EFFECTS OF ORAL INTAKE OF *Mucuna pruriens* SEED POWDER ON THE HEMATO-BIOCHEMICAL AND REPRODUCTIVE PERFORMANCE OF BUCKS

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ABSTRACT

The use of *Mucuna pruriens* seed extract for the treatment of male reproductive dysfunction has been well researched in animals and humans but the various methods of extractions and solvents used as well as the route of administration often influence the effectiveness of the plants seed. The experiment involve the use of fifteen West African Dwarf (WAD) bucks in a completely randomized design to study the effect of oral administration of *Mucuna pruriens* powder on the reproductive performance of WAD bucks. The bucks weighing between 9kg-10kg were randomly assigned to five treatments. The experiment lasted for 7weeks, during which body weight was taken weekly along with rectal temperature. Blood was collected fortnightly for haematological and biochemical analysis while semen was collected by electro-ejaculation at the end of the experiment for semen analysis. There was no significant difference ($p>0.05$) in all the haematological and biochemical parameters except with White blood cell, Red blood cell, Alkaline Phosphate and Cholesterol which were significantly higher with increase in *Mucuna pruriens* powder. There was significant difference ($p < 0.05$) in all the sperm characteristics such as the sperm motility (%), sperm count ($x10^6$/ml), live to dead ratio, normal sperm morphology and semen volume (ml). Rectal temperature was normal in all the groups and weight gain was not significantly affected throughout the period. It was concluded that oral administration of 10g of *Mucuna pruriens* powder was the best in terms of improvement of semen characteristics of West African Dwarf buck.

Keywords: buck, haematology, *Mucuna pruriens* powder, serum and semen.

INTRODUCTION

Herbal supplements have been recently found useful in remediating or preventing various diseases, in both humans and animals (Njoga *et al.,* 2022). Consequently, the use of *Mucuna pruriens (MP)* as a substitute for synthetic aprhodisiac drugs has recently gained popularity in developing countries due to its handiness, modest nature with relatively zero side effects /toxicity (Mutwedu *et al*., 2019) and containing substances useable for therapeutic purposes and are precursors for chemo-pharmaceutical semi-synthesis (Pathania *et al*., 2020). It is one of the popular medicinal plants of Africa associated with the Genus *Mucuna* and

Species *pruriens* with local name called '*Yerepe'* in Yoruba language. The flower head takes the form of axillary arrayed panicle (Agbede and Aletor, 2005) bearing white lavender or purple flowers that cause a severe itch if they come in contact with the skin (Ferda and Ethan, 2019). MP has been reported to contain Levodopa which has conveyed the impression to relieve the symptoms of Parkinson disease (Okukpe *et al*., 2014). The seeds represent an effective ethnobotanical used as an aphrodisiac to enhance male fertility via its action on the hypothalamus-pituitary axis when administered in appropriate dosage (Tangsrisakda *et al.*, 2021). MP act by enhancing serum testosterone, luteinizing hormone, dopamine, adrenaline and noradrenaline concentration, thereby influencing the sperm motility, sperm concentration and livability in infertile subjects (Choowong-In *et al.,* 2021). As recorded by Azibanasamesa *et al.* (2021) the seeds contain 12.5 percent of L-dihydroxyphenylalanine, Gallic acid, ascorbic acid, including glutathione which might be responsible for the antioxidant properties. *Mucuna pruriens* extract also contains an important precursor L-Dopa and L-Dopamine that could be converted to dopamine (Han *et al.,* 2022) within the nervous system of the body. This helps to maintain and replenish Dopamine neurotransmitter level in the brain (Okukpe *et al*., 2014; Kamkaen et al., 2022). L-Dopa is an acid that is converted or made from the L-Tyrosine acid, which itself is converted to Dopamine, which is not only integral to healthy and normal brain functioning, but also by being one of the many neurotransmitters, enhancing brain nerves and cells to communicate with each other. This is important as it by-pass physiological process and provide direct precursors to Dopamine.Gasmi et al. (2022) L-dopa content varies from 1.6 - 7 % (Siddhuraju and Becker, 2005; Hernández-Orihuela *et al.,* 2022). According to Vilairat *et al.* (2023) ensiling was reported to decrease L-dopa content in the seeds by 10-47%. Jampolska *et al*. (2023) reported L-dopa to be less harmful in ruminants.

Mucuna pruriens powder has been used extensively in man with success in terms of boosting reproductive performance and enhanced activity hence, the need to test it on ruminants (WAD) via oral method of administration to see if the same success would be replicated and at what inclusion level. *Mucuna pruriens* has been reported with the ability to increase lean muscle mass and also decrease fat in the body of the animals (Pathania *et al*., 2020). Barde *et al*. (2023) reported that blood parameters such as packed cell volume, hemoglobin, red blood cell and white blood cell have been efficiently boosted via herbal supplementation such as MP in ruminants, while addressing various blood deficiency syndromes. The present desire for lean meat with reduced fat is necessary to reduce cholesterol in human consumer of meat. Therefore, the study aimed to evaluate the effect of oral intake of *Mucuna pruriens* powder on the hemato-biochemical and semen characteristics of West African Dwarf bucks.

MATERIALS AND METHODS

Experimental Site: The experiment was carried out at the small ruminant unit, paddock section, Teaching and Research Farm, University of Ilorin, Ilorin, Kwara State along Southern guinea savannah ecological zone (latitude 29N, 18^0, longitude 35E, 4^0) between January and April.

Preparations of Mucuna Pruriens Seed Powder: *Mucuna pruriens* pods were harvested at the University of Ilorin campus; the seeds were subsequently removed from the pods, cleaned, dried and ground to fine powder using a grinder. A feed made up of the following ingredients

was formulated: Wheat offal 15%, groundnut cake 10%, corn offal 35%, palm kernel cake 37%, bone meal 2%, mineral/salt 1% to give a crude protein of 17.35%, crude fibre 10.74%, ether extract 4.30% and ash 7.3%.

Management of Animals and Experimental Design:

Fifteen (15) growing West African Dwarf bucks weighing between 9 to10kg were used. They were quarantined for three weeks during which, oxytetracyline L.A and multivitamins preparation were administered at the rate of 1ml per 10kg body weight through intramuscular route for prophylactic treatment. Ivermectin was administered subcutaneously at the rate of 0.2ml per 10kg body weight against external and internal parasites. The animals were fed with the formulated feed and water was provided daily. The cages were disinfected using Morigad disinfectant and the feeding and watering facilities washed thoroughly to prevent disease transmission. After the quarantine period, bucks were randomly assigned to five treatments made up of three bucks in a 7- week experimental period. The control treatment (A) were given 100ml normal saline water before feeding, while treatments B, C, D and E were administered 10, 20, 30 and 40g of *Mucuna pruriens* seed powder orally after it has been dissolved in 100ml of saline water every other day between 6:00am to 8:00am. Body weight and rectal temperature were measured weekly while blood samples were collected through the jugular vein trice (at the beginning, middle and end of the experiment) for haematology and biochemical analysis. At the 7^{th} week, semen was collected using electro-ejaculator method for the determination of semen characteristics such as motility, sperm count, live to dead ratio, normal sperm morphology using the method of Zemjanis (1970).

Statistical Analysis

All parametric data such as weight gain, rectal temperature, sperm characteristics, haematology and serological data were subjected to analysis of variance(ANOVA) using the model of Completely Randomized Design (Steel and Torrie, 1980). Significant means were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS

The result of the haematology parameter (Table 1) showed that the final packed cell volume (PCV), haemoglobin (Hb), Lymphocyte, Eosinophil, Monocyte and Basophil were not significantly influenced by the administration of oral *Mucuna pruriens* (*Mp*) powder at the different levels used. White blood cell (WBC) and Red blood cell (RBC) significantly increased at 10g oral Mp powder administration but gradually reduce with additional increase in Mp which was not significantly different ($p>0.05$) from the control. Moreover, the final serum protein, albumin and creatinine were not significantly affected ($p>0.05$) by the administration of oral Mp powder at the different levels used (Table 2). The serum enzyme, Alkaline phosphatase (ALP) significantly ($p<0.05$) increase with increasing Mp administration to reach its peak at 30g/100ml Mp powder administration after which it significantly reduce. Although ALP in animals in treatments B and C were not significantly different from the control treatment A. Increasing level of Mp significantly reduce cholesterol level after its peak at treatment B. Body weight was not significantly influenced by Mp as there was no significant gain in weight. There was significant increase in rectal temperature at treatment C with 20g administration of Mp

while the other treatments were not significantly different from the control. Percent sperm count, Sperm motility, Live to dead ratio, percent normal sperm and sperm volume significantly increase in treatment B (10g Mp) compared to other Mp treatments, though not significantly different from the control except in sperm count and semen volume. The semen characteristics reduced with increasing Mp powder administration.

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Table 1: Effect Of *Mucuna Pruriens* Powder on Haematological Parameters of West African Dwarf (Wad) Bucks

Treatments	A (0g)	B (10g)	C (20g)	D (30g)	E (40g)	±SEM
PCV(%)						
Initial	25.50	29.00	26.00	28.00	25.50	1.36
Final	29.50	33.00	25.50	27.50	26.00	2.92
WBC ($x10^9$/L)						
Initial	5.25^{b}	8.20^{a}	6.65^{b}	6.10^{b}	5.75^{b}	0.40
Final	6.05^{ab}	8.20^{a}	6.40^{ab}	5.45^{b}	5.00^{b}	0.69
RBC ($x10^{12}$/L)						
Initial	1.25	1.95	1.55	1.65	1.30	0.19
Final	1.70^{ab}	2.30^{a}	1.50^{b}	1.65^{ab}	1.55^{ab}	0.21
HAEMOGLOBIN (g/dl)						
Initial	5.75	6.35	5.8	6.00	5.50	0.29
Final	6.15	6.35	5.75	6.10	5.55	0.32
NEUTROPHIL (%)						
Initial	61.00^{b}	71.00^{a}	67.00^{ab}	68.00^{ab}	66.50^{ab}	2.01
Final	64.50	71.50	68.50	69.50	71.50	2.06
LYMPHOCYTE (%)						
INITIAL	39.00^{a}	26.00^{b}	29.50^{ab}	30.50^{ab}	32.50^{ab}	2.75
FINAL	35.50	25.00	28.00	27.50	27.00	2.77
EOSINOPHIL (%)						
Initial	0.00^{b}	0.50^{ab}	3.50^{a}	1.50^{ab}	1.00^{ab}	0.87
Final	0.00	1.00	2.50	2.00	1.00	1.36
MONOCYTE (%)						
Initial	0.00	0.00	0.00	0.00	0.00	0.67
Final	0.00	1.00	1.00	1.00	0.00	0.77
BASOPHIL (%)						
Initial	0.00	0.00	0.00	0.00	0.00	0.45
Final	0.00	2.00	0.00	0.00	0.50	0.92

a, b - means within the row bearing different superscripts differ significantly ($p<0.05$) while those with the same are not significantly different ($p>0.05$).

Table 2: Effect Of *Mucuna Pruriens Powder* On Serological Parameters Of West African Dwarf (Wad) Goats

Treatments	A (0g)	B (10g)	C (20g)	D (30g)	E (40g)	±SEM
PROTEIN (g/l)						
Initial	68.00^{bc}	69.00^{bc}	74.50^{a}	72.00^{ab}	66.00^{c}	1.28
Final	59.15	63.31	64.67	68.83	60.54	2.28
ALBUMIN (g/l)						
Initial	34.50^{abc}	38.50^{a}	33.00^{bc}	36.50^{ab}	30.50^{c}	1.27
Final	26.33	24.63	24.46	26.53	24.22	2.12
ALP (iu/l)						
Initial	124.00^{c}	359.50^{b}	174.50^{c}	427.00^{a}	191.00^{c}	16.67
Final	147.74^{ab}	183.23^{ab}	141.33^{ab}	272.11^{a}	124.48^{b}	45.52
CHOLESTEROL (mmol/l)						
Initial	1.95	2.05	2.50	2.60	1.90	0.26
Final	2.75^{ab}	3.50^{a}	1.96^{b}	2.42^{ab}	1.95^{b}	0.10
CREATININE (umol/l)						
Initial	132.50^{a}	69.00^{c}	111.00^{b}	106.50^{b}	87.50^{bc}	2.96
Final	109.25	102.44	115..64	120.29	118.53	0.46

a, b, c means within the row bearing different superscripts differ significantly ($p<0.05$) while those with the same are not significantly different ($p>0.05$).

Table 3: Effect Of *Mucuna Pruriens* Powder on Weight Gain, Rectal Temperature And Semen Characteristics Of West African Dwarf (Wad) Bucks.

Treatments	A (0g)	B (10g)	C (20g)	D (30g)	E (40g)	±SEM
Weight Gain (Kg)	1.03	1.00	1.00	1.00	1.00	0.00
Rectal Temp, (^{0}C)	37.43^{b}	37.63^{b}	38.27^{a}	37.27^{b}	37.40^{b}	0.15
Sperm Count (x10^{6}/ml)	67.70^{ab}	105.20^{a}	47.90^{ab}	71.70^{ab}	25.40^{b}	15.57
Sperm Motility (%)	78.80^{a}	82.10^{a}	69.50^{ab}	78.50^{a}	57.40^{b}	5.18
Live To Dead Ratio	78.80^{a}	84.25^{a}	72.65^{ab}	82.55^{a}	56.90^{b}	5.43
Normal Sperm (%)	81.55^{a}	83.55^{a}	70.75^{ab}	78.30^{ab}	58.10^{b}	5.68
Volume (ml)	0.40^{ab}	0.55^{a}	0.25^{ab}	0.40^{ab}	0.10^{b}	0.11

a, b means within the row bearing different superscripts differ significantly ($p<0.05$) while those with the same are not significantly different ($p>0.05$).

DISCUSSION

Packed Cell Volume (PCV), White Blood Cell (WBC), Neutrophil, Eosinophil and Monocyte values were within the normal ranges reported by Daramola *et al*. (2003).While Red Blood Cell (RBC), Haemoglobin, Neutrophil and Lymphocyte values were at variance with values reported by Daramola *et al*., (2003). There were no significance difference ($p<0.05$) in the haematology parameters across the treatments except in RBC and WBC. The increase in packed cell volume (PCV) might be as a result of increase in environmental temperature as reported by Emenalom *et al.* (2004) and Shabbir et al. (2020). A decrease in red blood cell (RBC) and haemoglobin (Hb) has been reported by

Jain (1986) to be as a result of anaemia caused by the destruction of blood cells or inadequate production of blood cell, while an increase in RBC and Hb are as a result of improved production or inhibition of any destructive substance in the system (Turner *et al.,* 2023). Increase in white blood cell has been reported to be as a result of rapid and potent defence against any infectious agents or during exercise (sexual exercise) as reported by Mendoza-Castillo *et al*. (2003), Okukpe *et al.* (2014) and Brouwer *et al.* (2023).

The reduced WBC with increasing inclusion of Mp showed that it could best be used within a specific range for it not to have a negative effect on the body. This supports previous work that it inhibit the specific chemical reactions induced by superoxides and hydroxyl radicals and that it contains hypoglycaemic principles which may be both organic and mineral, which seems to act indirectly by the release of insulin or by a direct insulin-like action (Emenalom *et al.,* 2005a, b; Schalm *et al.,* 2010). There was no significant difference ($p<0.05$) across the treatments in the serum biochemical parameters. The values recorded are at variance with values reported by Tambuwal *et al*., (2002) except in Alkaline phosphatase (ALP) and Cholesterol that are significantly different across the table although it supports previous work on Mp extract by Okukpe *et al*. (2014) and Endrinikapoulos *et al.* (2023). There was increase in serum protein which might have been as a result of additional protein intake from the Mp powder as it is reported to be high in protein by Muinga *et al*. (2003), Emiola *et al*. (2007) and Garcia-Iborra *et al.* (2023) The decrease in albumin might have been as a result of liver disease and malnutrition as reported by Spector (1961), Siddhuraju *et al* (2005) and Moman *et al.* (2022).

Increase in alkaline phosphatase is as a result of active bone formation as reported by Kaplan (1992), Schalm *et al*. (2010) and Lowe et al. (2022) and can be influenced by disease (Oyeyemi *et al*., 2000). Increase in cholesterol might be as a result of artery disease, vascular diseases as reported by Duncan *et al*. (1994) and Rajeshwar *et al*. (2005). Gounden et al. (2023) repoted that an Increase in creatinine might be as a result of dieresis and high chemical waste molecule in the kidney which is in consonance with the report of Oyeyemi *et al.,* (2000) and Spector (2007).

There was no significant difference ($p<0.05$) in the weight gain across the treatments which implies there was no noticeable weight gain across the treatments while there was a significant difference ($p>0.05$) in the values recorded in the rectal temperature which was in agreement with values reported by Castillo-Caamal *et al*., (2003a, b) and Taiwo *et al.,* (2006) for normal body temperature of West African dwarf bucks. Deviation from normal temperature indicates that the bucks are under stress as reported by Oyeyemi *et al*., (1998) and Silanikove (2000).There was significant difference ($p>0.05$) across the treatments in the sperm characteristics across the table and the values recorded were at variance with the values reported by Oyeyemi *et al*., (2011). This supports previous work that it heightens arousal and increase sexual activity to a moderate level and sustains it for a longer time (Giuliano *et al.*, 2001; Misra and Wagner, 2007; Okukpe *et al*., 2014). The Sperm count was significantly high ($p<0.05$) at the 10g Mp inclusion and subsequently reduced. This lends support to its use as sexual stimulant

or aphrodisiac, either wholly or in combination with other herbal plants in human (Evan, 2009), though seems not as efficient as subcutaneous extract administration as reported by Okukpe *et al.* (2014). Choowong-In *et al.* (2021) documented *Mucuna pruriens (Mp) to be effective* in improving male sexual performance and infertility due to the presence of L-3, 4 dihydroxyphenyl alanine (L-DOPA),which is in tandem with Kumar *et al.* (1994) and Misra and Wagner (2007).

Sperm motility was significantly different ($p<0.05$), though it significantly reduced with increasing intake levels. This could be due to the enhanced activity of the sperm cells that led to their burning-out quickly. This could be attested to by the live-to-dead ratio. The oral intake affected the live-to-dead ratio as the number of living cells was significantly reduced with increasing intake. This could be attributed to the effects of Mp intake improving cell motility that led to cells burning out readily and finally death of cells. Though, this could improve the progressive movement of the sperm cells to the oviduct in natural mating. The percentage live spermatozoa were not significantly different from the control at 10, 20 and 30g Mp but subsequently reduced with additional increase in intake. This shows that oral intake of Mp powder could improve sexual performance as well as reduce male infertility as reported by previous researchers (Kaphle *et al*., 2006 and Okukpe *et al*., 2014). The quality of spermatozoa as indicated by sperm abnormality is known to be the best indicator of fertility in males (Oyeyemi, 2000; Ilesanmi, 2009 and Okukpe *et al*., 2012). Testicular sperm are infertile and must undergo maturation changes in the epididymis to acquire fertilizing capacity. The capacity for fertility and motility are acquired in the corpus epididymidis James *et al.* (2020). The most obvious morphological change as spermatozoa move from the caput to the cauda epididymis is the movement of the cytoplasmic droplet from the neck of the sperm down the tail and its eventual loss. As sperm output depends on age, species, breed, season, scrotal size, frequency of ejaculation and degree of sexual preparation (Okukpe *et al*., 2014). According to Hanson et al. (2018), the frequency of ejaculation and degree of sexual preparation may likely have a negative impact on the sperm morphology as more low-quality sperm cells are likely to have been voided from the caput epididymis. Low quality as a result of the short time for capacitation before it was ejaculated.

CONCLUSION

In conclusion, oral administration of *Mucuna pruriens* powder in West African Dwarf Bucks has effect on the white blood cell (WBC), red blood cell (RBC), alkaline phosphatase (ALP), cholesterol and sperm characteristics such as the sperm count, sperm motility, live to dead ratio, morphology and volume with each increasing efficiently in the treatment fed 10g of the *Mucuna pruriens* powder orally. It is recommended that the administration of a 1g/kg body weight oral dosage of *Mucuna pruriens* powder was effective in increasing sexual performance in terms of semen characteristics and was not denatured by the rumen microbes. The mechanism of the action of oral administration of the powder should be researched.

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