From Garden to Gonads: The Dual Role of *Telfairia occidentalis* Leaves (Pumpkin Leave) in Male Fertility

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ABSTRACT

The Cucurbitaceae spicy plant *Telfairia occidentalis* leaves are used in folk medicine as aphrodisiac, and to treat male sexual disorders, inflammation, and microbial infections. It showed antibacterial activity against various microorganisms including various Gram-negative organisms. This review aims to provide better understanding on the existing profertility effects of *Telfairia Occidentalis* leaves on male fertility, focusing on sperm count, sperm motility and sperm morphology. Infertility can result from disorders of the testicles themselves or an abnormality affecting sperm count, sperm motility and sperm morphology. Data show that in experimental animals, extracts of *Telfairia occidentalis* leaves at lower dose improved sperm count, sperm motility and sperm morphology, while at higher doses, with longer durations had antifertility effects. Several extracts of *Telfairia occidentalis* leaves, including ethanol, aqueous, methanol and hydroethanolic, had protective effects on the seminal function of rats at lower doses (≤ 200 mg/kg body weight), but at higher doses (≥ 200 mg/kg body weight) they impaired morphological structure of the sperm cells in normal rats. The current evidence suggests that *Telfairia occidentalis* leaves have both profertility and antifertility effects in experimental animals. This review has demonstrated that *Telfairia occidentalis* leaves extract is both semino-therapeutic and semino-toxic depending on the dose and duration of intake.

***Keywords*:** *spermcount, sperm motility, sperm morphology, pumpkin leave*

1.0 INTRODUCTION

Infertility, a prevalent concern worldwide, impacts individuals and couples across diverse cultures [1]. As the quest for understanding intensifies, exploring the potential remedies within nature, such as the use of *Telfairia occidentalis* leaves has gained significance [2]. In the male reproductive system, infertility is most commonly caused by problems in the ejection of semen, absence or low levels of sperm, or abnormal shape (morphology) and movement (motility) of the sperm [3]. Infertility can be primary or secondary [4]. Availability, access, and quality of interventions to address infertility remain a challenge in most countries [5]. Diagnosis and treatment of infertility is often not prioritized in national population

development policies, reproductive health strategies and are rarely covered through public health financing [6]. Any health condition that a man has that reduces the likelihood that his female spouse will conceive is known as male infertility. With unprotected sex, about 13 out of 100 couples are unable to conceive. Both male and female infertility have a variety of causes. More than one-third of cases of infertility have a male factor. this is most frequently the result of issues with his sperm production or delivery [7]. It is generally estimated that around 7-8% of men worldwide are infertile [8]. In Port Harcourt, Rivers state, 382 male spouses of the infertile couples had their semen obtained and examined. Normospermia, oligospermia, and azoospermia were the patterns of semen density observed in infertile males, accounting for 52%, 46%, and 3% of cases, respectively. Of the individuals, 18.3% had morphological abnormalities (teratozoospermia) and 20.9% had motility abnormalities (asthenozoospermia). 2.9%, 3.9%, and 3.9% of patients, respectively had oligoteratozoospermia, asthenoteratozoospermia, and oligoasthenozoospermia, among other numerous abnormalities. The highest number of azoospermic instances (6.45%) and highest percentage of cases (4.55%) were reported among older patients (50–59 years) and rig workers. In oligospermic semen, the prevalence of bacterial infections was high [9].

T. occidentalis is a native of southern Nigeria and a member of the Cucurbitaceae family [10]. Resolving infertility can also help to reduce gender disparities. Despite the fact that infertility affects both men and women, women who are in a relationship with men are frequently thought to be infertile, whether or not they actually are [11]. By shedding insight on the effects of *Telfairia occidentalis* leaves on male reproductive organs, this review may help to reduce the incidence of infertility among Nigerian males [12]. Herbs are becoming a more affordable alternative to pricey pharmaceutical medications for treating illnesses in non-industrialized nations. When used correctly in terms of dosage and form, natural products are thought to be less dangerous than synthetic ones, which frequently cause certain negative effects [13]. *Telfairia occidentalis* is a vegetable consumed for its therapeutic qualities possessing high antioxidative and spermatogenic activity that might be ascribed to their phenolic and vitamin contents [14].

2.0 Etiology of male infertility

Fertility can be affected by a number of issues, including those that prevent cells from developing into sperm, prevent sperm from reaching the egg, and even the temperature of the scrotum. Infection and hormone imbalances are the main contributors of male factor infertility in Nigeria [15]. The primary factors influencing male fertility are as follows: Sperm disorders**,** Varicoceles**,** Retrograde Ejaculation**,** Immunologic infertility**,** Obstruction**,** Hormones**,** Medication.

2.1 Pathophysiology of male infertility

Male infertility may occur based on pre-testicular, testicular and post-testicular abnormalities [8]. Pre-testicular abnormalities include chromosomal abnormalities, retrograde ejaculation, anejaculation, hypogonadotropic hypogonadism, and erectile dysfunction [16]. Testicular disorders include atrophic testes, primitive testicular dysfunction, orchiectomy, and testicular malignancies. Male infertility and varicoceles are linked, most likely as a result of testicular thermoregulation being compromised by disruption of the pampiniform venous plexus heat regulation mechanism. A number of medications and chemical toxins, spermatoceles with or without surgery, epididymitis, fetal intrauterine exposure to estrogens, epididymal cysts, and idiopathic causes can all result in epididymal dysfunction [17]. Lesions of the seminal tract, inflammatory illnesses, congenital absence of the vas deferens, post-vasectomy, erectile dysfunction, premature ejaculation, and condom or diaphragm use are examples of post-testicular etiologies. In addition, multiple sclerosis, bladder neck surgery, post-TURP surgery, retroperitoneal lymph node dissection,

rectal surgery, and alpha antagonist drugs like Tamsulosin would fall under this group [8].

2.2 Epidermiology of male infertility

Approximately 13% to 15% of couples worldwide have infertility, and one in five are unable to conceive within the first year of trying [8]. In Nigeria, 42.4% of men experience infertility [18]. The widely documented global trend of declining sperm counts over the past few decades is concerning [19]. Sperm counts decreased from an average of 113 million/mL in 1940 to 66 million/mL in the 1990s [20]. Globally, this pattern has persisted, with the mean sperm count falling by 51.6% between 1973 and 2018. What's even more worrisome is that after 2000, the rate of loss accelerated, rising from 1.16% annually after 1972 to 2.64% annually after 2000 [8].

2.3 Indications and features of male infertility

Male infertility can manifest through various signs and symptoms including; difficulty with ejaculation or maintaining an erection, low sperm count, abnormal sperm motility, abnormal sperm morphology, pain, swelling or lumps in the testicular area, sexual dysfunction and underlying medical conditions. Issues with ejaculating or maintaining an erection during sexual intercourse can be indicative of male infertility. A low sperm count, also known as oligospermia, can contribute to male infertility. It is diagnosed when sperm counts are below 15 million sperm per millilitre of semen. Sperm motility refers to the sperm ability to move efficiently. Poor sperm motility can make it difficult for sperm to reach and fertilize the egg. The shape of the sperm is essential for successful fertilization. Abnormal sperm morphology can hinder the sperm's ability to penetrate the egg. Physical symptoms such as pain, swelling or lumps in the testicular area may indicate underlying issues that could affect fertility. Conditions like erectile dysfunction or premature ejaculation can affect fertility by inhibiting successful sexual intercourse. Certain medical conditions such as diabetes, infections, varicocele (enlarged veins in the scrotum), or genetic disorders can contribute to male infertility [21].

2.4 Natural components found in *Telfairia occidentalis* leave and how they promote fertility

2.4.1 Hormonal balance: essential vitamins like A, C and E, found in *Telfairia occidentalis,* alongside with minerals play key roles in hormonal balance. Hormones are crucial for regulating the menstrual cycle, ovulation and over all reproductive health. Furthhrmore adequate levels of vitamins and minerals support a robust immune system. A strong immune system is essential for overall health and can contribute to a favourable environment for conception and a healthy pregnancy [22].

2.4.2 Cellular health: antioxidants, including those found in *Telfairia occidentalis*, protect reproductive cells from oxidative stress. This can be particularly important for maintaining the health of eggs and sperm [22].

2.4.3 Sperm health: Nutrients like zinc, found in *Telfairia occidentalis* leaves are associated with sperm production and quality. Adequate levels of vitamins and minerals contribute to the overall health of both male and female reproductive systems [23].

2.4.4 Energy and nutrient supply: Proteins like leusine and essential fatty acids like omega 3 fatty acids found in *Telfairia occidentalis,* contribute to the energy supply needed for reproductive processes. They are involved in the synthesis of reproductive hormones and the development of reproductive tissues [23].

2.**5 Mechanism of Action of *Telfairia occidentalis***

The mechanism of action of reactive oxygen species (ROS) in male infertility involves reactive oxygen species, oxidative stress and antioxidant defence which can adversely affect sperm function and fertility.

Reactive oxygen species are molecules containing oxygen with reactive properties. They are produced naturally in the body during various metabolic processes. In the male reproductive system, sperm cells are particularly vulnerable to reactive oxygen species due to

their high polyunsaturated fatty acid content and the presence of transition metals that catalyse ROS generation. When the production of ROS exceeds the body's ability to neutralize them with antioxidants, oxidative stress occurs. Oxidative stress can damage sperm cells directly by attacking their membranes, proteins and DNA. ROS-induced damage to sperm cells can lead to impaired sperm motility, reduced sperm viability, and abnormal sperm morphology. These factors can significantly impact fertility by reducing the sperm's ability to reach and fertilize the egg. Antioxidant Defence Mechanisms: the body has natural antioxidant defence mechanisms to neutralize ROS and mitigate oxidative damage. Antioxidants such as vitamin C, vitamin E, gluthathione, and superoxide dismutase help to scavage ROS and protect sperm cells from oxidative stress. External Factors: external factors such as environmental toxins, smoking, alcohol consumption, obesity, and certain medications can increase ROS production and exacerbate oxidative stress in the male reproductive system, further contributing to male infertility [24].

TABLE 1: COMPARING FIVE PRIMARY STUDIES

Case 1	Population/Route of administration	Treatment groups	Weight (g)	Duration in weeks/dosage in mg	Frequency /time	Sperm count ($X10^6$/ml)	Sperm motility	Sperm morphology %
Saalu et al., 2010	Adult male wistar rat/gastric gavage	A (control)	175	8/10Ml distilled water	Daily/ 12 noon	117.5 ± 6.8	99.0 ± 1.0	91.5 ± 1.3 (normal) 8.4 1.4 (abnormal)
	"	B	177	8/200	Daily/ 12 noon	138.4 ± 4.6	98.5 ± 1.5	92.5 ± 1.2 (normal) 7.5 1.3 (abnorm)
	"	C	179	8/400	Daily/ 12 noon	85.3 ± 2.7	75.3 ± 4.9	73.9 ± 1.1 (normal) 27.3 1.1 (abnormal)
	"	D	180	8/800	Daily/ 12 noon	75.6 ± 2.7	65.5 ± 2.7	65.2 ± 2.7 (normal) 34.8 3.2 (abnormal)
Case 2								
Salman et al., 2018	Adult male wister rat/gastric gavage	A (control)		2/10Ml distilld water	Daily	39.5 ± 3.0	58.7 ± 1.6	57.5 ± 3.6
	"	B		2/200	Daily	47.8 ± 2.5	77.7 ± 3.7	75.2 ± 1.5
Case 3								
Adisa et al., 2014	Adult male wister rat/gastric gavage	A (control)	195	4	Daily	61.33 ± 1.90	89.17 ± 0.83	99.17 ± 0.83
	"	B	230	4/100	Daily	43.67 ± 3.02	72 ± 1.59	91.1 7 ± 1.54
	"	C	264	4.200	Daily	33.17 ± 1.01	59.8 ± 0.65	78.83 ± 0.31
Case 4								
Akang et al., 2015	Adult male wister rat/gastric gavage	A (control)		4/10Ml distilld water	Daily			
	"	B		4/250	Daily	95.9 ± 3.82	93.5 ± 4.95	
	"	C		4/500	Daily	91.1 ± 1.70	96.5± 2.12	
	"	A (control)		8/10Ml distilld water	Daily	48.95 ± 1.06	67.5± 3.54	
	"	B		8/250	Daily	79.25 ± 1.48	71.0 ± 1.41	
	"	C		8/500	Daily	56.05 ± 2.62	57.5 ± 3.54	
Case 5								
Osinubi et al., 2015	Adult male wister rat/gastric gavage	A		8	Daily	48.95 ± 1.06	67.5 ± 3.54	
	"	B		8/250	Daily	79.25 ± 1.48	71.0 ± 1.41	
	"	C		8/500	Daily	56.05 ± 2.62	57.5 ± 3.54	

2.6 DISCUSSION

Case 1 table had the following treatment groups, A: Control (distilled water), B: 200 mg dosage, C: 400 mg dosage, D: 800 mg dosage. It was observed that sperm count decreases with increasing dosage. Sperm motility decreases with increasing dosage. Abnormal sperm morphology increases with increasing dosage. Case 2 table had the following treatment groups, A: Control (distilled water), B: 200 mg dosage. It was observed that sperm count increases with the 200 mg dosage.sperm motility increases with the 200 mg dosage. No data on sperm morphology provided. In case 3 table, treatment groups consisted of group A: Control (distilled water), B: 100 mg dosage, C: 200 mg dosage. It was observed that, perm count decreases with increasing dosage. Sperm motility decreases with increasing dosage.Sperm morphology shows a mixed response. In case 4 table, treatment groups A: Control (4 weeks, distilled water), B: 250 mg dosage (4 weeks), C: 500 mg dosage (4 weeks), A: Control (8 weeks, distilled water), B: 250 mg dosage (8 weeks), C: 500 mg dosage (8 weeks). It was observed that higher dosages generally decrease sperm count and motility.Sperm morphology varies across groups. The treatment groups for table 5 consisted of A: Control (8 weeks, distilled water), B: 250 mg dosage (8 weeks), C: 500 mg dosage (8 weeks). Similar trends to case 4 observed.

Dosage-Response Relationship: Across the tables, there's a clear trend of decreasing sperm count and motility with increasing dosages of the treatment substance. This suggests a dose-dependent effect on spermatogenesis and sperm function.

Based on time dependence, tables 4 and 5 indicate that the duration of treatment (4 weeks vs. 8 weeks) also influences the observed effects. Prolonged exposure to the treatment exacerbates the negative impact on sperm parameters. While sperm count and motility consistently decrease with higher dosages, the effect on sperm morphology varies. Some dosages show a significant increase in abnormal sperm morphology, indicating potential damage to sperm structure. Control groups across the tables demonstrate typical sperm parameters for untreated rats, providing a baseline for comparison with the treatment groups. The observed effects on sperm parameters suggest potential reproductive toxicity of the treatment substance. Such findings are crucial for assessing the safety of the substance, particularly regarding its impact on male fertility.

CONCLUSION

Regular use of high amounts of aqueous extract of *Telfairia occidentalis* leaves could be detrimental to fertility in both men and women. Aqueous extract of *Telfairia occidentalis* leaves have both profertility and reversible antifertility effects in experimental animals. Although low doses of aqueous extract of *Telfairia occidentalis* leaves in experimental animals over a period of time promoted testis regeneration and improved testosterone concentration and sperm quality, at higher doses they have antifertility effects.

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