage in sperm, but until now, the underpinning molecular biology has been somewhat of a mystery. Mallidis and colleagues studied semen samples from men with diabetes who were undergoing insulin treatment and found that apart from being of slightly lower volume, the samples looked normal when routinely examined under a microscope. “But when we looked for DNA damage, we saw a very different picture,” said Mallidis, explaining that this was not normally part of a routine analysis. The sperm RNA was significantly different, and many of the alterations they saw appeared to be RNA transcripts used in repairing DNA. Comparison with a database of men of proven fertility confirmed our findings,” said Mallidis. “Diabetics have a significant decrease in their ability to repair sperm DNA, and once this is damaged it cannot be restored,” he added. RNA transcription is the first step of gene expression, where DNA code is translated into various forms of action at the molecular level, such as making proteins to carry out cell functions, including growth, division and death. Errors in transcription are highly suggestive of errors in the DNA itself, and Mallidis said he and his team saw a “fourteen-fold decrease in the expression of a protein called ornithine decarboxylase, which is responsible for the production of spermine and spermidine, compounds responsible for cell growth that help stabilise the structure of DNA”. They also found that a factor called spermatogenesis 20, of unknown function but known to be unique to the testis, was greatly increased. Mallidis and colleagues concluded that: “Taken together, these factors indicate clearly that having diabetes has a direct influence on the health of semen.” The scientists’ next step is to find out what happens in diabetic men to cause damage to their sperm DNA. Mallidis said they had a clue in that they found: “A class of compounds known as advanced glycation end products (AGEs) in the male reproductive tract. These are formed as the result of glycation (the addition of sugar).” AGEs accumulate during normal ageing, added Mallidis, explaining that: “They are dependent on life style — diet, smoking etc — and in many diabetic complications are centrally implicated in DNA damage. We believe that they play a similar role in the male reproductive system.” Mallidis and his team will be continuing the research to try and establish how AGEs contribute to DNA damage. They believe they may have discovered a new function for AGEs; one that extends their role beyond diabetes and its consequences. Considering the public health implications of their findings, Mallidis said: “We must now try to develop strategies to protect sperm, and to diminish the accumulation of AGEs.” These could include steps like changes in diet, which disrupt the formation of AGEs, or taking supplements to increasing the body’s protection against AGEs. And another puzzle is spermatogenesis 20. What does it do exactly, and why, and when, and how? And why do diabetics have it in much larger amounts? “We need to find answers to all these questions,” said Mallidis. The study was Abstract No. O-258, and was scheduled for Wednesday at 14.00 hrs local time.Click here for European Society of Human Reproduction and Embryology.Source: ESHRE, . Written by: Catharine Paddock, PhD Deoxyribonucleic acid—or DNA— is a molecule that serves as the hereditary material containing biological instructions that make every human and other organism unique. During reproduction, adult organisms pass their DNA and its set of instructions along to their offspring. DNA is made up of nucleotides, which are essentially chemical building blocks. Nucleotides join together in chains to form a strand of DNA, and contain three parts: a phosphate group, a sugar group, and one of four types of chemical bases: Adenine (A)Guanine (G)Cytosine (C)Thymine (T) These chemical bases come together to create the information found in DNA, and stores it in a code, based on their sequence. A human genome—or the full set of instructions from DNA—contains about 3 billion bases and about 20,000 genes on 23 pairs of chromosomes. DNA is found in nearly every cell of the human body. It is primarily located in the nucleus (where it is also referred to as "nuclear DNA"), though there is also a small amount in the mitochondria as well. Mitochondria are another part of human cells and are in charge of converting energy from food into a form that can power the cells. Collectively, all the nuclear DNA in an organism is known as its "genome." The purpose of DNA is to instruct organisms—including humans—on how to develop, survive, and reproduce. In order for this to happen, DNA sequences—known as "genes"—are converted into proteins, which are complex molecules responsible for carrying out most of the work in human bodies. While genes vary in size—ranging from about 1,000 bases to 1 million bases in humans—they only make up approximately 1% of the DNA sequence. The rest of the DNA sequences regulate when, how, and how much of a protein is made. It takes two separate steps to make proteins using instructions from DNA. The first is when enzymes read the information delivered in a DNA molecule and then transcribe it to a separate molecule called messenger ribonucleic acid, or mRNA. Once that happens, the information sent by the mRNA molecule is then translated into a language that amino acids—also known as the building blocks of proteins—can understand. The cell applies those instructions in order to link the correct amino acids together to create a specific type of protein. Given that there are 20 types of amino acids that can be put together in many possible orders and combinations, it gives DNA the opportunity to form a wide range of proteins. To understand how DNA works, it's important to go back to the four chemical bases mentioned earlier: A, G, C, and T. They each pair up with another base in order to create units called "base pairs." Then, each base also attaches to a sugar molecule and a phosphate molecule, forming a nucleotide. When arranged in two long strands, nucleotides form what looks like a twisted ladder or spiral staircase known as a "double helix." Using the example of a ladder, the base pairs are the rungs, while the sugar and phosphate molecules form the vertical sides of the ladder, holding it all together. The shape of the double helix is what gives DNA the capability to pass along biological instructions with great accuracy. This is the case because the spiral shape is the reason DNA is able to replicate itself during cell division. When it comes time for a cell to divide, the double helix separates down the middle to become two single strands. From there, the single strands function as templates to form new double helix DNA molecules, which—once the bases are partnered and added to the structure—turns out as a replica of the original DNA molecule. This video has been medically reviewed by Anju Goel, MD, MPH In 1869, Swiss physician and biochemist Friedrich Miescher discovered a chemical substance in human leucocytes. His research focused on the chemical contents of a cell's nucleus, and in order to get a better look at them, he examined pus on surgical bandages from the local hospital. Pus was known to contain large amounts of leucocytes, so Miescher purified their nuclei to better understand their makeup. In doing so, he was able to isolate a new chemical substance in the nucleus, which he named "nuclein"—but is known today as DNA. While there was a significant amount of research done on nucleic acids during and shortly after Miescher's lifetime, it would take several more decades before scientists understood their significance. There was a renewed interest in DNA starting in the 1930s, with many major discoveries soon following, including the understanding that DNA was responsible for passing along hereditary characteristics. The structure of DNA was also the subject of research in the 1930s, including that of English physicist and molecular biologist William T. Astbury, who suggested that DNA was a long and helical linear molecule. The best-known DNA breakthrough came in 1953, when Rosalind Franklin, James Watson, Francis Crick, and Maurice Wilkins conducted research that would result in the discovery of the double helix model of DNA. Using X-ray diffraction patterns and building models, the scientists determined that the double helix structure of DNA enabled it to carry biological information from one generation to the next. In 1962, Watson, Crick, and Wilkins were awarded the Nobel Prize in medicine for their discovery. Though Franklin would have been eligible to receive the prize, she died in 1958 from ovarian cancer at the age of 37, and the Nobel Prize rules stipulate that the award can't be split among more than three people, or given out after someone has died. Like many scientists who researched genetics in the field's early days, Watson was known to hold damaging—and scientifically inaccurate—beliefs on race, ethnicity, gender, and sexual identity, among other demographics. While the discoveries he made alongside his colleagues were significant, it's also important to acknowledge aspects of his work that don't hold up today.

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