REVIEW ARTICLE

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SUMMARY

Transsexuality refers to the individual whose gender is not aligned with their biological sex, this is a condition that triggers a feeling of non-belonging, and has been increasing its incidence in recent years. It has an unknown origin, and current studies indicate that several biological factors may be linked to the occurrence of it. Trans male individuals are those who were born with the female biological sex, but do not identify with this designation. The therapy of choice is the administration of exogenous testosterone applied intramuscularly. The aim of this study was to describe the systemic and biochemical parameters of trans men after hormonal therapy, from the analysis of articles that highlight the systemic changes triggered by testosterone administration. The inversion of the reference values from female

to male, in several systemic parameters, could be observed after the calculation of the means of the results reported in the literature, pointing out the mechanisms by which testosterone acts in the body.

Keywords: 17-Hydroxysteroid Dehydrogenases, transsexuality, hormones, hormone replacement therapy.

1. INTRODUCTION

1.1 ABOUT GENDER DYSPHORIA

Transsexuality, also called gender identity disorder (GID) or gender dysphoria (GD), is classified in ICD F64-0 ("ICD10 International Disease Code", 2020) and refers to the individual whose biological sex it does not align with his gender identity, that is, he witnesses a different gender than he was assigned at birth (BURKE et al., 2017; SARASWAT; WEINANDSAFER, 2015; UNGER, 2016). In the case of trans men, they are biologically born females, but identify with the male gender.

Biological sex, gender and sexual orientation are different things. Gender identity is about self-identification, as individually the person experiences their existence. Sexual orientation is about attraction to other genders, transgender individuals can be heterosexual, bisexual or homosexual, without this affecting their gender identity and, finally, biological sex is linked to the genital and chromosomal factor, which defines the entire physiological issue involved (GUPTA; IMBOREK; KRASOWSKI, 2016; ADRIAANSEN et al., 2017).

1.2 ETIOLOGY

1.2.1 NEUROLOGICAL FACTORS

In a study that analyzed neurological alterations in this population, it was found that some transgender men analyzed had the brain structure compatible with the structure of cis men

(who identify with their designated sex at birth), while others presented their brain structure different from both sexes of the control groups (BURKE et al., 2017). Other studies, such as that of Uribe et al. (2020), in individuals with GD reported that neurological alterations were found in places of the brain responsible for body perception, compared to the control group, composed of cisgender men (URIBE et al., 2020).

Swaab et al. (2011) proposed that the incompatibility between gender and biological sex could occur due to the fact that the sexual differentiation of the brain occurs before the differentiation of sexual gonads at the beginning of fetal life (BAO; SWAAB, 2011). Still in the neurological sphere, Yokota et al. (2005) reported that the pattern of the callous body in people with GD is closer to people of the same gender than that of people of the same biological sex (YOKOTA; KAWAMURA; KAMEYA, 2005).

1.2.2 GENETIC FACTORS

As for the genetic factors that are being studied to understand the development of the condition, the most pointed is linked to the CYP17 gene (SARASWAT; WEINANDSAFER, 2015; BENTZ et al., 2008). The CYP17 gene is responsible for encoding the synthesis of a protein in the cytochrome P450 family, CYP17A1, which is linked to the synthesis of precursors of steroid hormones such as testosterone and estrogen, which are necessary for the normal development and reproduction of humans (BENTZ et al., 2008).

A control case study that counted on the participation of one hundred and fifty-one participants with DG pointed to a mutation in the CYP17 gene as a theoretical cause of the condition. CYP17 A2 T>C is a functional single nucleotide polymorphism, which is associated with elevation in serum and plasma of estradiol, progesterone and testosterone levels (BENTZ et al., 2008). The results of the research showed that of the 151 participants (49 of them being trans men), the mutant allele was statistically in greater association with trans male individuals and not with trans female participants (biologically assigned to males at birth). The allelic distribution in trans women was equivalent to male cis gender controls, while this distribution in the trans male portion did not follow a specific gender pattern, and its distribution was also equivalent to the group of cis men (SARASWAT; WEINANDSAFER, 2015; BENTZ et al., 2008).

1.2.3 PRE-NATAL EXPOSURE FACTORS

Prenatal exposure factors were also evaluated, studies were conducted in a sample of five hundred participants with GD, all of them exposed during fetal life to an estrogen iced drug for abortion prevention, *Diethylstilbestrol* (DES), of these 500 participants, 150 had severe gender dysphoria (SARASWAT; WEINANDSAFER, 2015).

1.3 EPIDEMIOLOGY

The number of patients with GD seeking help and treatment has been increasing over the decades (UNGER, 2016; GUPTA, IMBOREK; KRASOWSKI, 2016) and, according to a data survey, which was considered the largest recent study on the prevalence of transsexuality, it was reported that the prevalence is approximately 1 trans man for 40,000 cis people, and 1 trans woman for every 15,000 cis people (UNGER, 2016).

However, as many prevalence studies require a clinical database, and even with the increase in the number of individuals with GD a large number of them choose to perform hormone therapy at home, without attending health agencies, the accounting of the number of cases is complicated, thus leaving only a small portion of the true prevalence (UNGER , 2016).

The aim of this study was to describe the systemic and biochemical parameters of trans men after hormonal therapy. From a literature review, the following parameters were investigated: Red series (Hb, HTC, erythrocyte count), leukocyte count, creatinine, liver enzymes (ALT, ALT, GGT), lipid profile (total cholesterol, HDL, LDL, triglycerides) fasting glucose dosage and hormonal profile (total testosterone and estradiol). Based on these analyzed data, the mean of the obtained values was calculation, for the purpose of analyzing the profiles of this group.

2. MATERIALS AND METHODS

2.1 STUDY DESIGN

The present work is a Literature Review based on the research and analysis of bibliographic works and scientific articles related to the subject delimited, available and freely accessible in the scientific databases of the Indexers PubMed and Scientific Electronic Library Online (SciELO). In order to promote a broad review of the subject, national and international publications were selected preferably from the last ten years, which address the systemic changes that occur in trans male individuals after hormonal therapy.

The analyzed data were collected from a group of articles, 16 of them having been published within the period 2015-2020, using as keywords the following english terms: *17-Hydroxysteroid Dehydrogenases*, *Transsexualism*, *Hormones* and *Hormone Replacement Therapy*. After collecting the results reported in the literature for biochemical and systemic parameters, a calculation of the mean of these data was performed for the purpose of analyzing the changes after hormonal therapy.

3. RESULTS

3.1 THERAPY

3.1.1 ANALYTICAL ERRORS

It is possible to notice the increase in the number of patients with GD in clinics and laboratories, as more and more this population seeks medical help to perform hormone therapy (UNGER, 2016). For the most part, the systems of clinical analysis laboratories contemplate only the biological sex of the patient in their forms, this binary system does not allow the insertion of gender data. This is a problem, because if the user is already on hormone therapy, the reference values will no longer be the same, and the automated analysis devices configured with the male and female reference values, will release the samples of these patients as if they presented abnormal results in certain markers (UNGER, 2016; ADRIAANSEN et al., 2017).

In this situation, the most affected markers are those that use sex information to release the results, such as tests of liver enzymes, creatinine and hematocrit (GUPTA; IMBOREK; KRASOWSKI, 2016), leaving with the analyst the responsibility of recognizing whether this result is really changed or not (GUPTA; IMBOREK; KRASOWSKI, 2016; ADRIAANSEN et al., 2017).

In Brazil, in the Services of the SUS and guaranteed by law, the trans population is entitled to the use of a social name, the name chosen by the individual. Ordinance No. 1,820/2009 says that the user must be identified by first name and civil surname, however, in all documents there must be a field for the use of social name (SILVA et al., 2017). This right facilitates the life of the transgender user, as it can also be used in laboratories, allowing the analyst to have a broader view of the situation of this user when checking the flags of the machines (SILVA et al., 2017).

3.1.2 HORMONE THERAPY

Clinical examinations are part of the pre-treatment phase and are also used to monitor patient health (UNGER, 2016). The therapy used in the treatment of men with GD is the administration of exogenous testosterone, being more used in this treatment in its form for intramuscular application, however, the medication can also be administered orally, subcutaneously and transdermally (UNGER, 2016; ADRIAANSEN et al., 2017; GOOREN, 2014). The principle of testosterone (T) treatment is the same as the treatment given to men performing hormone replacement (UNGER, 2016).

The way to start treatment varies around the world, but usually begins with the referral of a mental health professional to an endocrinologist, being responsible for prescribing the medication (UNGER, 2016; GOOREN, 2014). The goals of hormone therapy (HT) with T are to suppress secondary female sexual characteristics, and develop male characteristics and virilization to the user.

The t-administration interval varies from patient to patient, and takes into account the treatment objective, treatment time and individual clinical factors, and this interval is initially every fourteen days, and after some time, twenty-one days (UNGER, 2016; GOOREN, 2014;

CHIPKIN, KIM, 2017). T acts in the body to stimulate a second puberty, and all this transition can take up to five years to be complete, but the changes are dependent on the hormone, some of which may recede in the absence of the same. Therefore, therapy should be performed throughout life (GORTON; ERICKSON-SCHROTH, 2017).

3.2 SYSTEMIC CHANGES

3.2.1 MORPHOPHYSIOLOGICAL CHANGES

Androgenic receptors are widely distributed throughout the body and, because of this, testosterone therapy has several effects on various systems of the body, affecting physical, physiological and psychological aspects of those who undergo this treatment (IRWIG, 2017).

The literature reports that the most common physical changes are linked to this second puberty. At the beginning of HT (1-3 months) the first perceived changes are increased oil of the skin, increased muscle mass in the upper region, also generating an increase in physical strength, in this period also occurs the redistribution of body fat to a male pattern, the interruption of the menstrual cycle can occur in these first three months (SILVA et al., 2017).

From the three months, the physical changes become more evident, and this period is marked by the appearance of facial and body hair and voice alteration, which will begin to fail and will be hoarse until the definition of the vocal cords to a more serious and manly tone (ADRIAANSEN et al., 2017; SILVA et al., 2017; CHIPKIN, KIM, 2017; GORTON; ERICKSON-SCHROTH, 2017).

From the first year of HT occurs the thickening of facial hair, androgenetic alopecia is also very reported in this period, the hair begins to fall and grows again in a male pattern due to the interaction of T with the pilosebaceous glands (ADRIAANSEN et al., 2017). After this initial phase of HT, the later changes begin, which are the atrophy of the vaginal epithelium, increase of the clitoris (on average 5 centimeters) and the definitive laying of the vocal cords (ADRIAANSEN et al., 2017; GORTON; ERICKSON-SCHROTH, 2017).

Individuals who start treatment with older age already have a higher degree of definitive

feminization that cannot be reversed with T, as a result, they may be lower (mean height difference up to 12 centimeters), present the pattern of fat distribution more feminine and may also have a hip wider than that of a cis man (ADRIAANSEN et al. , 2017; GOOREN, 2014).

3.2.2 HEMATOLOGICAL CHANGES

Erythropoiesis is one of the many mechanisms in the body that undergo changes because of exogenous administration of testosterone. Studies suggest that androgenics act indirectly as stimulants of erythropoietin production and directly in erythropoiesis in the bone marrow. Higher testosterone levels in the blood plasma are constantly associated with higher hematocrit and hemoglobin values, but these values remain within the expected male reference values (cis men) (IRWIG, 2017; VELHO et al., 2017).

By calculating the mean data of the analyzed articles that reported changes in hemoglobin (Hb) and hematocrit (HTC), the results presented in Table 1 were obtained.

Taking into account the reference values for these parameters as the average of the adult Brazilian population (“MSD Manuals”, 2020), the result of 14.09 g/dL for Hb found would be within the expected in both reference values, with no risk to health if the interpretation of the test was performed according to the female or male reference value, as well as the hematocrit result, which obtained an average compatible with both reference values.

Regarding the values related to the cell count of erythrocytes and leukocytes, the baseline and post-hormone therapy values of a studied group can also be seen in Table 1 (VITA et al., 2018).

In both counts it was possible to visualize an increase in the white and red series (VITA et al., 2018), consistent with the stimulation of erythropoietin production and the action of hormones in the bone marrow (IRWIG, 2017).

Table 1: Hemoglobin, hematocrit and leukocytes and erythrocyte count values before and after hormonal therapy with testosterone.

Systemic Profile	Reference Values	Pre HT Values	Post HT Values
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Hemoglobin	(Jacobeit et al, 2007) (Mueller et al, 2010) (Jacobeit et al, 2009) (Mueller et al, 2010) (Pelusi et al, 2014) (Quirós et al, 2015) Average	Male: 14-17g/dL Female: 12-16 g/dL		14,45 g/dL 14,0 g/dL 14,8 g/dL 13,9 g/dL 13,95 g/dL 13,8 g/dL 13,45 g/dL 14,4 g/dL 14,09 g/dL
Hematocrit	(Jacobeit et al, 2007) (Mueller et al, 2010) (Jacobeit et al, 2009) (Mueller et al, 2010) (Pelusi et al, 2014) (Quirós et al, 2015) Average	Male: 41-51 Female: 36-47%		42,65% 43,87% 43,5% 42,95% 41,25% 41,60% 40,75% Not Rated 42,36%
Leukocytes	Vita et al, 2018	$4,5-11 \times 10^3$	7.4 ± 1	7.4 ± 1.6
Cells	Vita et al, 2018	$4,2-5,9 \times 10^6$	4.4 ± 0.4	4.8 ± 0.4

Source: elaborated by the author himself.

3.2.3 BIOCHEMICAL CHANGES

Creatinine

Transmale patients tend to have higher creatinine values after hormone therapy, since with the administration of exogenous testosterone there is a considerable increase in muscle mass, which is directly related to creatinine levels (VITA et al., 2018; GANDHI; MEDEIROS; SHAH, 2020). The mean values found in recent studies on this parameter in transgender men were between 0.73 ± 0.03 at their baseline Pre T level and 0.82 ± 0.04 after 18 months on hormone therapy (FERNANDEZ; TANNOCK, 2016). The reference values for this parameter are 0.7-1.3 mg/dL in the serum.

Liver Enzymes

Liver enzymes are another parameter that present significant alterations with HT, their increase is consistent with the inversion of female reference values for males, but without exceeding such reference values, being outside the pathological level. The risks of HT on liver function are more related to the administration of the hormone orally than to intramuscular administration, for this reason, this is the first-choice route of administration of the drug (FERNANDEZ; TANNOCK, 2016). The average values found for this parameter can be seen in Table 2.

Lipid Profile

Many studies that analyzed samples of male trans patients reported decreased HDL and increased LDL, as well as an unfavorable increase in triglyceride after one year of intramuscular testosterone administration (IRWIG, 2017; FERNANDEZ; TANNOCK, 2016). The average values found can be seen in Table 2. Even with the so-called increase in triglycerides and LDL cholesterol, the results are still within the reference values for these parameters.

Table 2: Values of liver enzymes before and after hormonal therapy, lipid profile dosage after hormone therapy.

Systemic Profile		Reference Values	Pre HT Values	Post HT Values
Alanine amino transferase (ALT)	(Velho <i>et al</i> , 2017).	0-35 U/L	14,4±4,2	18,3±8,2
Aspartate amino transferase (AST)	(Velho <i>et al</i> , 2017).	0-35 U/L	15,1±3,9	21,4±22,7
Gamma glutamylomyc transpeptidase (GGT)	(Velho <i>et al</i> , 2017).	8-78 U/L	11,4±2,3	17,8±12,4
Total Cholesterol	(Mueller <i>et al</i> , 2007) (Jacobeit <i>et al</i> , 2009) (Quirós <i>et al</i> , 2015) Average	< 190 mg/dL		189,13 mg/dL 203 mg/dL 170,8 mg/dL 187,64 mg/dL
Hdl	(Mueller <i>et al</i> , 2007) (Jacobeit <i>et al</i> , 2009) (Quirós <i>et al</i> , 2015) Average	>40 mg/dL		53,64 mg/dL 50,5 mg/dL 48,8 mg/dL 50,98 mg/dL

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Ldl	(Mueller <i>et al</i> , 2007) (Jacobeit <i>et al</i> , 2009) (Quirós <i>et al</i> , 2015) Average	<130 mg/dL		130,04 mg/dL 129 mg/dL 108,3 mg/dL 122,44 mg/dL
Triglycerides	(Mueller <i>et al</i> , 2007) (Jacobeit <i>et al</i> , 2009) (Quirós <i>et al</i> , 2015) Average	< 175 (Fasting)		137.28 mg/dL 87.5 mg/dL 86.3 mg/dL 103.69 mg/dL

Source: elaborated by the author himself.

Glycemic Profile

The glycemic profile presents a decrease in fasting glucose levels in trans men in HT, this decrease is accompanied by the reported decrease in insulin sensitivity, generating a compensatory increase of this hormone in plasma during fasting (GOOREN; Giltay; BUNCK, 2008). The mean values found related to fasting glucose in this group were from 81 to 93.6 mg/dL, and the reference value for this parameter was < 100 mg/dL ("SBD Guidelines 2019-2020", 2020).

Hormonal Profile

The changes found in the hormonal profile are the most relevant of this group and are directly linked to the administration of exogenous testosterone. Levels of sex hormones in the serum may change depending on the route of administration of the hormone. The dosages of the hormone may be adequate according to the laboratory tests of the patient, the excess testosterone causes the conversion of the same into estrogen by aromatization, generating an effect contrary to the desired (UNGER, 2016). The mean values of sex hormones (testosterone and estradiol) found in the literature can be seen in Table 3.

Table 3: Mean values of sex hormones in serum of trans men before and after hormone therapy, according to the literature.

Systemic Profile		Reference Values	Pre HT Values	Post HT Values
Testosterone	(Vita <i>et al</i> , 2018)	Men: 10 to 42 nmol/L Women: 0.7 to 2.6 nmol/L	1.6±0.5 nmol/L	17.0±8.5 nmol/L

Estradiol	(Vita <i>et al</i> , 2018)	Women: 50–150 pmol/L Men: 37–110 pmol/L	164.5±54.3 pmol/L	220.6±98.7 pmol/L
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Source: elaborated by the author himself.

Taking into account these reference values and the data collected regarding the hormonal profile of this group, it is safe to say that the desired inversion of testosterone values occurred, although with this there was also an increase in estradiol as a compensatory mechanism of the body, due to sporadic peaks at the time of administration of the hormone (UNGER, 2016; GOOREN; GILTAY; BUNCK, 2008).

3.3 ADVERSE EFFECTS OF HORMONE THERAPY

Hormone therapy with testosterone is considered safe if levels of this hormone remain at physiological level, within the male reference values. Studies suggest, however, that a sudden increase in testosterone at the supraphysiological level can negatively affect the indices that can lead to cardiac pathologies (GOOREN, 2014). The administration of long-term testosterone, according to the literature, may lead to a decrease in HDL and the increase in LDL and triglycerides, as well as in the increase in markers of inflammation and blood pressure (UNGER, 2016; GOOREN, 2014)

4. FINAL CONSIDERATIONS

Regarding the results described in the scientific literature, it is possible to signal that due to hormonal therapy with testosterone the values in all systemic parameters show some level of alteration caused by the administration of the hormone.

Systemic changes trigger morphophysiological and behavioral changes resulting from hormone replacement. In general, the values found show that in all parameters that use the binary system of division of reference values, the values were inversioned, going from female to male, with the continued administration of hormone therapy.

This study, therefore, brought evidence of changes in systemic parameters, contributing significantly to HT users, reporting the profound changes their bodies will undergo.

Knowledge of these changes is very necessary, so that the bodily and systemic changes that occur are clear, serving support at the time of the decision to start the transition process or not. The results of the study may also be used in the future as a scientific support tool for health professionals who come across examinations of trans-male patients, thus giving greater safety and dignity in diagnoses of men in HT.

REFERENCES

ADRIAANSEN, M. et al. Binary male-female laboratory reference ranges do not reflect reality for transgender individuals on sex-hormone therapy. *New Zealand Journal of Medical Laboratory Science*, v. 71, n. 3, p. 101-05, 2017.

BAO, A.; SWAAB, D. Sexual differentiation of the human brain: Relation to gender identity, sexual orientation and neuropsychiatric disorders. *Frontiers in Neuroendocrinology*, v. 32, n. 2, p. 214-26, 2011.

BENTZ, E. et al. A polymorphism of the CYP17 gene related to sex steroid metabolism is associated with female-to-male but not male-to-female transsexualism. *Fertility and Sterility*, v. 90, n. 1, p. 56-9, 2008.

BURKE, S. et al. Testosterone Effects on the Brain in Transgender Men. *Cerebral Cortex*, v. 28, n. 5, p. 1582-96, 2017.

CHIPKIN, S.; KIM, F. Ten Most Important Things to Know About Caring for Transgender Patients. *The American Journal of Medicine*, v. 130, n. 11, p. 1238-1245, 2017.

CID10 Código Internacional de Doenças. Disponível em: <<https://www.cid10.com.br/buscacode?query=F640>>. Acesso em: 10 nov. 2020.

Diretrizes da SBD 2019-2020. Disponível em: <<https://www.diabetes.org.br/profissionais/images/DIRETRIZES-COMPLETA-2019-2020.pdf>>. Acesso em: 10 nov. 2020.

FERNANDEZ, J.; TANNOCK, L. Metabolic effects of hormone therapy in transgender patients.

Endocrine Practice, v. 22, n. 4, p. 383-388, 2016.

GANDHI, P.; MEDEIROS, E.; SHAH, A. Physiology or Pathology? Elevated Serum Creatinine in a Female-to-Male Transgender Patient. American Journal of Kidney Diseases, v. 75, n. 4, p. A13-A14, 2020.

GOOREN, L. Management of female-to-male transgender persons. Current Opinion in Endocrinology & Diabetes and Obesity, v. 21, n. 3, p. 233-38, 2014.

GOOREN, L.; GILTAY, E.; BUNCK, M. Long-Term Treatment of Transsexuals with Cross-Sex Hormones: Extensive Personal Experience. The Journal of Clinical Endocrinology & Metabolism, v. 93, n. 1, p. 19-25, 2008.

GORTON, R.; ERICKSON-SCHROTH, L. Hormonal and Surgical Treatment Options for Transgender Men (Female-to-Male). Psychiatric Clinics of North America, v. 40, n. 1, p. 79-97, 2017.

GUPTA, S.; IMBOREK, K.; KRASOWSKI, M. Challenges in Transgender Healthcare: The Pathology Perspective. Laboratory Medicine, v. 47, n. 3, p. 180-88, 2016.

IRWIG, M. Testosterone therapy for transgender men. The Lancet Diabetes & Endocrinology, v. 5, n. 4, p. 301-311, 2017.

MSD Manuals. Disponível em: <<https://www.msdmanuals.com>>. Acesso em: 10 nov. 2020.

SARASWAT, A.; WEINAND, J.; SAFER, J. Evidence Supporting the Biologic Nature of Gender Identity. Endocrine Practice, v. 21, n. 2, p. 199-204, 2015.

SILVA, L. et al. Uso do nome social no Sistema Único de Saúde: elementos para o debate sobre a assistência prestada a travestis e transexuais. Physis: Revista de Saúde Coletiva, v. 27, n. 3, p. 835-846, 2017.

UNGER, C. Hormone therapy for transgender patients. Translational Andrology and Urology, v. 5, n. 6, p. 877-84, 2016.

URIBE, C. et al. Brain network interactions in transgender individuals with gender incongruence. *NeuroImage*, v. 211, p. 116613, 2020.

VELHO, I. et al. Effects of testosterone therapy on BMI, blood pressure, and laboratory profile of transgender men: a systematic review. *Andrology*, v. 5, n. 5, p. 881-88, 2017.

VITA, R. et al. Changes in hormonal and metabolic parameters in transgender subjects on cross-sex hormone therapy: A cohort study. *Maturitas*, v. 107, p. 92-6, 2018.

YOKOTA, Y.; KAWAMURA, Y.; KAMEYA, Y. Callosal Shapes at the Midsagittal Plane: MRI Differences of Normal Males, Normal Females, and GID. 2005 IEEE Engineering in Medicine and Biology 27th Annual Conference, 2005.

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