ASSESSMENT OF THE ANTIPROLIFERATIVE POTENTIAL OF Citrullus lanatus (WATER MELON) FRUIT JUICE

ENEGIDE CHINEDU1*, AROME DAVID1, SOLOMON F. AMEH1, UGOCHI ILOMUNANYA2

1Department of Science Laboratory Technology (Physiology & Pharmacology Technology), University of Jos, Jos Nigeria
2Department of Food Science & Technology, University of Nigeria, Nsukka Nigeria
E-mail: chinex.snow@gmail.com

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ABSTRACT

Objective: The aim of this study is to examine the antiproliferative potential of Citrullus lanatus fruit juice on rapidly proliferating cells. Method: The study was done using rapidly proliferating seeds of Sorghum bicolor. The mean lengths (mm) of radicle emanating from seeds of all the groups were measured after 24, 48 and 72 hours respectively. Results: The growth of the methotrexate treated seeds radicle was retarded significantly (P<0.05) through-out the study. The rate of inhibition was 58.17, 77.84 and 88.81% after 24, 48 and 72 hours respectively. C. lanatus fruit juice doses of 40 and 60% v/v gave a significant (P<0.05) radicle growth inhibition after 48 and 72 hours. At 40% v/v dose inhibition rate was 46.48 and 74.81%, while at 60% v/v dose inhibition was 52.01 and 79.33% respectively. C. lanatus fruit juice dose of 80% v/v showed a significant (P<0.05) inhibition of seeds radicle throughout the study. The inhibition rate was 71.24, 88.69 and 95.32% after 24, 48 and 72 hours. Conclusion: The study has unveiled the antiproliferative potential of C. lanatus fruit juice. We therefore propose that further studies on its antiproliferative effect should be carried-out on animal models.

Keywords: Antiproliferative potential, fruit juice, Citrullus lanatus.

INTRODUCTION

Cancer is a genetic ailment which occurs due to accumulated multistep events that have taken place within the culprit cells. This therefore leads to the alteration of the properties and functioning of such cell. Cancer has evolved into a global health terror and it is one of the leading causes of death in the world today. [1] The World Health Organization (WHO) has since identified cancer as one of the most significant cause of death presently, with about 6 million reported deaths in 1996, 11.4 million deaths in 2004, 7.6 million deaths in 2008 and 8.2 million deaths in 2012. However, present postulations reveals that there might be an escalation of cancer mortality to about 15 million by 2030, if nothing is done to arrest the disease. [2, 3] The known hallmarks of cancer include rapid proliferation which is uncontrollable, apoptosis evasion, angiogenesis as well as metastasis. [4] Divers medical treatments/procedures have since been developed by the scientific community to curtail this ailment. Though some form of success have been achieved using these treatments/procedures, they have however not been able to tame the ailment effectively as reports have shown that occurrence and death caused cancer is on the rise. [3] Even the available agents/procedures have significant short-comings like high toxicity, costly and not readily available especially in rural areas. This therefore calls for an urgent development of ideal agents/procedures that will effectively tame this ailment, yet with little or none of the short-comings currently being experienced. It has however been revealed that prevention of cancer still remain the best solution. Literatures have shown that some agents are capable of preventing the occurrence of cancer and are referred to as chemopreventive agents. Chemoprevention can simply be referred to as the use of natural or synthetic agents in prevention of cancer or its progression into an invasive state. Various plant products have been implicated in this, as fruits and vegetables are suspected chemopreventive agents due to their nutrition composition. Citrullus lanatus (water melon) is a vine-like flowering plant belonging to the family Cucurbitaceae. Its fruit has a juicy fleshy mesocarp and endocarp (usually deep red or pink), with a thick outer covering as exocarp (usually greenish with spots of darker green). It is known to be rich in electrolytes (sodium and potassium), minerals (calcium, copper, maganese and zinc), phyto-nutrients (carotene-alpha, crypto-xanthin-beta, lutein-zeaxanthin, lycopene), vitamins (vitamin A, vitamin C, vitamin E, niacine, pantothenic acid, pyridoxine thiamine and folates) and carbohydrate. [5] It is widely consumed for its remarkable nutritional value. However, it is also applied in remediying some ailments traditionly. It is used locally as febrifuge and diuretic agent. It is also used in the treatment of renal stones, dropsy, diarrhoea, gonorrhea and prevention of cardiac attack. [6] Due to its constituent, it is has also been suspected to posses anticancer effect. The aim of this study is to examine the antiproliferative potential of C. lanatus fruit juice on rapidly proliferating cells.

MATERIALS AND METHOD

Materials

Methotrexate injection (Korea United Pharm. Inc., Korea) was purchased from Tarhaf Pharmacy, Jos.

Plant Material

Collection and authentication

C. lanatus (water melon) fruit was harvested from a local garden, identified and authenticated at the Federal College of Forestry Jos by Mr. Jeff Azila.

Extraction

The fruit was washed, and then the exocarp was removed using a sterile knife. After which, the fruit juice was extracted using a manual juice extractor. The resultant juice collected was retained in a sterile vessel and stored at 4 °C till used.

Experimental plant (Sorghum bicolor)

The experimental plant, guinea corn (Sorghum bicolor), was procured from Angwan-rukuba market, Jos. It was subjected to a viability assessment by putting it in a vessel with water. The floating seeds were disposed, while the submerged ones were dried for usage and cleansed with alcohol.

Antiproliferative assessment

The modified Ayinde et al.[7] bench-top assay method was adopted for this study. Methotrexate was prepared to a concentration 50 µg/mL. Different concentrations of C. lanatus fruit juice (40, 60 and 80% v/v) were also prepared. Five (5) sterile Petri dishes were layered with filter paper (Whatman No. 1) and cotton wool. The various dishes were coded in accordance with the treatment its seeds will receive. Twenty (20) seeds of S. bicolor each, were placed in the individual Petri dishes. The control seeds received a treatment of 10 mL distilled water. The methotrexate seeds were however treated with 10 mL of the prepared methotrexate solution. The test seeds were treated with the various C. lanatus fruit juice preparations. Specific Petri dishes
were treated with 10 mL of a definite concentration. The seeds in a specific Petri dish received 40% v/v concentration, another group of seeds in a different Petri dish received 60% v/v, while the group of seeds in the last Petri dish received 80% v/v concentration. All treated seeds in the different Petri dishes were incubated in a dark room. Then the mean lengths (mm) of radicle emanating from the seeds were measured after 24, 48 and 72 hours. The percentage inhibition was calculated as \[\frac{[\text{mean radicle length control} - \text{mean radicle length treated}]}{\text{mean radicle length control}} \times 100\].

Statistical Analysis

The data obtained were expressed as mean ± standard error mean. Two-way analysis of variance and Bonferroni post hoc test were used to test for significance. \(P<0.05\) was considered significant. Graph pad prism (version 5.02) was used for the analysis.

RESULT AND DISCUSSION

![Fig. 1: The growth of guinea corn (Sorghum bicolor) radicle throughout the experiment. Values are Mean ± S.E.M, n=20. * = P<0.05, MTX= Methotrexate, CJL = Citrullus lanatus (watermelon) juice.](image1)

![Fig. 2: Percentage inhibition of Sorghum bicolor seeds radicle by Citrullus lanatus. MTX= Methotrexate, CJL = Citrullus lanatus (watermelon) juice.](image2)

Cancer is a global health tragedy that has continued to draw global attention due to the high mortality it produces yearly. It is now a known fact that agents currently available have not been able to curtail the condition appropriately. Even most of them are known to produce dangerous adverse effects. This has therefore spurred up more research with the aim of producing a more effective agent/procedure with less toxicity. Various researches in the field of epidemiology have revealed that dietary patterns are significantly implicated in the prevention of various ailments such as diabetes, heart disease and even cancer. The intake of various plant products such as vegetables and fruit have been reported to be involved with the lowering of the risk of cancer occurrence. [8, 9, 10] This therefore suggests that some fruits may possess significant anticancer property which can be employed in taming the ailment. It is now known that one of the basic characteristics of cancer cells is high proliferation. The effect of suspected anticancer agents on proliferation has now been adopted as a parameter in testing for the anticancer potential of such agents. Various bench top assay procedures involving rapidly proliferating radicles from seeds as a parameter in the screening of supposed anticancer agents have been employed previously by McLaughlin et al., [12] Shogbaite et al., [11] Ayinde et al., [13] and Chinedu et al. [14] As observed with cancer cells, meristematic cells of seeds (including S. bicolor) shows rapid proliferation under suitable conditions. [7] This explains the use of this procedure for this study.

The result revealed that the control seeds radicle growth rate was high and unhindered throughout the 72 hours of study. This demonstrates the ability of S. bicolor seeds at suitable condition to rapidly proliferate, just like cancerous cells. The growth of the methotrexate treated seeds radicle was however retarded significantly \((P<0.05)\) throughout the study. This upholds its current use as a potent anticancer agent. The rate of inhibition was 58.17, 77.64 and 88.81% after 24, 48 and 72 hours respectively. C. lanatus fruit juice doses of 40 and 60% v/v gave a significant \((P<0.05)\) radicle growth inhibition after 48 and 72 hours. At 40% v/v dose, inhibition rate was 46.48 and 74.81%, while at 60% v/v dose inhibition was 52.01 and 79.33% respectively. However, C. lanatus fruit juice dose of 80% v/v showed a significant \((P<0.05)\) inhibition of seeds radicle throughout the study. The inhibition rate was 71.24, 88.69 and 95.32% after 24, 48 and 72 hours respectively [Fig.1-2]. The effect elicited by the fruit juice was dose dependent as the highest dose gave the best result of the three dose levels. This result therefore shows that C. lanatus fruit juice has a high antiproliferative potential. This effect may however be attributed to the presence of antioxidants (vitamin A, vitamin C, vitamin E, carotene-beta, crypto-xanthin-beta, lutein-zeaxanthin and lycopene) in it. [5, 6] Antioxidants are known for their anticancer properties, and this has been previously documented in various scientific reports. [15, 16, 17, 18, 19] This have led to the recommendation of increased consumption of diets rich in antioxidants (like vegetables, fruits and natural fruit juice) as a non-toxic, convenient and cost-effective method for taming cancer. In line with this, the experimental result has therefore implicated C. lanatus fruit juice as a potential antiproliferative and anticancer agent.

CONCLUSION

The study has unveiled the antiproliferative potential of C. lanatus fruit juice. We therefore propose that further studies on its antiproliferative effect should be carried out on animal models.

REFERENCES