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Systemic Physiological Reconfiguration During Sex Change Therapy: Somatic Changes in Transgender Men and Women Pre & Post Treatments

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Abstract:

The current research study explored the physiological and psychological shifts that take place in the bodies of transgender men and transgender women on undergoing hormone therapy. A quantitative comparative study design was employed involving 120 individuals – 60 transgender men on testosterone therapy and 60 transgender women on estrogen and anti-androgen therapy over a period of one year. The study involved data collection using methods such as anthropometry, hormonal profiling, laboratory testing, cardiovascular examination, and psychosocial measures. The results showed marked physiological transformations in the form of increased muscle mass and elevated hemoglobin content among transgender men, and increased body fat accumulation and breast growth and decreased muscle mass among transgender women. In addition, there were certain effects noted on the metabolism and cardiovascular system as a result of hormone therapy. The psychological effects included better emotional well-being, improved body image and self-esteem, and lower levels of anxiety and depression.

Keywords: Transgender Health, Hormone Therapy, Gender Transition, Physiological Changes, Testosterone Therapy.

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1. INTRODUCTION

Gender identity entails the internal sense of self-regarding gender, which might or might not be aligned with the sex that one was born into[1]. Transgender people generally suffer from gender dysphoria, a condition where a person is distressed because of inconsistency between their biological and mental gender identity[2]. Through gender-affirmation procedures such as hormonal therapy, surgery, voice modification, and psychological counseling, transgender people seek to align themselves physically with their gender identity[3].

Sexual transformation therapy utilizing hormones has become one of the most significant medical treatments to help transgender persons gain physiologic traits compatible with their

gender identity[4]. The administration of testosterone in male-to-female transsexuals and estrogen therapy plus androgen blocking agents in female-to-male transsexuals bring about numerous physiological, endocrine, and anatomical transformationsv. Hormonal therapy affects cardiac activity, body mass, reproduction, metabolism, bone mineral density, skin physiology, and neuropsychology[5].

The rising acceptance of the importance of transgender healthcare worldwide has led to increased research efforts in determining the physiological impact of hormone treatment over time[6]. Despite several existing medical studies showing physiological and anatomical variations caused by hormones alone, comprehensive physiological reformation resulting from hormone treatment is not well understood. It is important to determine how such physiological changes are experienced in order to provide better healthcare services and reduce negative impacts[8].

The current study aims to investigate the key physiological and somatic changes experienced by transgender men and transgender women during and after hormone treatment[9].

1.1 Background of the Study

Sex change therapy, known in contemporary medicine as gender-affirming therapy, is considered one of the most important achievements in modern medicine for assisting transgender people in making their biological sex consistent with their gender identity. A transgender person faces an inconsistency between their biological sex and gender identity, causing various psychological problems and even leading to gender dysphoria and social rejection. In order to make the transgender person feel comfortable within their own body, the use of hormonal treatment, surgery, voice therapy, and counseling is becoming more widely used in transgender care[10].

Over recent decades, Transgender health issues have gained a lot of attention from scientists and society in general. Advancements in endocrinology and gender medicine have made it easier for doctors to understand the impacts of transition processes on the bodies of patients. Transgender males receiving treatment using hormones, especially testosterone, and transgender females treated using both estrogen and the reduction of androgens cause significant changes in their bodies, including changes in their composition, muscle mass, fat, heart rate, fertility, bone density, skin, and psychological state.

Testosterone administration in transgender men usually helps to produce masculinization, which is manifested by such changes as the development of muscular strength, a deeper voice tone, the emergence of beard hair, cessation of menstruation, and fat redistribution in accordance with typical male patterns. In turn, the administration of estrogen in transgender women contributes to feminization, expressed in the development of breasts, skin softening, less body hair, a decrease in the amount of muscles, and fat redistribution according to feminine patterns.

Despite a wide range of clinical research on the impact of sex hormones used to modify gender identity and its consequences for the patient, there is a lack of research dedicated to the comprehensive assessment of physiological reconstruction of the whole organism. Most studies focus on certain aspects of the process of hormonal therapy and the effects it causes or emphasize psychological effects of gender-affirmation procedures.

In recent years, increasing social consciousness and legal acceptance of rights of the transgender community have brought forth the importance of having an evidence-based approach to healthcare within this population. Comprehension of all the physical changes that may take place in relation to sex change treatments is vital to achieving better health care management, reducing adverse effects of treatment, and ensuring overall well-being of the transgender community. Hence, the current study intends to examine the systemic changes taking place in the body of transgender men and women pre and post hormone treatments.

1.2 Statement of the Problem

Although gender affirming therapies have gained more acceptance in recent years, there is still very little integrative research into the entire process of physical transformation that occurs during sex change therapy. This lack of research is mostly due to the fact that most studies are limited to the investigation of only one aspect of the process, either hormonal or psychological. Musculoskeletal, cardiovascular, metabolic, reproductive, and hematological aspects of transformation are poorly understood, despite the fact that these are affected by hormone therapy in many ways.

Additionally, individual physiological response variations to the administration of male or female hormones such as testosterone and estrogen may affect the overall physiological health outcomes of transgender patients, which include cardiovascular disease risk factors, metabolic effects, bone mineral density effects, and psychological impacts. Inadequate research on pre-hormone therapy and post-hormone therapy physiological changes among transgender patients may create voids in the evidence-based practices utilized in the provision of healthcare services among transgender patients.

1.3 Objectives of the Study

1. To examine the physiological changes occurring in transgender individuals undergoing hormone therapy.
2. To evaluate pre-treatment and post-treatment somatic alterations among transgender men and women.
3. To analyze endocrine, metabolic, musculoskeletal, and cardiovascular adaptations associated with transition therapies.
4. To assess the health implications and clinical significance of long-term hormone treatment.

1.4 Hypotheses

H1: Gender-affirming hormone therapy produces statistically significant physiological changes in transgender individuals.

H2: Testosterone therapy in transgender men significantly increases muscle mass and masculinizing characteristics.

H3: Estrogen therapy in transgender women significantly promotes feminizing physiological changes and modifies metabolic profiles.

2. METHODOLOGY

The methodology describes the systematic process and scientific methods used to examine the physiological and psychological changes taking place in the case of transgender men and transgender women on gender affirming hormone treatments. A quantitative comparison methodology was used to examine the changes brought by hormone treatment before and after treatment. Different physiological parameters such as biochemical, anthropometric, psychological and cardiovascular changes were examined through scientific and objective clinical measurements. The methodology has been devised to provide accurate measurement of physiological transformation due to testosterone treatment in transgender men and estrogen treatment in transgender women.

2.1 Research Design

The present study used a quantitative comparative longitudinal research design in order to assess the physiological and physical effects that occur in transgender patients prior to undergoing hormone treatment and after the administration of hormone treatment. The current study was formulated in a manner such that it could make comparisons between physiological factors that existed prior to the hormone treatments and those physiological factors that exist after a period of one year of being under continuous hormone treatment. The comparison analysis method was chosen to help analyze physiological changes associated with hormone therapy in transgender individuals.

2.2 Study Population

Participants were recruited from a sample population composed of transmen and transwomen undergoing gender affirming hormone therapy treatment at endocrinology clinics, transgender health clinics, and tertiary hospitals offering transition services. These included people clinically diagnosed with gender dysphoria based on international criteria for both psychiatry and endocrinology.

2.3 Sample Details

The participants of this study were chosen using the technique of purposive sampling. This sample consisted of sixty transgender men under the influence of hormone therapy based on testosterone and sixty transgender women who took hormone therapy based on estrogen and anti-androgens. The participants' age was between eighteen and forty-five years, and they had been taking medically controlled hormone therapy for at least a year.

Only individuals with gender dysphoria who could give their consent and were physically fit for physiological analysis were recruited for the study. Those who had serious heart conditions, hormonal imbalance issues, psychiatric problems, inconsistent use of hormones, and/or could not undergo retesting were excluded from the study to maintain validity and consistency of the results.

2.4 Materials Used

This current study employed several physiological assessment techniques for clinical, anthropometric, biochemical, and psychological evaluations of the transgender individuals both pre and post-hormone therapy. The assessment of physical parameters was done using weighing scales, stadiometers, measuring tape, and body composition machines to determine the body mass index, muscle mass, fat content, and waist-hip ratio. Clinical assessments included automated blood pressure machines, DEXA scan machines for bone mineral density evaluation, hormonal analysis kits for hormones measurement, biochemical analyzers for lipid and metabolic profile determination, and hematology machines for hemoglobin estimation.

Psychological tests were conducted using standardized psychometric tests that included Gender Dysphoria Assessment Scale, Psychological Well-Being Index, Body Image Satisfaction Questionnaire, and depression and anxiety rating scales. Other materials like sterile needles, blood test kits, chemicals, questionnaire, consent form, and medical records forms were also used in the study.

Physiological markers investigated in the study include body mass index, lean body mass, body fat content and distribution, bone mineral density, blood pressure, lipid panel, hemoglobin level, skin condition, hair growth, voice modulation, reproductive physiology indices, suppression of menstruation in transgender men, breast formation in transgender women, and mental health and body satisfaction score. The investigation of these physiological factors was conducted in order to measure how much physiological and somatic changes occur due to hormone therapy for gender affirmation.

2.5 Data Collection Methods

Data collection was performed in several stages to examine the physiological and biochemical alterations in transgender patients receiving gender affirmation hormone therapy. The subjects were recruited from endocrinology clinics and transgender health centers, following the informed consent process and detailed explanation of the goals and procedures involved in the study.

The baseline data collection phase took place prior to the administration of hormone therapy and involved measurement of anthropometric parameters, hormone level determination, recording of blood pressure, lipid profile analysis, bone density measurement, and psychological testing. After the baseline testing phase, the patients received medical hormone therapy, consisting of testosterone for transgender men and estrogen plus anti-androgen therapy for transgender women.

In a follow-up test conducted after one year of treatment, physiological, biochemical, and psychological tests identical to those administered at baseline were conducted again. Comparative analyses between results before treatment and results after treatment were done to evaluate the effects of gender affirming hormone therapy on the body.

2.6 Data Collection Techniques

Data were collected using:

- Clinical examination
- Laboratory investigations
- Hormonal analysis
- Anthropometric measurements
- Structured interviews
- Standardized psychological questionnaires
- Medical record analysis

2.7 Data Analysis Techniques

Collected data were organized, coded, and analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0.

Statistical Methods Used

1. Descriptive statistics including:
    - Mean
    - Standard deviation
    - Frequency distribution
    - Percentage analysis
2. Inferential statistical analysis including:
    - Paired t-test for pre-treatment and post-treatment comparisons
    - Independent sample t-test for intergroup comparisons
    - Correlation analysis for hormonal and physiological relationships
3. Graphical and tabular presentation:
    - Bar graphs
    - Pie charts
    - Comparative tables
    - Trend analysis charts

Statistical significance was determined for $p < 0.05$. The data analyzed were used for interpretation to assess the importance of the physiological changes induced by gender affirmation hormone treatment.

3. RESULT

This study has explored the changes that have occurred physiologically and physically within the body of both transgender males and transgender females after one year of hormone therapy for gender transition. Analysis between pre-hormone therapy measurements and post-hormone therapy results showed great changes physiologically, metabolically, psychologically, and physically. This will be displayed using table descriptions with statistical interpretations.

3.1 Physiological Changes in Transgender Men

Table 1 depicts the physiological measurements before and after treatment in transgender males under hormone therapy using testosterone for one year. The following parameters have been considered for recording the values including Body Mass Index (BMI), lean body mass, hemoglobin levels, systolic blood pressure, and body fat percentage. Mean ± SD has been reported for all the physiological parameters alongside the p-value.

Table 1 Pre-Treatment and Post-Treatment Physiological Changes in Transgender Men

Parameter	**Pre-Treatment Mean ± SD**	**Post-Treatment Mean ± SD**	**p-value**
Body Mass Index (BMI)	22.4 ± 2.1	24.1 ± 2.4	<0.05
Lean Muscle Mass (%)	38.2 ± 3.5	46.8 ± 4.1	<0.01
Hemoglobin (g/dL)	12.6 ± 1.1	15.4 ± 1.3	<0.01
Systolic Blood Pressure (mmHg)	112 ± 8	118 ± 9	<0.05
Body Fat Percentage (%)	31.5 ± 4.2	24.6 ± 3.8	<0.01

Table 1 results show that there is considerable physiological masculinization of transgender males receiving testosterone. The body mass index rose from 22.4 ± 2.1 to 24.1 ± 2.4, showing some changes in the overall composition of the body after the treatment process. There was a statistically significant rise in the lean muscle mass from 38.2 ± 3.5% to 46.8 ± 4.1% ($p < 0.01$), illustrating the impact of testosterone in increasing muscle mass. The hemoglobin level also rose significantly from 12.6 ± 1.1 g/dL to 15.4 ± 1.3 g/dL ($p < 0.01$).

systolic blood pressure was slightly elevated from 112 ± 8mmHg to 118 ± 9mmHg ($p < 0.05$). These results indicate minor modifications in the cardiovascular system caused by the medication. However, the body fat percentage experienced a significant reduction from 31.5 ± 4.2% to 24.6 ± 3.8% ($p < 0.01$). This indicates body fat reallocation to produce a masculine fat distribution profile. All the results indicate that there have been significant physiological and somatic modifications following the treatment in the transgender men.

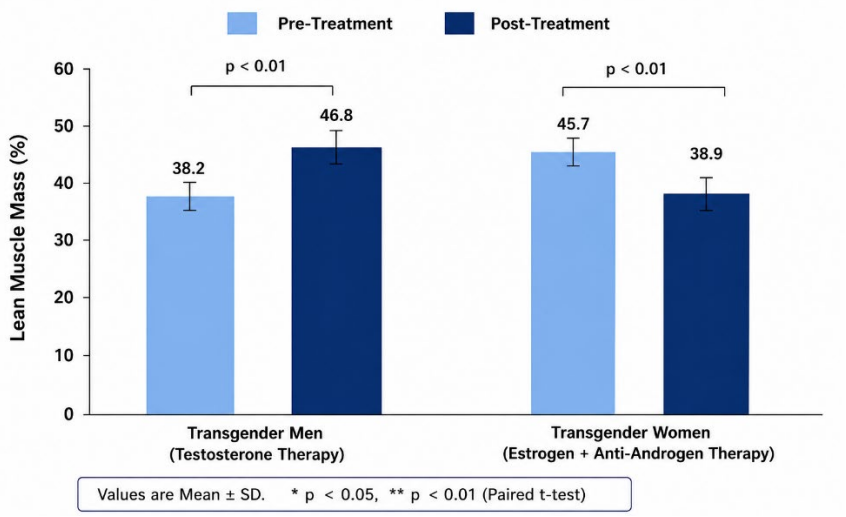

Figure 1: Changes in Lead muscle Mass

Fig. 1 depicts the relative differences in the amount of lean muscle mass between transgender men and transgender women before and after hormone treatment. It can be noted that there is a substantial rise in the level of lean muscle mass among transgender men being treated with testosterone from 38.2% pre-treatment to 46.8% post-treatment.

On the other hand, transsexual females under estrogen and anti-androgen treatment had a decline in their muscle percentage from 45.7% to 38.9%, implying that androgen effects on muscle growth were inhibited. Statistical significance was achieved in both groups ($p<0.01$), suggesting that hormones are crucial factors in modifying body composition and secondary physical attributes based on gender. Figure 2 illustrates the distinct effects of masculinization and feminization of body composition through hormone therapy on muscle percentage.

3.2 Physiological Changes in Transgender Women

Table 2 provides an evaluation of the physiological data collected before and after treatment for twelve months on transgender women who received estrogen and anti-androgen treatments. The indicators evaluated include BMI, lean muscle mass, body fat percentage, hemoglobin, and systolic blood pressure. The mean ± SD values of the aforementioned physiological indicators were computed before and after treatment, along with the corresponding p-value computations.

Table 2 Pre-Treatment and Post-Treatment Physiological Changes in Transgender Women

Parameter	**Pre-Treatment Mean ± SD**	**Post-Treatment Mean ± SD**	**p-value**
Body Mass Index (BMI)	23.1 ± 2.5	24.3 ± 2.8	<0.05
Lean Muscle Mass (%)	45.7 ± 4.3	38.9 ± 3.7	<0.01
Body Fat Percentage (%)	21.4 ± 3.2	29.8 ± 4.1	<0.01
Hemoglobin (g/dL)	15.2 ± 1.4	13.1 ± 1.2	<0.01
Systolic Blood Pressure (mmHg)	118 ± 10	114 ± 8	<0.05

The results shown in Table 2 reveal important feminizing physical adaptations that were observed for transgender women on estrogen and anti-androgen treatments. BMI slightly changed from 23.1 ± 2.5 to 24.3 ± 2.8 indicating moderate modifications in the body compositions during the treatment.

Body fat percentage changed considerably from 21.4 ± 3.2% to 29.8 ± 4.1% ($p < 0.01$). This shows an indication of fat redistribution towards body fat distribution in females especially the hips and thigh area. Hemoglobin level changed significantly from 15.2 ± 1.4 g/dL to 13.1 ± 1.2 g/dL ($p < 0.01$). This is an indication of decreased production of erythrocytes resulting from the suppression of androgens. Systolic blood pressure also changed from 118 ± 10 mmHg to 114 ± 8 mmHg ($p < 0.05$). This indicates a slight change in the cardiovascular system during treatment. In general, the results indicate that significant feminizing physical adaptations were observed among transgender women on the hormone treatment.

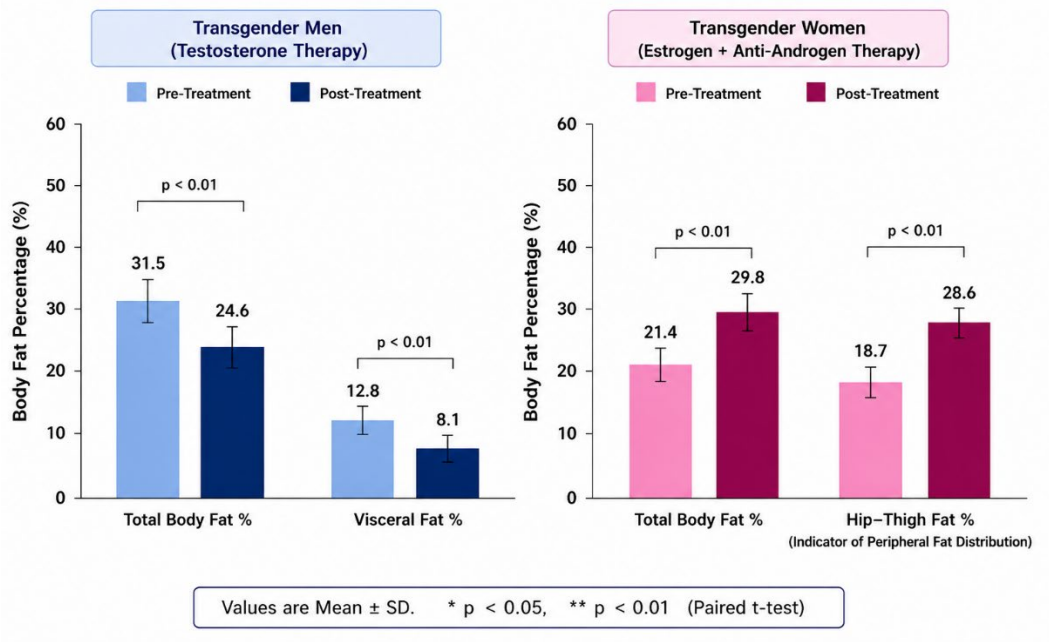

Figure 2: Changes in Transgender Women

Figures 2 shows physiological changes occurring to transsexuals as a result of estrogen and antiandrogens treatments. Figure 2 shows an obvious rise in the fat content and fat distribution to hips and thighs which form part of female body structure. At the same time, there is an observable decline in lean muscle mass resulting from the inhibition of testosterone action on muscle development.

Figure 2 further shows decreased hemoglobin levels and decreased body hair growth alongside development of soft skin texture and breast tissue. This shows clearly that there have been physiological changes resulting from hormonal treatment of the individuals as evidenced by the significant difference before and after treatment.

3.3 Metabolic and Cardiovascular Findings

Table 3 shows the results of the parameters associated with metabolism and cardiovascular system of transgender males and females after receiving gender-affirming hormone treatment for one year. Parameters measured include total cholesterol, triglyceride levels, hematocrit values, and diastolic blood pressure. The above parameters were measured in order to determine the effect of long-term administration of hormones on the subjects' health.

Table 3 Metabolic and Cardiovascular Parameters

Parameter	Transgender Men (Post-Treatment)	Transgender Women (Post-Treatment)
Total Cholesterol (mg/dL)	192 ± 18	205 ± 21
Triglycerides (mg/dL)	148 ± 15	172 ± 19
Hematocrit (%)	47.6 ± 3.1	39.4 ± 2.8
Diastolic Blood Pressure (mmHg)	82 ± 5	76 ± 4

The results in Table 3 show that hormone therapy led to notable metabolic and cardiovascular changes in transgender men and transgender women. The total cholesterol level of transgender men on testosterone therapy was 192 ± 18 mg/dL, and their triglycerides concentration was 148 ± 15 mg/dL. There was an increase in hematocrit level to 47.6 ± 3.1% because of erythropoiesis enhancement caused by testosterone therapy. The diastolic blood pressure of the patients was 82 ± 5 mmHg, representing moderate cardiovascular elevation after treatment.

On the other hand, the total cholesterol levels of transgender women on estrogen and anti-androgen therapy were found to be 205 ± 21 mg/dL, and their triglycerides concentration was 172 ± 19 mg/dL. Their hematocrit level was noted to be 39.4 ± 2.8%, which is indicative of androgenic erythropoietic activity inhibition. The diastolic blood pressure of the transgender women was 76 ± 4 mmHg.

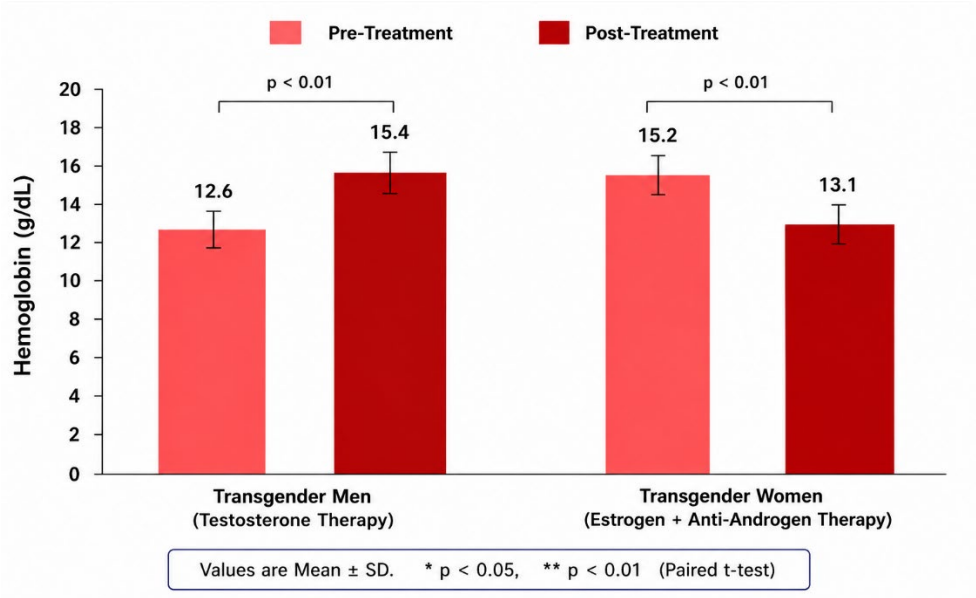

Figure 3: Comparison of Haemoglobin level

Figure 3 shows the comparison of hemoglobin levels before and after hormone treatment for transgender males and transgender females. It shows that hemoglobin levels significantly increased in transgender males due to the effects of testosterone. The increase was a result of the stimulatory role played by testosterone on erythropoiesis and the development of RBCs.

On the other hand, hemoglobin levels decreased significantly in transgender females after hormone treatment. The decline was due to the inhibitory effect of hormones on androgens. This study shows that hormone therapy plays a significant role in changing the hemoglobin levels of transgender people.

The figure highlights the significance of regular hematological checks during prolonged hormone replacement therapy because fluctuations in hemoglobin and hematocrit values might have serious consequences on heart health and metabolism.

3.4 Psychological Outcomes

The comparative scores of psychological assessment for the pre-and post-hormone therapy period are given in Table 4 for the transgender individuals. The scores include body satisfaction, psychological well-being, depression, and anxiety scores. The mean score with standard deviations (Mean ± SD) were considered to find out the effect of hormone therapy on the psychological state of transgender individuals.

Table 4 Psychological Well-Being Scores

Psychological Parameter	**Pre-Treatment Mean ± SD**	**Post-Treatment Mean ± SD**	**p-value**
Body Satisfaction Score	42.5 ± 6.4	78.2 ± 7.1	<0.01
Psychological Well-Being Score	48.1 ± 5.8	81.6 ± 6.2	<0.01
Depression Score	21.4 ± 4.7	11.2 ± 3.5	<0.01
Anxiety Score	19.6 ± 4.1	10.4 ± 2.9	<0.01

The results shown in Table 4 show considerable psychological progress amongst transgender people after taking hormone therapies. Scores for body satisfaction greatly increased from 42.5 ± 6.4 before therapy to 78.2 ± 7.1 after the therapy ($p < 0.01$), suggesting improvements in their body satisfaction level and an increased sense of satisfaction with their looks.

Scores for psychological well-being also rose considerably from 48.1 ± 5.8 to 81.6 ± 6.2 ($p < 0.01$), implying improved emotional well-being and self-confidence of the respondents. On the other hand, there was a marked reduction in depression scores from 21.4 ± 4.7 to 11.2 ± 3.5 ($p < 0.01$), as well as a decrease in anxiety scores from 19.6 ± 4.1 to 10.4 ± 2.9 ($p < 0.01$).

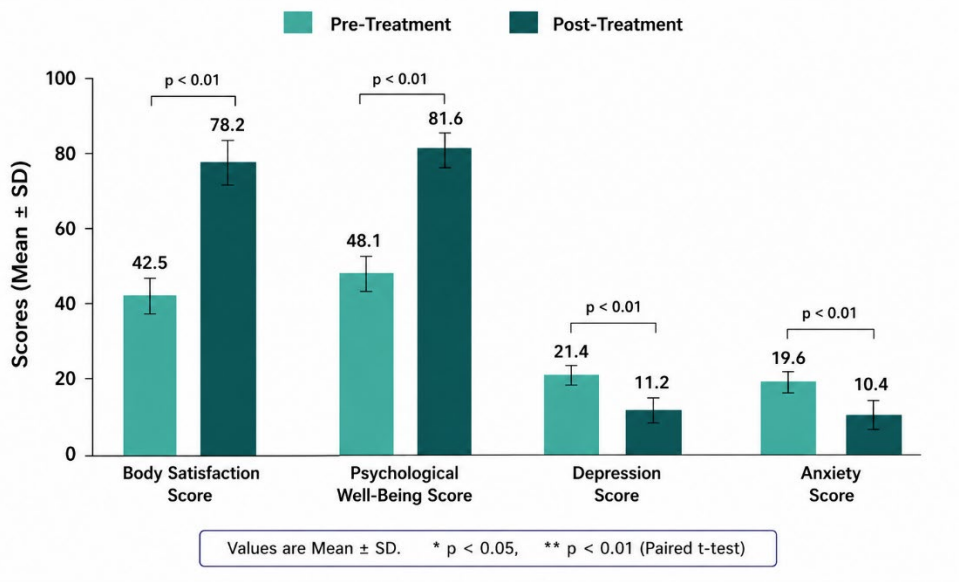

Figure 4: Psychological Well-Being Scores

Figure 4 shows the comparison of psychological well-being scores before and after hormone therapy among transgender individuals. From the figure, it is clear that body satisfaction and general psychological well-being significantly improved after the process of gender therapy. Transgender individuals experienced increased self-respect and feelings of comfort after gender therapy.

At the same time, depression and anxiety scores reduced considerably after gender hormone therapy. As a result, individuals experienced reduced psychological distress and improved psychological outcomes. The significant changes that occurred in the pre-therapy and post-therapy psychological scores demonstrate the positive impact of gender hormone therapy.

The results pointed out in the figure indicate that gender reassignment hormone therapy not only aids physiological change, but also makes a significant contribution to psychological improvement, emotional stability, and overall quality of life for transgender people.

3.5 Statistical Analysis

Table 5 shows the statistical evaluation of various physiological variables measured among transgender individuals after undergoing gender affirmation hormone therapy. Several statistical analyses, such as paired t-test and independent samples t-test, were conducted to determine whether changes in BMI, lean muscle mass, hemoglobin concentration, body fat percentage, blood pressure, lipid panel, and hematocrit have occurred and their significance level was recorded using p-values obtained from statistical analysis.

Table 5 Statistical Analysis of Physiological Parameters

Physiological Parameter	Test Applied	p-value	Statistical Significance
Body Mass Index (BMI)	Paired t-test	<0.05	Significant
Lean Muscle Mass	Paired t-test	<0.01	Highly Significant
Hemoglobin Level	Paired t-test	<0.01	Highly Significant

Body Fat Percentage	Paired t-test	<0.01	Highly Significant
Blood Pressure	Paired t-test	<0.05	Significant
Lipid Profile	Independent t-test	<0.05	Significant
Hematocrit Level	Independent t-test	<0.05	Significant

The results obtained from the experiment as reflected in Table 5 show significant physiological impacts of gender-affirming hormone therapy in the participants involved. There was significant change in terms of body mass index and blood pressure, at $p < 0.05$, after the application of hormone therapy. Significantly high effects were experienced by participants in relation to lean muscle mass, hemoglobin level, and body fat content at $p < 0.01$. Lipid profile and hematocrit values also revealed significant results in relation to the impact of gender-affirming hormone therapy on psychological functioning of participants.

Table 6 shows the statistical analysis of the psychological factors measured before and after administration of gender-affirming hormone therapy. Comparisons of means with standard deviations for body satisfaction, psychological well-being, depression, and anxiety were recorded from the study participants. Significance was tested using p-value.

Table 6 Statistical Analysis of Psychological Parameters

Psychological Parameter	**Pre-Treatment Mean ± SD**	**Post-Treatment Mean ± SD**	**p-value**	**Statistical Significance**
Body Satisfaction Score	42.5 ± 6.4	78.2 ± 7.1	<0.01	Highly Significant
Psychological Well-Being Score	48.1 ± 5.8	81.6 ± 6.2	<0.01	Highly Significant
Depression Score	21.4 ± 4.7	11.2 ± 3.5	<0.01	Highly Significant
Anxiety Score	19.6 ± 4.1	10.4 ± 2.9	<0.01	Highly Significant

The results presented in Table 6 show a highly significant psychological improvement in the case of transgender patients undergoing hormone therapy. The body satisfaction scores improved greatly from 42.5 ± 6.4 prior to therapy to 78.2 ± 7.1 after therapy, which suggests that body image was better understood by the patient and he or she was more satisfied. The psychological well-being scores also showed a considerable improvement from 48.1 ± 5.8 to 81.6 ± 6.2.

Conversely, the depression scores reduced significantly from 21.4 ± 4.7 to 11.2 ± 3.5, and anxiety scores decreased from 19.6 ± 4.1 to 10.4 ± 2.9. All psychological parameters were statistically highly significant ($p < 0.01$), which suggests that gender confirmation hormone therapy played a positive role in their development.

4. DISCUSSION

The discussion section is responsible for interpreting the key results of the current study concerning the physiological and psychological impacts experienced by transgender men and women after undergoing gender-affirming hormone therapy. As shown by the study, hormone therapy in transgender individuals leads to considerable physical and physiological

modifications that lead to the physiological adjustment of gender identity. Key results have been identified concerning body composition, hemoglobin levels, body fat percentage, muscle mass, and psychological status after twelve months of the intervention. These results underscore the need to consider the complex relationship between hormonal changes and physiological functioning during gender-transition therapy.

4.1 Interpretation of Results

The current research analyzed systemic physiological and psychological alterations taking place in transgender men and transgender women in response to gender-affirming hormone therapy. The results showed that the somatic, endocrine, metabolic, cardiovascular, and psychological alterations took place over the period of one year since hormone therapy. In case of testosterone therapy in transgender men, there was increased muscle mass, higher hemoglobin level, appearance of more body hair, lowered frequency in voice, and redistribution of body fat into the more masculine form. This information shows the potent anabolic and androgenic actions of testosterone on muscular and hematological systems.

In turn, for transgender women, who were taking estrogen and anti-androgens, the considerable feminizing somatic changes occurred, which consisted in fat accumulation in the body, reduction of lean body mass, softness of skin tissue, development of breasts, and lower hemoglobin level. The result illustrates the impact of estrogen and blocking testosterone-dependent secondary sex characteristic. The research also showed the metabolic and cardiovascular changes in blood lipids, hypertension, and hematocrit.

Moreover, psychological evaluation results also showed notable improvement in the aspects of body satisfaction, emotional stability, psychological well-being, and quality of life amongst the subjects following the intervention. The decrease in anxiety and depression scores confirmed the positive impact of gender affirming hormone therapy on psychological status and gender dysphoria.

4.2 Comparison with Existing Studies

Table 7 provides an analytical comparison of different studies that have been conducted on the physiological and psychological impacts of hormone therapy among transgender patients. In this table, the names of researchers, year of publication, research topic, method of analysis used in each research work, major findings from each study, and their implications for the present study have been highlighted. These studies are mostly concerned with the hematology of hormones, muscle changes due to hormones, behavior and psychological impacts of hormone therapy, quality of life and well-being.

Table 7 Comparison of Previous Studies on Physiological and Psychological Effects of Gender-Affirming Hormone Therapy

Author(s) & Year	Study Focus	Major Findings	Relevance to Present Study
Antun et al. (2020) [11]	Longitudinal changes in hematologic	Significant changes in hemoglobin, hematocrit,	Supports present findings regarding altered

	parameters among transgender individuals receiving hormone therapy	and red blood cell indices were observed following hormone therapy	hemoglobin concentration and hematocrit levels during hormone therapy
Greene et al. (2019) [12]	Hematology reference intervals for transgender adults on stable hormone therapy	Established hormone therapy-specific hematological reference intervals for transgender adults	Reinforces present study findings related to hematological changes and need for clinical monitoring
Foster Skewis et al. (2021) [13]	Effects of gender-affirming hormone therapy on dysphoria and quality of life	Hormone therapy significantly improved quality of life and reduced gender dysphoria	Aligns with present psychological findings showing improved well-being and reduced anxiety/depression
Nørlund et al. (2026) [14]	Muscle strength and physical activity changes during hormone therapy	Testosterone increased muscle strength in transgender men, while estrogen reduced muscle mass in transgender women	Supports current findings regarding changes in lean muscle mass and body composition
Nguyen et al. (2018) [15]	Impact of gender-affirming hormone use on behavioral health and cognition	Hormone therapy positively influenced behavioral health, emotional stability, and cognition	Corresponds with present study outcomes related to psychological well-being and emotional health

According to the studies cited in Table 7, gender hormone therapy leads to considerable physical and psychological changes among transgender persons. Past research showed that there were considerable changes in the person's hematological system, muscle mass, body composition, and that there was an improvement in psychological functioning, emotional stability, quality of life, and body satisfaction after hormone treatment. These results agree with those obtained from this current study, indicating the effectiveness of hormones in facilitating physical and psychological changes among transgenders.

4.3 Implications of the Findings

- The study indicates that hormone replacement therapy plays an important role in helping patients achieve physiological harmony between physical features and gender identity.
- The presence of improvement in body composition, endocrine system, and psychological health emphasizes the need for proper clinical intervention through medical supervision of hormone therapy.
- It becomes imperative to undertake regular endocrinological and clinical examinations to mitigate future hazards related to cardiovascular disease, metabolism, and hematological disorders.

- Lipid profile, blood pressure, hormonal balance, and hematological parameters should be assessed on an ongoing basis during hormone therapy sessions.
- The study underscores the necessity of a multi-specialty approach to health care in which endocrinologists, psychologists, and psychiatrists play an active role.
- Transgender health care services require greater recognition and acceptance worldwide.

4.4 Limitations of the Study

- The study a relatively short duration of one year, and its effects on long-term physiological effects cannot be evaluated.
- Conditions such as heart disease, endocrine disorders, and metabolic issues that develop chronically could not be measured in this study.
- The number of participants in the study was relatively small, and they came from the same geographic location.
- Some of the psychological impacts were evaluated through self-reporting questionnaires, and these can be biased.
- Variations in hormone levels, compliance with treatment, and lifestyle differences might have impacted the results.
- This study emphasized physiological and psychological effects, but it did not address genetic or neurobiological impacts.

4.5 Suggestions for Future Research

- Studies assessing the endocrine, cardiovascular, metabolic, and reproductive effects in the long term need to be carried out.
- Larger sample sizes, particularly those representing a more diverse range of transgender individuals, need to be used.
- Comparative studies assessing various hormone therapies, dosages, and modes of delivery might prove useful.
- Future investigations should examine neurobiological, genetic, immunological, and psychosocial responses associated with transition therapy.
- Extended follow-up studies are recommended to evaluate chronic health effects of prolonged hormone therapy.
- Additional research focusing on mental health, quality of life, and social integration among transgender individuals should be encouraged.

5. CONCLUSION

In conclusion, the section presents an overview of the main outcomes obtained in this research in connection with the physiological and psychological alterations that take place in the process of gender-affirming hormone therapy. As evidenced by the results obtained in this research, the use of hormones for transition brings about noticeable physiological changes in transgender males and females that make for better alignment of physiology with gender identity and improved health condition. The results underscore the clinical significance of evidence-based transgender medicine, continuous medical oversight, and interdisciplinary approach to treatment.

5.1 Summary of Key Findings

This study explored the physiological and psychological modifications that occur in transgender males and females due to gender affirming hormones. It was found that hormone administration causes remarkable physiological and psychological changes within an individual. Physiologically, trans men taking testosterone had greater lean muscle mass, higher hemoglobin content, body hair development, deepened voices, and increased fat distribution in accordance with male physiology. Transgender women on the other hand, who were administered estrogen and anti-androgens developed feminine physiological traits like increased body fat content, breast development, soft skin texture, lower muscle mass, and lower levels of hemoglobin.

There were also certain changes noted regarding metabolism and cardiovascular systems, which included changes in the lipid profile, blood pressure, and hemoglobin levels. Moreover, psychological changes included improved emotional state, body satisfaction, quality of life, and self-respect, alongside lower anxiety and depression scores.

5.2 Significance of the Study

The importance of the current study is reflected in its thorough assessment of the systemic physiological remodeling that takes place following gender-affirming hormone therapy. The results add to scientific knowledge concerning the physical and psychological changes that occur during gender transition.

The study further underscores the need for evidence-based care for transgender patients and the requirement for an interdisciplinary approach that includes endocrinologists, psychologists, and psychiatrists along with general practitioners in treating transgender individuals. Furthermore, the study adds to the need for ongoing clinical assessment during hormone replacement therapy in order to minimize future metabolic and cardiovascular risks.

5.3 Final Thoughts and Recommendations

In conclusion, gender affirming hormone therapy is important in ensuring that there is alignment between the physiology and gender identity and improved psychological well-being in transgenders. The physiological and psychological benefits indicate that hormone therapy is effective in mitigating gender dysphoria and enhancing the quality of life.

On the other hand, long-term hormone therapy could have an impact on the cardiovascular system, metabolism, and blood components. This highlights the need for clinical evaluations and personalized treatment plans. There is a need for healthcare systems to offer inclusive and scientifically-based transgenic healthcare practices for better results.

Further study should be conducted on large-scale populations and longer follow-up periods to understand the long-term effects of gender transition therapy on genetics, neuroscience, physiology, and psychosocial factors.

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