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Effects of Some Nigerian Antimalarial Medicinal Plants on Glucose Levels in Wistar Rats

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Abstract

The uses of medicinal plants for the treatment of diseases and their effects on rats have been documented. Blood glucose level in oral administration of some antimalarial medicinal plant decoction on Wistar rats was investigated. 36 adult Wistar rats weighing 180±10g were divided into six groups of six each consisting of 3 males and 3 females. The first group of six was given normal diet and water. Each of the other groups received 0.2ml, 0.4ml, 0.6ml, 0.8ml and 1ml of the medicinal plant decoction daily for 7 days. Blood samples were collected from them into oxalate bottles for determination of glucose levels. There was no significant difference between the glucose levels in the control and in the experimental animals. The result of this study can be used as the basis of clinical studies on humans who are diabetic and are receiving treatment for malaria with these medicinal plants.

Key words: malaria, medicinal plants, glucose, diabetes

INTRODUCTION

Malaria is caused by Plasmodium infection, transmitted by the female anopheles mosquitoes. Each year, there are approximately 350 million to 500 million cases of malaria, killing between one million and three million people; the majority of whom are children in the sub Saharan Africa [1]. Several medicinal plants have been used for the treatment of many ailments. World Health Organization has recommended that extensive research be carried out the beneficial effects of medicinal plants [2], but only few of them have been investigated [3]. Traditional Medicines derived from medicinal plants are used by about 60% of the world's population [4]. In

Nigeria as in other tropical African countries, the natives use many medicinal plants for the treatment of malaria. With the introduction of cheap antimalarial drugs, there was marked reduction in the use of local herbal medicines. Unfortunately, several resistant forms of the parasite now exist, and the once abandoned local herbs are gradually gaining ground again. A combination of medicinal plants commonly used by the locals in Nigeria for the treatment of malaria are Azadirachta indica, Cymbopogon citratus, Anacardium occidentale, Tilia europoea, Mangifera indica, Carica papaya and psidium guajava. Each of the plants has medicinal uses and has been used for the treatment of malaria. Azadirachta indica is antipyretic, hypoplycacemic, antifungal, spermicidal, antimalarial, antibacterial and diuretic [5,6]. Cymbopogon citratus is commonly used in teas, soups and curries. It is antifungal [7] and has been used for the treatment of flu, fever, pneumonia, malaria [8] and type 2 diabetes [9]. Anacardium occidentale is antimicrobial [10] and used for the treatment of malaria. Tilia europoea is used as flavor in foods and beverages and it is rich in vitamin C [11]. Mangifera indica is taken as a remedy for diarrhea, fever, diabetes, hypertension [12] and for mental weakness, dysentery, teeth problems, dry cough, muscle cramps, stress and heart problems [10]. Carica papaya is used for the treatment of malaria, parasitic worms [11] and bacterial infection [13]. Psidium guajava is used for the treatment of dysentery, diarrhea, bacterial infection, cough suppressant, analgesic, fever, colds, flu, sore throat, fungi and malaria. The fruits lower blood sugar level [11]. Diabetes mellitus characterized by persistent hyperglyceamia is the most prominent disease related to failure of blood sugar regulation [14]. Elevated blood glucose levels can also be found in crushing syndrome, liver disease and hyperthyroidism, while decrease glucose levels are present in Addison's disease, hyperinsulinism and hypothyroidsm [15]. In healthy persons, blood glucose levels are controlled by two pancreatic hormones, glucagon and insulin secreted by alpha and beta cells respectively [15]. The other hormones that can influence blood glucose levels are epinephrine, cortisol and growth hormone [16]. The aim of this work was to determine blood glucose level in Wistar albino rats on antimalarial medicinal plants so as to determine its relationship with hyperglyceamia and hypoglyceamia.

MATERIALS AND METHODS

Preparation of the decoction

The plants were washed in water, dried, cut into small pieces, not more than 3cm in length and weighed (Table 1). They were put in a wide mouth container and about 700ml of tap water added to them and boiled for 3 hours. Maintenance of the herbs was achieved by boiling the herbs twice daily for 10 - 30 minutes each. About 50ml tap water was added to the mixture daily. The decoction was filtered with a No 1 Whatmann filter paper and aspirated with a graduated syringe.

Experimental animals

Thirty six Wistar albino rats 12 weeks old, weighing 180±10 g were housed in rat cages in a well ventilated house, temperature of 32±2°C during the day with 12 hr natural light and 24±2°C in the night with 12 hr darkness. The rats had free access to tap water and dry rat pellets obtained from Delta State University Nigeria. The rats were allowed to acclimatize for two weeks before the experiment.

Table 1 Weights of plants immersed in 700ml tap water

Plant	Weight (g)
Carica papaya	130
Azadirachta indica	135
Anacardium occidentale	75
Tilia europoea	50
Cymbopogan citrates	75
Magnifera indica	135
Psidium guava	100

Dosage/Administration

Thirty six rats were divided into six groups. Each group had 6 rats of 3 males and 3 females and were given 0 ml, 0.2 ml, 0.4 ml, 0.6 ml, 0.8 ml and 1 ml of the decoction from the medicinal plant twice daily for 7 days. The animals given 0%, i.e. tap water served as controls. The drug was administered orally with a canula attached a graduated syringe. At the end of 7 days, the rats were weighed and blood samples collected through cardiac puncture under chloroform anaesthesia into fluoride oxalate specimen bottles for glucose estimation.

Biochemical analysis

The blood samples were centrifuged and the plasma analyzed for glucose according to standard biochemical methods.

RESULTS

Table 2 Glucose level and oral administration of the antimalarial medicinal plant decoction

Volume of decoction administered	0ml (Control)	0.2ml	0.4ml	0.6ml	0.8ml	1.0ml
Glucose level (Males) (mmol/l)	4.60±0.35	4.60±0.50	4.55±0.25	4.55±0.45	4.45±0.35	4.48±0.55
Glucose level (Females) (mmol/l)	4.60±0.45	4.65±0.40	4.50±0.45	4.55±0.50	4.45±0.55	4.47±0.45

The blood glucose levels of the control animals on normal diet were not significantly different from the glucose levels in the experimental animals. There was also no difference between the values in the males and female rats. All results were within reference range.

DISCUSSION

The safety assessment of drugs in experimental animals has been very successful in predicting toxicity in humans [17]. The major advantages of preclinical safety assessment studies are the known responses of experimental species, the controlled conditions under which they can be maintained and the establishment of appropriate metrics, which can be applied to extrapolation of findings in laboratory animals to assessment of possible human effects. The blood glucose level in mammals is maintained at a reference range of between 3.6 and 5.8mol/l and it is tightly regulated as a part of the metabolic homeostasis [18]. However, this range may be distorted significantly by forces such as diseases, diet, drugs and medicinal plants. Traditional medicines derived from medicinal plants are used by about 60% of the world's population [14]. Some of the medicinal plants used in this study; Azadirachta indica [5,6], Cymbopogon citrates [9], Mangifera indica [12], Carica papaya [19,20], Anacardium occidentale [21,22] and Psidium guajava [8] when used alone can lower blood glucose level but we have not found significant hypoglyceamia in rats when the herbs were combined. We have also not found hyperglyceamia in the rats. The normoglyceamia may be as a result of interactions between the various constituents of the plants. It may also depend on the dosage administered to the rats and the internal mechanisms of blood glucose regulation by the pancreatic hormones, glucagon and insulin secreted by alpha and beta cells respectively [15] and by epinephrine, cortisol and growth hormone [16]. The rats used in this study were not infected with malaria parasites because this experiment was to form the basis for further studies, not only on humans but on diabetic rats on the medicinal plant decoction. We conclude that moderate oral intake of the antimalarial medicinal plant decoction for 7 days by non diabetic rats did not cause hyperglyceamia or hypoglyceamia. The result of this study will form the basis for further studies on diabetic rats as a prelude to standardized clinical trials of the antimalarial hedrbs.

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