

Analysis of *Mucuna Pruriens* on Blood Serum Chemistry in Rat

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Abstract

A medicinal plant as defined by the world health organization (WHO) is a plant which one or more parts of it contain substances that can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs. Based on the results of this study, it can be concluded that dietary inclusions of velvet *Mucuna pruriens* (velvet bean) leaf meal at 1.5 g/kg, 3 g/kg and 6 g/kg animal feed significantly reduced serum levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) with 6 g/kg inclusion level having the highest level of reduction and did not induce any significant effects on ALP which is the biomarker of obstructive jaundice. Also, it possesses the nutritional values of lowering blood urea, serum creatinine levels as well as increasing dopamine and serotonin levels in the blood. Dietary inclusion of *Mucuna pruriens* (velvet bean) leaf meal can be made up to 6g/kg animal feed to reduce incidence of uremia, and as an antioxidant to prevent lipid peroxidation.

Keywords: *Mucuna pruriens*, Liver enzymes, Kidney enzymes, Blood Urea, Creatinine.

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I. Introduction

Mucuna pruriens also known as velvet bean is a twinning herb found in the tropics and well known for producing itching [1]. This property is attributed to the presence of 5-hydroxytryptamine (5-HT) in the hair on the pods [2]. It has been widely used in many countries as a medicinal plant [3]. *Mucuna pruriens* is thought to have originated from India. It is one of the popular medicinal plants of India and it constitutes more than 200 indigenous drug formulations. All parts of *Mucuna pruriens* possess valuable medicinal properties. The seed has been used as a stimulant and nerve tonic to treat impotence and infertility, as well as in the treatment of Parkinson's disease [4]. The pods are reported as an anthelmintic and the roots are used in the treatment of neurological disorders and blood purification. Another report also mentioned this plant to have antioxidant activity [5] and can be used in the treatment of cholesterol [6], diabetes [7], cough [8], rheumatism, gout, cancer, tumors, tuberculosis, asthma, cholera, diarrhea, dysentery, irritation, muscle pain [3] [4] and to treat snake bites [9]. Various studies have reported the activity of *Mucuna pruriens* seeds as a promising antiparkinson due to the content of L-DOPA [10] [11]. L-DOPA is the precursor to the neurotransmitters dopamine and is able to cross the blood-brain barrier. Since Parkinson implies a decrease of dopamine, the presence of L-DOPA can help to increase the dopamine [12] [13]. The seed of *Mucuna pruriens* from Indonesia has been reported to contain about 7.56 to 13.9% L-DOPA. It is also known that *Mucuna pruriens* contains alkaloids, saponins, flavonoids, steroids, triterpenoids, glycosides, reducing sugar, cardiac glycosides and tannins [14] [15] [16] [17] [18]. In *Mucuna pruriens*, the Phytochemical screening has revealed the presence of alkaloids, reducing sugar, anthraquinones, flavonoids, saponins, tannins, cardiac glycosides, phenols and steroids [19].

The importance of blood in maintaining good health cannot be overemphasized. The Chinese describe blood as the 'mother of energy' in the sense that it provides the basic building materials and fluid substances that are required to nourish the life essence of our being; thus blood is represented as a receptacle for sustaining our life energy [20]. The functions of blood are many and varied. Besides providing material nourishments, the blood also provides the necessary moisture needed by the internal organs to function properly. Insufficient blood or blood deficiencies can cause many problems ranging from weakness, lethargy, inability to concentrate, hot flushes, increased susceptibility to infection, shortness of breath, fatigue, dizziness, palpitation, anxiety, depression, insomnia, nervousness, headache and diminished sex drive [20]. The blood contains a myriad of

metabolites and other constituent that provide a valuable medium for clinical investigation and nutritional status of individuals. Hence, WHO (1963) recommended the use of blood, biochemical and hematological parameters in medical assessment. Enzymes are proteinous biomolecules that catalyze metabolic reactions [21], they are responsible for anabolic and catabolic activities in biosystems. Biochemical parameters are used as laboratory indices to evaluate events in biosystems [22].

II. Materials And Methods

Collection and Authentication of Plant Materials

Fresh leaves of *Mucuna pruriens* were collected from Palm Plantation Institute of Agricultural Research and Training, Ibadan. The Plant materials were identified and authenticated with a voucher specimen number: UIH-22563 at the Department of Botany, University of Ibadan. The leaves were thoroughly washed and air dried at room temperature for 10-15 days after which they were milled using a milling machine and stored in a air-tight bag until use [23].

Ethanollic Extraction of Plant Materials

About 500g of the dried and milled leaves of *Mucuna pruriens* was weighed and extracted with 2 litres of 95% ethanol in a conical flask, covered with foil paper and protected from sunlight for 48 hours with regular stirring with a stirring rod to ensure proper mixing. The ethanolic constituent was then filtered using Whitman no. 1 filter paper, after which the filtrate was concentrated using water bath of 40°C. The concentrates were stored in a labeled sterile amber bottle in a refrigerator at 4°C [24].

Procurement, Housing and Handling of Experimental Animals

The housing and handling of the experimental animals conformed to the prescribed and acceptable standards and were acclimatized for two (2) weeks before the commencement of the experiment. They were allowed access to feed and clean water under the standard laboratory condition of temperature, humidity and light. Twenty (20) Wistar rats were randomized into one control group A and three (3) experimental groups B, C and D respectively containing five (5) animals in each group. The dietary inclusions were as follows:

Group A (negative control): They were administered normal feed and water. *Mucuna pruriens* were not administered.

Group B : They were administered 1.5g/kg (extract in feed) + water.

Group C: They were administered 3.0g/kg (extract in feed) + water.

Group D: They were administered 6.0g/kg (extract in feed) + water.

Sample Collection

At the end of eight (8) weeks, 5ml of blood sample was obtained from each rat and put into a properly labeled non-heparinized bottle and used for serum biochemistry analysis. The blood was allowed to clot at room temperature and then centrifuged for 10 minutes in a bench centrifuge at 2000 r.p.m. The clear serum was siphoned into clean sample bottles and stored immediately in the freezer until required for analysis. The sera separated from the clot by centrifugation were used to determine serum biochemical parameters. Concentrations were determined by the microhematocrit and cyan-methaemoglobin methods respectively, according to [25]. From the serum samples, the total protein was measured using biuret reaction. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were determined with the use of a photoelectric colorimeter [26], while the alkaline phosphatase (ALP) activity was determined according to [27]. The organs livers, kidneys, spleens, intestines, eyes and ears were also collected and put into sterile plain tubes containing normal saline for further biochemical analyses and determination of neurotransmitters levels.

Statistical Analysis

Data values were expressed as mean values and statistical significance of the treatment effect was analyzed using one way analysis of variance (ANOVA) by comparing the control with the *Mucuna pruriens* leaf meal treated groups.

III. Results

Table 1: Shows the effects of *Mucuna pruriens* leaf meal on serum biochemical parameters. The result revealed significant difference ($P>0.005$) in mean values between treated groups when compared to the control groups except in ALP. The values for ALT and AST decreased with increase in inclusion level of *Mucuna pruriens* leaf meal. ALT has the lowest value in group D (6 g/kg feed) (0.037 ug/g) and the highest value in group A (0.048 ug/g). AST follows the same trend having the lowest and highest values of (0.074 μ g/g) and (0.116 μ g/g) respectively. The values obtained for ALP did not reveal any significant difference between treatments. Urea and Creatinine values were significantly reduced ($P>0.005$). Group A has the highest values of

(0.397 mmol/L) and (0.700 mmol/L) and group D (6 g/kg feed) has the lowest values of (0.330 mmol/L) and (0.520 mmol/L) for both Urea and Creatinine respectively. The values for SOD and Total Protein revealed significant increase ($P>0.005$) with increased level of *Mucuna pruriens* leaf meal inclusion. Group A has the lowest values of (0.330 mg/kg) and (10.820 mg/kg) and group D (6 g/kg feed) has the highest values of (0.353 mg/kg) and (11.230 mg/kg) for both SOD and Total Proteins respectively.

Table 1: The effects of *Mucuna pruriens* leaf meal on serum biochemical parameters.

TRT	ALT (µg/g)	AST (µg/g)	ALP (µg/g)	SOD (mg/kg)	Urea (mmol/L)	Creatinine(µ ml/L)	Total protein (g/L)
A (control)	0.048 ^a	0.116 ^a	0.188 ^a	0.283 ^a	0.392 ^a	0.70 ^a	10.82 ^d
B(1.5g/kg)	0.045 ^b	0.111 ^b	0.191 ^a	0.294 ^b	0.362 ^b	0.66 ^b	11.10 ^b
C(3g/kg)	0.042 ^c	0.097 ^c	0.186 ^a	0.323 ^c	0.342 ^c	0.58 ^c	10.93 ^c
D(6g/kg)	0.037 ^d	0.074 ^d	0.187 ^a	0.353 ^d	0.330 ^d	0.52 ^d	11.23 ^a

P value (P<0.005)

KEY:

AST: Aspartate aminotransferase

ALT: Alanine aminotransferase

ALP: Alkaline phosphate

SOD: Superoxide dismutase

TRT: Treatment

Table 2 revealed significant increase ($P<0.005$) in creatinine data values obtained in the kidney, while there was no significant difference in both spleen and intestine. Urea values showed significant increase in group D (6 g/kg feed) in all the organs, Total Protein showed no significant difference and SOD followed the same trend.

Table 2: Effects of *Mucuna pruriens* leaf meal on organs biochemical parameters

TRT	Creatinine (µm/L)	SOD(m g/kg)	Urea(mmol/L)	Total protien(m/L)
Kidney				
A(control)	0.224 ^d	0.001 ^b	1.133 ^c	10.900 ^a
B(1.5g/kg)	0.231 ^c	0.002 ^b	1.130 ^c	9.840 ^c
C(3g/kg)	0.236 ^b	0.001 ^b	1.143 ^b	10.175 ^b
D(6g/kg)	0.243 ^a	0.006 ^a	1.149 ^a	9.725 ^d
Spleen				
A(control)	0.122 ^a	0.068 ^a	0.220 ^c	0.006 ^a
B(1.5g/kg)	0.120 ^a	0.048 ^b	0.216 ^b	0.004 ^a
C(3g/kg)	0.121 ^b	0.065 ^a	0.227 ^a	0.005 ^a
D(6g/kg)	0.116 ^a	0.055 ^c	0.225 ^a	0.006 ^a
Intestine				
A(control)	0.122 ^a	0.046 ^b	0.230 ^a	0.002 ^a
B(1.5g/kg)	0.118 ^a	0.048 ^b	0.224 ^b	0.006 ^a

C(3g/kg)	0.112 ^b	0.048 ^b	0.214 ^c	0.008 ^a
D(6g/kg)	0.126 ^a	0.052 ^a	0.181 ^d	0.011 ^a

Table 3 showed there was no statistical significant ($P>0.005$) difference in cytochrome c oxidase values obtained for both eye and ear. Succinate dehydrogenase (SUD) follows the same trend except in group D where SUD value was significantly increased in the ear with the value of 0.012 compared to 0.006 valued that was obtained in the control group. Values obtained for dopamine in both ear and eye showed significant increase ($P<0.005$), this could be due to the fact that *M. pruriens* is a known precursor of dopamine, and data values recorded for serotonin and glutamate followed a similar trend.

Table 4 revealed there was no statistical significant difference ($P>0.005$) between treated and control groups except in group D (6 g/kg feed) where data value obtained for AST was significantly reduced and SOD values were significantly increased. SOD has the highest value of 0.018 mg/kg in group D (6 g/kg feed) compared to 0.010mg/kg recorded in group A (Control). Data values obtained for ALP showed decrease in the liver and increase in ALT, however, both increase and decrease in data values were not statistically significant.

Table 4: The effects of *Mucuna pruriens* leaf meal on biochemical parameters of the liver.

Liver	AST(μgg^{t})	ALP(μgg^{t})	ALT(μgg^{t})	SOD(mg/kg ^t)
A(control)	0.119 ^a	0.054 ^a	0.123 ^a	0.010 ^b
B(1.5g/kg)	0.116 ^a	0.055 ^a	0.124 ^a	0.012 ^b
C(3g/kg)	0.115 ^a	0.052 ^a	0.123 ^a	0.012 ^b
D(6g/kg)	0.110 ^b	0.051 ^a	0.126 ^a	0.018 ^a

KEY:

- ALT: Alanine aminotransferase**
- AST: Aspartate aminotransferase**
- ALP: Alkaline phosphate**
- SOD: Superoxide dismutase**

IV. Discussion

Biochemical Parameters

Table 1 shows the effects of *M. pruriens* leaf meal on the selected serum biochemical parameters. The serum activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and Alkaline phosphatase (ALP) are usually used as indices in assessing the physiological status of the liver [28]. The level of these serum enzymes increases during liver damage and disease conditions. The result of this study revealed that the serum level of the membrane bound target enzymes, aspartate aminotransaminase (AST) and alanine aminotransaminase (ALT) significantly decreased ($P<0.005$) with increase in the inclusion level of *Mucuna pruriens* leaf meal when measured after three weeks of treatment in relation to the control. The reason for this decreased observation in enzyme levels has been attributed to the fact that *Mucuna pruriens* is a known antioxidant [29]. Also, superoxide dismutase (SOD) showed statistically significant difference between treatments and control with group A (Control) having the lowest value (0.283 mg/kg) and group D (6 g/kg) having the highest value (0.353 mg/kg). The results from this current study were consistent with a study that was obtained from treatment with methanolic extract of *Mucuna pruriens* that showed a decrease in the levels of lipid peroxidation and an increase in the levels of glutathione, superoxide dismutase and catalase [30]. These results suggest that the extract of *Mucuna pruriens* leaf exhibits significant antitumor and antioxidant effects in mice [1]. Therefore, the suppression of liver enzymes to significant amounts after feeding with *Mucuna pruriens* leaf meal could be explained by the enhanced suppressive effect displayed by some components in *Mucuna pruriens* extract, thereby, preventing over-sensitization of enzymes to the metabolism of various substances foreign to the normal system in the rats used for the study. Also, there was no significant difference in alkaline phosphatase (ALP) a biomarker of obstructive jaundice between treatment mean values when compared to the control group.

Assessment of Renal Dysfunction

Urea and creatinine are considered as a suitable prognostic indicator of renal dysfunction and kidney failure for any toxic compounds [31]. The kidney is a major organ of excretion and its functional status is estimated by the creatinine clearance, which inadvertently is a measure of the glomerular filtration rate. The results of this study depict that urea and creatinine levels were significantly reduced ($p < 0.005$) in the rats put on diets containing different inclusion levels of velvet bean (*Mucuna pruriens*) leaf meal (MPLM) when compared to the control group. The reduction in the creatinine and urea levels shows that MPLM has the potential to improve renal dysfunction.

V. Conclusion

Based on the results of this study, it can be concluded that dietary inclusions of velvet *Mucuna pruriens* (velvet bean) leaf meal at 1.5 g/kg, 3 g/kg and 6 g/kg animal feed significantly reduced serum levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) with 6 g/kg inclusion level having the highest level of reduction and did not induce any significant effects on ALP which is the biomarker of obstructive jaundice.

VI. Recommendation

Dietary inclusion of *Mucuna pruriens* (velvet bean) leaf meal can be made up to 6g/kg animal feed to reduce incidence of uremia, and as an antioxidant to prevent lipid peroxidation. However, further studies should be carried out on histopathological effects of the plant.

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