Odontología (Montevideo). 2025; 3:202
doi: 10.62486/agodonto2025202
ISSN: 3046-4102

ORIGINAL

Oral chromatin detection: an example of scientific and technological development management at an Angolan university

Detección de cromatina oral: un ejemplo de gestión de desarrollo científico y tecnológico en una universidad angolana

Roberto Lardoeyt Ferrer[1], Maria do Rosário Bragança[2], Milaydes Lardoeyt Ferrer[2]

[1]Instituto Superior Politécnico "Alvorecer da Juventude" (ISPAJ). Luanda, República de Angola.
[2]Facultad de Medicina. Universidad Katyavala Bwila. Benguela, República de Angola.

Cite as: Lardoeyt Ferrer R, do Rosário Bragança M, Lardoeyt Ferrer M. Oral chromatin detection: an example of scientific and technological development management at an Angolan university. Odontología (Montevideo). 2025; 3:202. https://doi.org/10.62486/agodonto2025202

Submitted: 28-03-2024 **Revised:** 21-06-2024 **Accepted:** 24-09-2024 **Published:** 01-01-2025

Editor: Lourdes Hernandez Cuetara

ABSTRACT

Introduction: the Faculty of Medicine of Benguela, province of Angola, has the social responsibility to respond to the perceived health needs of the population with its technological resources, its students in training, linked to one of the most important substantive processes, which is scientific research.
Objective: to implement the sexual chromatin technique, as a management of the scientific and technological innovation process of the Faculty of Medicine of the Katyavala Bwila University (FMUKB)
Method: a descriptive observational study was carried out, reporting a series of cases with sexual differentiation disorders (SDD). The technique was standardized with the Giemsa reagent and the procedure was carried out on four cases with SDD.
Results: genetic sex was defined based on sexual chromatin in the four cases with SDD. Three cases were chromatin positive, with clinical suspicion of Congenital Adrenal Hyperplasia, while one case was chromatin negative, with clinical suspicion of a 5 α reductase deficiency.
Conclusion: it is possible to define the chromatin sex in the cases studied, a result of great importance for the clinical management and therapeutic strategy by the multidisciplinary team. It is demonstrated that the monitors of the Medical Genetics discipline are protagonists in the management of scientific processes and the capacity for technological innovation in the faculty. With the realization of the technique, the genetics laboratory of the faculty is inaugurated.

Keywords: Scientific-Technological Development; University-Society; Medical Education; Genetics; Sexual Differentiation Disorders; Angola.

RESUMEN

Introducción: la Facultad de Medicina de Benguela, provincia de Angola, tiene la responsabilidad social de responder a las necesidades de salud sentidas de la población frente a sus recursos tecnológicos, sus estudiantes en formación, vinculados a uno de los procesos sustantivos más importantes que es la investigación científica.
Objetivo: implantar la técnica de la cromatina sexual, como gestión del proceso de innovación científica y tecnológica de la Facultad de Medicina de la Universidad Katyavala Bwila (FMUKB).
Método: se realizó un estudio observacional descriptivo reporte de serie de casos con trastornos de la diferenciación sexual (TDS). Se estandarizó la técnica con el reactivo Giemsa y se procedió a la realización del proceder a cuatro casos con TDS.

Resultados: el sexo genético se definió en base a la cromatina sexual en los cuatro casos con TDS. Tres casos resultaron ser cromatina positiva, con sospecha clínica de una Hiperplasia Suprarrenal Congénita, mientras que un caso resultó cromatina negativo, con sospecha clínica de un déficit de 5 α reductasa.
Conclusión: se logra definir el sexo cromatínico en los casos estudiados, resultado de gran importancia para el manejo clínico y estrategia terapéutica por parte del equipo multi disciplinario. Se demuestra que los monitores de la disciplina Genética Médica son protagonistas en la gestión de los procesos científicos y la capacidad de innovación tecnológica en la facultad. Con la realización de la técnica se inaugura el laboratorio de genética de la facultad.

Palabras clave: Desarrollo Científico-Tecnológico; Universidad-Sociedad; Educación Médica; Genética; Trastornos de la Diferenciación Sexual; Angola.

INTRODUCTION

University Social Responsibility (USR) is a new philosophy of university management that aims to renew the social commitment of the University, providing innovative solutions to the challenges of higher education in the context of a globalized world.[1]

Bringing the school closer to life is the first law of teaching. Medical education must be developed in social phenomena, depending on the importance of University-Society interaction as the basis of education in the 21st century.

One of the greatest challenges for medical schools is their effective link with society. This must be expressed in identifying problems that constitute real social needs or in the search for solutions, using scientific research, and in applying methods that promote learning and the extensionist projection of the processes generated in the university environment.

Relevance" is the level and type of relationship established between the University and Society in any of its teaching, research and extension functions. On the one hand, this connection is related to the analysis and interpretation of society's interests, needs and demands; on the other hand, to the satisfaction of these demands by the University and, finally, to the production of self-reflective processes. One of the reflections of the XXXIII Regional Assembly of the Central American System of University-Society Relations was the transmission of knowledge as a methodology for the accompaniment of the University in the communities through university extension.[2]

In this sense, the management of scientific development and technological innovation in medical schools has its maximum expression in its social responsibility and relevance. All knowledge and technology produced with the active participation of the main actors (teachers and students) should contribute to the solution of the problems and health needs of the population, with modes of action characterized by ethics and responsibility in the processes of production, socialization and application of the results of science.

The University has always been the cradle of ideas, projects, and alternatives, searching for solutions to society's problems and demanding ever greater participation from the academy.[3,4]

The Faculty of Medicine of Katyavala Bwila University (FMUKB) is in its sixteenth year of operation since 2008, when an entrance examination was held for the first time, enrolling the first 60 students in the Medical Course.

With the creation of new public institutions of higher education and the resizing of the Agostinho Neto University in Academic Regions, by Decree No. 7/09 of 05/12/2009 of the Council of Ministers, the Medicine Course became part of the Faculty of Medicine of the Katyavala Bwila University, belonging to the Academic Region II, which includes the provinces of Benguela and Kwanza-Sul, whose headquarters is located in the city of Benguela.

FMUKB's mission is to contribute to the social development of Angola, specifically to the population's health care, through the integral and permanent training of physicians and the development, dissemination and socialization of knowledge about the factors that influence their health.

With the above in mind, a research project was designed at FMUKB to create a clinical genetics service aimed at individualized preventive care in collaboration with the Benguela General Hospital. In the first phase, a pilot study was conducted on children and newborns in the province of Benguela with genetic diseases and congenital disabilities to validate the proposed clinical history, with a predominance of children with disorders of sexual differentiation (DSD).

TDS is the name given to congenital diseases manifested by discrepancies between external genitalia, gonads and chromosomal sex. These disorders can be classified into three groups: TDS with chromosomal anomalies, TDS with karyotype 46, XX and TDS with karyotype 46, XY.[5]

These three groups' definitions are only possible through chromosomal studies or at least through sex

chromatin determination (Barr body identification).

In Benguela, these resources were unavailable, as there is neither a speciality of Clinical Genetics nor professionals dedicated to this branch of knowledge. As a result, the clinical-diagnostic approach to patients with TDS needed to be completed. It was not possible to study chromosomal sex (the starting point for determining the etiopathogenic diagnosis), which made it impossible to correctly manage and follow up on these disorders, which, being pediatric emergencies, require a solution from academia.

Given this scenario, the following question was posed: "How can FMUKB, through one of its substantive processes (management of scientific and technological development), contribute to the correct diagnosis and management of patients with TDS?"

FMUKB has laboratories equipped to encourage the development of scientific research, technologies, and tools to improve health management.

METHODS

A descriptive observational study (case series report) was carried out to evaluate the technical conditions of the FMUKB microbiology laboratory necessary for studying oral chromatin.

The monitors of the Medical Genetics discipline were trained in the oral chromatin study technique. In the first training phase, the procedure was applied to a simple stratified random sample of 20 FMUKB medical students (10 women with normal menstrual cycles and ten men) aged 18-25 years; in the second phase, the subject of this article, it was applied to four cases with TDS. Four slides were processed for each patient (two from each cheek), and 16 were analyzed.

The following materials and reagents were used: 76 mm x 26 mm slide, 24 mm x 50 mm coverslip, metal, wooden or plastic spatula to collect the sample, distilled water, Giemsa reagent, gloves, slide box, two beakers, glass funnel, pipette, drop counter, optical microscope, immersion oil, immersion oil, immersion counter, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil, immersion oil and immersion oil. The following guidelines carried out the procedure.

The procedure was carried out according to the following steps:

- Scrape the buccal mucosa of the right or left cheek with a wooden, metal or plastic spatula.
- Smear on two slides, previously cleaned and dried. Place in a plastic box to dry the sample at room temperature.
- After five minutes of drying, deposit three drops of Giemsa reagent on the slide with the dropper.
- Pre-prepare Giemnsa reagent standardized to a 3:1 ratio (3 mL of distilled water to 1 mL of Giemsa reagent).
- Cover the slide with the coverslip, remove air bubbles with the help of another slide for 10 minutes, and blot the excess stain with filter paper.
- The slides were observed under an optical microscope, starting with the lowest magnification objective (10 x) to locate the epithelial cells and the immersion objective (100 x) to observe Barr's corpuscle.
- Count 100 cells and identify those with Barr's corpuscle. If the sample shows a minimum value of 40 % of cells with positive chromatin (Barr's body), then the sample is classified as female (figure 1).

Figure 1. Participation of the student monitors of the Medical Genetics discipline in the different steps of the technique

Finally, the percentage of cells positive for oral chromatin (presence of Barr bodies) was reported for the four cases with TDS and referral to the multidisciplinary team.

RESULTS

The following clinical data were obtained in the cases with TDS (figure 2).

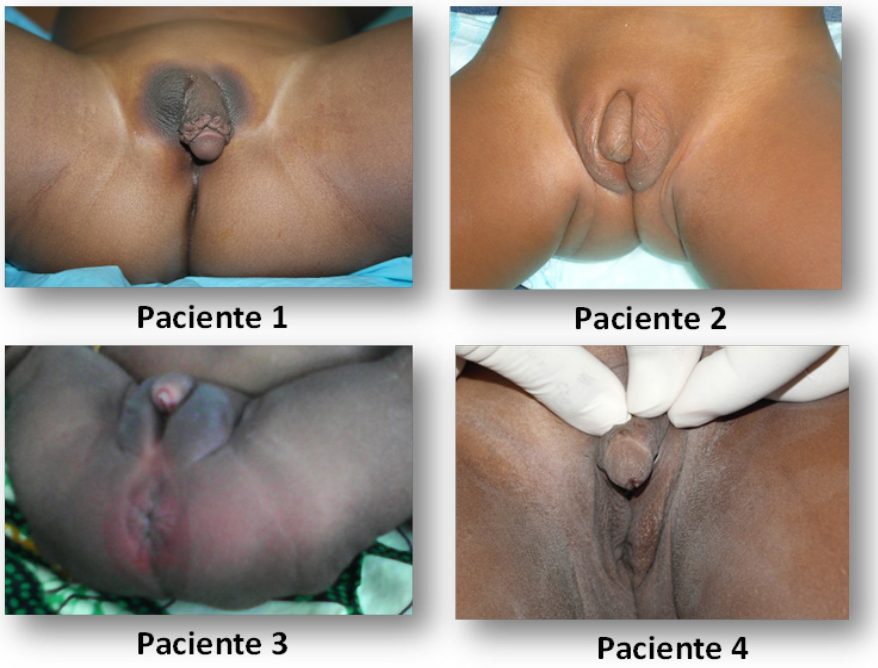

Figure 2. Patients with disorders of sexual differentiation assessed and studied in relation to oral chromatin

Patient 1: Three-year-old transitional, with no family history of TDS, with a paternal uncle with intellectual disability of unknown cause, a mother with first trimester miscarriages and infant death of unknown cause in a paternal uncle's child. Parents are of Umbundu ethnicity. He was born from a hospital delivery, euthyroid, at term. Physical examination revealed hyperpigmented scrotal tissue without scrotal pouches, a 2 cm phallic structure, and well-formed glans and hypospadias. An 11 mm structure was palpated in the right inguinal region, whose ultrasound confirmed it was a testicle. The oral chromatin technique showed 2 % of Barr bodies (negative chromatin). He has Prader stage IV.

Patient 2: One-year-old infant with no family history of genetic events. The mother is from the Kikongo ethnic group, and the father is from the Umbundu ethnic group. There is a history of alcohol consumption by the parents during the entire pregnancy. She was born from a hospital delivery, euthyroid, at term, weighing 1600 grams (intrauterine growth retardation). On physical examination, the following signs were observed: external genitalia with labia majora, no labia minora, hypertrophic clitoris, reaching phallic appearance of 1.5 cm in length, no external urethral meatus and presence of vaginal introitus. The oral chromatin technique revealed 49 % of Barr bodies. She has Prader stage II.

Patient 3: Newborn, 21 days old, premature, euthyroid, hospital delivery, with no family history of genetic events. Parents are from the Umbundu ethnic group and have no history of teratogens during pregnancy. Physical examination revealed: microcephaly, rough and hirsute forehead, jaundice, hypertrophic labia majora, absence of vaginal introitus, phallic structure of approximately 1 cm, without urethral meatus. It has an orifice, which appears to be urethral, at the root of the phallus and in the anus located anteriorly. The oral chromatin study revealed 54 % of Barr bodies. She has Prader stage II.

Patient 4: Five-year-old patient with a history of unexplained death of a sister in the first days of her life. Parents are from the Umbundu ethnic group. She was born from a hospital delivery, euthyroid, at term. Physical examination revealed hypoplastic labia majora, agenesis of labia minora, absence of vaginal introitus and external vaginal orifice, presence of a 2 cm phallic structure with glans penis and hypospadias. An oral chromatin study revealed 76 % of Barr bodies. Prader stage IV.

DISCUSSION

In all cases, the diagnosis and approach to the type of TDS was established. Interphase cytogenetic studies related to the detection of sex chromatin or Barr body and Y mass are very simple investigations that, together

with the chromosomal study in cell division (karyotype), allow the identification of the genetic sex, an essential element for the process of sexual differentiation.[6,7]

Different reagents can identify sex chromatin, such as staining with acetic orcein, thionin, basic fuchsin and Schiff's reagent (Feulgen's reaction). Many of these techniques are laborious, although the last one is more accurate since it uses a specific DNA dye.

In the present investigation, Giemsa was used, preparing one part of this reagent for three parts of double distilled water with immediate filtering to obtain a clear image of acceptable resolution. This method has the advantage over others because it does not require bleaching and is simple, fast, and economical.[8]

In this first stage, the Genetics monitors were the main protagonists, thus demonstrating that the intervention of the University, as a participant in the solution of social problems, goes through the process of training qualified human resources. With these, the University can act on the various existing problems, managing, in turn, to promote the social commitment of its future professionals through the understanding of the social function of knowledge, science and technology, giving the possibility of giving back to the community what it receives from it.[9]

Suppose young people need to gain experience critically analysing health problems and situations. In that case, as is the case of the TDS, there is a risk of losing reserves of capacity and human quality in universities, essential for the critical analysis of reality. For this reason, the University must continue to be a space where ideas and their discussion, essential instruments for social evolution, are privileged.[10]

Newborns with uncertain sex represent a real challenge for paediatricians and endocrinologists. The risk to the life of the newborn, the anxiety of the family and the social stress exerted on unhappy parents identify TDS as a medical emergency.[11]

Every patient with an anomaly of sexual differentiation should be treated by a specialized team, including appropriate psychological treatment for parents and family members, and evaluated by paediatricians, urologists, endocrinologists, geneticists and psychologists.[12]

Each of the patients presented in the study requires further study, namely hormonal measurements, imaging tests, biopsy, laparoscopy, laparotomy, Chorionic Gonadotropic Hormone (HCG) testing and other genetic studies, such as karyotyping and determination of the SRY gene, among others. On the other hand, each patient has an extensive number of causes. However, despite this, it was possible, in the first stage, to determine the possible genetic sex in an academic institution that had no experience with the technique, responding to a social demand.[6]

In the case of patient 1, the presence of the male gonad in the right inguinal canal was corroborated by negative chromatin (absence of Barr's body), which suggested a possible TDS with karyotype 46, XY. Given this clinical situation, the differential diagnosis should be made with the two most frequent entities of this etiopathogenic group, namely 5-alpha reductase deficiency, whose gene is located at the 2p23 locus and which converts testosterone to dihydrotestosterone, and androgen insensitivity syndrome (Morris disease), an X-linked condition, whose gene is located at the Xq11-12 locus.[7]

For the rest of the patients, in whom the presence of Barr bodies was detected in a high percentage, the diagnosis was guided by the most frequent entity for TDS with karyotype 46, XX, Congenital Adrenal Hyperplasia, which in 95 % of the cases is due to a 21-hydroxylase deficiency, encoded by a gene located in chromosomal region 6p21.

It is important to note that in 70 % of cases, there is a salt-losing variant; as it is a Mendelian disease with autosomal recessive inheritance, there may be a family history of this variant, and the newborn may die if measures are not taken within the first 24 hours of life. This fact could be related to the death of the sister of patient 4, whose cause of death was unknown to the parents.

Furthermore, to be in tune with the present day, the University must define the integral vision of its three missions: higher education, research and innovation. Today's society requires that the transfer of technical and scientific knowledge be translated into innovation and that technical-scientific advisors and managers be trained as innovation-inducing agents.[3,4,13,14]

Finally, this research contains three of the impacts that the University generates in its environment: educational impact, cognitive and epistemological impact and social impact, because, for the first time, a simple technique was implemented, taking advantage of the technical-scientific potential of the faculty, with the participation of students, to solve a medical and social problem, as is the case of TDS. Therefore, as a university, the University must define what kind of knowledge it should produce, what objectives it should have, and to whom and how to disseminate it to address the knowledge inadequacies that harm social development.[1]

CONCLUSIONS

It once again demonstrated the strategic role of universities in the knowledge society and the critical importance of education, training, research, knowledge transfer, and innovation for the welfare and sustainable development of people.

The monitors of the Medical Genetics discipline and the faculty are protagonists in the management of scientific processes and technological innovation capacity in the faculty, having performed, for the first time, a genetic technique in the province of Benguela in response to the need for diagnosis and proper management of disorders of sexual differentiation.

It is recommended that the technique of karyotyping, or chromosomal study, be used in cell division.

REFERENCES

1. García Chacchi DV, Ladera-Castañeda M, Atoche Pacherres MA, Medina Sotelo CG, Sánchez-Huamán YD, Atoche Pacherres CA. Responsabilidad Social Universitaria en América Latina. Una revisión sistemática. Salud, Ciencia y Tecnología. 2024; 4. Disponible en: https://dialnet.unirioja.es/servlet/articulo?codigo=9394813

2. Arrechavala JR. Declaratoria de la XXXIII asamblea regional del sistema Centroamericano de relación universidad sociedad (SICAUS) AÑO 2022. Revista Compromiso Social. 2024; 4(8). 448-454.

3. Dávila Pinto P, Mantilla Garcés D, Latorre Aizaga F. La Responsabilidad Social Universitaria como Pilar Formativo: Análisis Empírico en la Universidad Central del Ecuador. Ciencia Latina [Internet]. 12 de agosto de 2024 [citado 17 de septiembre de 2024];8(4):1866-83. Disponible en: https://www.ciencialatina.org/index.php/cienciala/article/view/12431.

4. Victor Manuel Martinez Ramirez, Rosalia Lopez Paniagua, Katia Beatriz Villafañe-Vidales, Moises Salvador Becerra Medina. Responsabilidad Social Universitaria desde el Enfoque Territorial: la Experiencia de la Universidad Michoacana de San Nicolás de Hidalgo. Revista de la Facultad de Contaduría y Ciencias Administrativas, Universidad Michoacana de San Nicolás de Hidalgo, Facultad de Contaduría y Ciencias Administrativas. 2024; 9(17):1-13.

5. Patiño Osorio E, Hernández Vargas ED, Bedoya Carvajal OA. Guía para el manejo de los trastornos del desarrollo sexual en la infancia, Medellín 2020-2021. Arch Med (Manizales). 2024;24(1). https://doi.org/10.30554/archmed.24.1.4316.2024

6. FJ Pelayo Baeza, Carabano Aguardo FJ, Sanz Santaeufemia E. La orden Izquierdo. Genitales ambiguos. Rev Pediatría de Atención Primaria. 2011;13:419-33

7. Marcelino Hernández-Valencia, Arturo Zárate. Efecto genético y hormonal sobre la diferenciación sexual. Paradójicamente la mujer requiere andrógenos y el hombre estrógenos. Ginecol Obstet Mex.2010;78(7):365-370

8. Jaime Descailleaux, Margarita Velázquez. Una técnica simplificada para cromatina X. Revista de Ciencias U.N.M.S.M.1986;74(1):171-7

9. Cardona-Arbeláez D. Responsabilidad social universitaria: Retos para un entorno desafiante. Saber Cienc. Lib. [Internet]. 12 de febrero de 2024 [citado 17 de septiembre de 2024];19(1):15-7. Disponible en: https://revistas.unilibre.edu.co/index.php/saber/article/view/11522

10. Guillermo Jaim Etcheverry. Universidad y sociedad: relación conflictiva e imprescindible. Petrotecnia. 2003;59-61

11. Krishna KB, Houk CP, Lee PA. Pragmatic approach to intersex, including genital ambiguity, in the newborn. Seminars in Perinatology. 2017;41(4):244-251. doi: 10.1053/j.semperi.2017.03.013

12. Yoerquis Mejías Sánchez, Orgel José Duany Machado, Noel Taboada Lugo. Trastornos de la diferenciación sexual: presentación de un caso de genitales ambiguos y revisión del tema. Rev Cubana Pediatr. 2007;79(3)

13. Sousa JCRd, Siqueira ES, Binotto E and Nobre LHN. University social responsibility: perceptions and advances. Social Responsibility Journal. 2021; 17(2): 263-281. Disponible en: https://doi.org/10.1108/SRJ-10-2017-0199.

14. Lara Manjarrez IA, Lara Salazar JR, Inzunza Duarte K. Responsabilidad social universitaria en las Instituciones de Educación Superior en México. SIBIUAS [Internet]. 2024 Jun. 30 [cited 2024 Sep. 17];(3):72-6. Available from: https://revistas.uas.edu.mx/index.php/SIBIUAS/article/view/253

FINANCING

The authors did not receive funding for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Data curation: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Formal analysis: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Research: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Methodology: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Project management: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Resources: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Software: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Supervision: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Validation: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Visualization: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Writing - original draft: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.
Writing - revision and editing: Roberto Lardoeyt Ferrer, Maria do Rosário Bragança, Milaydes Lardoeyt Ferrer.