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Identification of miRNAs as specific biomarkers in prostate cancer diagnostics: A combined *in silico* and molecular approach

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Cancer is a class of diseases characterized by out-of-control cell growth. There are over 100 different types of cancer, and each of these cancers are classified by the type of cell that it initially affects (1,2). For the purpose of this research we will be focussing on Prostate cancer (PC). Prostate cancer is one of the most common forms of cancer in men around the world. Each year approximately 4500 men in South Africa are diagnosed with PC (6). Prostate cancer is a type of cancer that starts in the prostate it is normally a walnut-sized gland found right below the bladder. It follows a natural course, starting as a tiny group of cancer cells that can grow into a full-blown tumour. In some men if PC that is not treated it may spread to surrounding tissue by a process called metastases and could lead to death. Current diagnostic tools include digital rectal examinations (DRE) (8), prostate specific antigen test (PSA)(11), biopsy(10) and ultra sound (9). All these diagnostic methods are currently being employed however they are invasive and they lack specificity and sensitivity (6,7). Therefore the need for a less invasive early detection method with the ability to overcome the lack of specificity and sensitivity is required. Biomarkers have recently been identified as a viable option for early detection of disease. Biomarkers are biological indicators ie. DNA, RNA, proteins and microRNAs (miRNA). Mature microRNAs (miRNAs) are a class of naturally occurring, small non-coding RNA molecules, about 21–25 nucleotides in length. MicroRNAs are partially complementary to one or more messenger RNA (mRNA) molecules, and their main function is to downregulate gene expression in a variety of manners, including translational repression, mRNA cleavage, and deadenylation (3,5,4). MiRNAs are becoming increasingly recognized as powerful biomarkers for human disease. The information potential held by miRNAs, combined with the fact that they are stable in serum and plasma, has led to a rapidly growing interest in using miRNAs in blood or urine as diagnostic and prognostic biomarkers (4). The aim of this study is therefore to identify miRNAs as specific biomarkers for the early detection of PC. The study is made up of three defined areas namely bioinformatic analyses, molecular validation and nanotechnology application. The identification of specific miRNAs and there known targets will be done using various bioinformatics techniques including programming and statistical analyses. The identified miRNAs will then be experimentally validated to generate an expression profile for the identified miRNAs, using molecular techniques. Furthermore, once the markers have been identified and experimentally validated to confirm that these markers encompass all characteristics that make for good biomarkers, they will then be used in the process of designing a diagnostic kit for the early detection of PC.

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