



Effect of banana on blood pressure of hypertensive individuals: a cross sectional study from Pokhara, Nepal.

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Abstract

Background

Hypertension or high blood pressure is a critical condition which can strain the heart, injure blood vessels, leads to augment the risk of heart attack, stroke, kidney problems, and if untreated may cause death. Several herbal approaches have been made to treat hypertensive individuals. Banana is a well known tropical fruit with little known anti hypertensive properties. The objective of this research was to investigate changes in blood pressure after consuming banana among the hypertensive individuals.

Methods

A cross-sectional study design was used to conduct this research. Data was collected by questionnaire and personal interviewing. Two ripened bananas (*Musa acuminata*) were provided to each subject for 20 days. Blood pressures of the participants were taken before and after the experimentation.

Results

Most of the subjects were in the age group >60 years followed by 30-40 years and 51-60 years. 57.1% of the respondents were female. Noticeable changes observed in the pre and post experimentation results. Systolic and diastolic blood pressure was significantly decreased after banana consumption.

Conclusion

Results of this research strongly supports that banana contains phytochemicals, thus its intake significantly reduces blood pressure among hypertensive individuals. However, more clinical studies in human are still required that may provide evidence of efficacy.

Key words

Blood pressure, banana, cardiovascular disease, hypertension, Nepal.



Background

Hypertension or high blood pressure is a condition when blood flows through the blood vessels with a force greater than normal. This is a critical condition which can strain the heart, injure blood vessels, leads to augment the risk of heart attack, stroke, kidney problems, and if untreated may cause death [1]. Globally hypertension is considered as an important risk factor for cardiovascular disease and primary cause of mortality [2]. Worldwide increase in premature death, stroke and heart disease which is considered due to increased blood pressure [3]. In the year 2000, it was estimated that nearly 1 billion people suffers with hypertension and by 2025 there will be an increase to 1.56 billion [4]. This figure shows a huge global economic burden, an estimated cost of US\$370 billion worldwide [5]. A recent systematic review and meta-analysis by Neupane in 2014 showed the current scenario in Asian countries. Prevalence of hypertension in Bangladesh: 17.9%; Bhutan: 23.9%; India: 31.4%; Maldives: 31.5%; Nepal: 33.8%; Pakistan: 25%; and Sri Lanka: 20.9% and surprisingly this is higher among women than men [6].

There are several research conducted in Nepal. A study by Vaidya *et al* in Kathmandu showed that prevalence rate is high and a sharp rise in hypertension was observed in society largely because of changing lifestyle due to socio-economic transition [7]. Another research by Chataut in central development region of Nepal showed that overall prevalence of hypertension was 22.4%, where 40% of them unaware about their status [8].

Medicinal plants are widely used in traditional medicine to treat diseases all over the world. Literatures documented, consumptions of fruits, vegetables, potassium, and vitamin C were significantly lower risk of hypertension (45%, 38%, 46%, and 43% respectively) [9, 10].

Banana is a well known tropical fruit. From its native Southwestern Pacific home, about 600 BC this plant spread to India and later all over the tropical countries. About 300 varieties of bananas are grown, most of them in Asia, Indo-Malaysian and Australian tropics. India, Philippines, China, Ecuador, Brazil, Indonesia, Mexico, Costa Rica, Colombia, Thailand are premier in banana cultivation [11]. Medicinal use of banana is well known. *Musa paradisiaca* and *Musa sapientum* is used in diarrhoea (unripe), dysentery, intestinal lesions in ulcerative colitis, diabetes (unripe), in sprue, uremia, nephritis, gout, hypertension, cardiac disease [12].

Antioxidant activity was observed by Yin *et al*. They observed only after a single banana meal, the resistance to oxidative modification of low density lipoprotein (LDL) was improved. Presence of dopamine, ascorbic acid and other antioxidants was responsible for this change [13].

Antihypertensive activity of the plant reported by Qian H *et al*. They isolated 7, 8-dihydroxy-3-methylisochroman-4-one,

from the fruit peel of *Musa sapientum* [14]. This study was done earlier in *Musa paradisiaca* in albino rats [15]. Later scientists reported that banana diet can reduce mean arterial blood pressure as well as onset preventing effect in rats with elevated blood pressure treated by desoxycorticosterone acetate (DOCA) [16]. Apart from effect in blood pressure, banana inhibits atherosclerosis and gallstones in vivo. *Musa paradisiaca* inhibits cholesterol crystallization, showing this effect [17]. Banana contains large amount of potassium. Approximately, 300mg/100g fresh weight [18]. Experimental evidences suggest that potassium is an important regulator of blood pressure. Altered vascular sensitivity to vasoactive hormones and alterations in divalent cation metabolism playing a key role mediating blood pressure [19]. After extensive review of literature relatively fewer documents found enlighten the blood pressure lowering effect of banana on human subjects [20].

The objective of this research was to investigate changes in blood pressure after consuming banana among the hypertensive individuals.

Material and Methods

Study Period

This study was conducted between 17-03-2015 to 17-04-2015.

Study design and participants.

A cross-sectional study design was used to conduct this study. The present study was conducted in Janapriya Tole, Pokhara, Kaski, Nepal. The sample size was 28 for this study, which included 16 adult males and 12 adult females.

Data collection

Principal investigator of this study collected sociodemographic data personally by distributing the predesigned questionnaires to the participants, which included all sociodemographic information and medical history.

Once they filled the questionnaire correctly, then hypertensive subjects were selected and interviewed personally for further details. Afterwards, two ripened bananas (*Musa acuminata*) were provided to each subject for 20 days. Blood pressures of the participants were taken before and after the experimentation by a mercury sphygmomanometer (ELKO). Subject identity was kept confidential to avoid bias.

Inclusion criteria

All the participants available during data collection time, with a history of hypertension (without medication), willing to participate in this study voluntarily were included.



Exclusion criteria

Persons not willing to take banana, or questionnaires filled incompletely and incorrectly, were excluded. Diabetics & hypertensives under medications, renal disorders, HIV cases, impairment of excretion of potassium in urine with any medical conditions & drug treatment were also excluded.

Ethical committee approval

The permission was taken from ward manager of Pokhara-10. The study was carried out after the approval obtained for community health nursing field postings in 2015 (Jan- April). Verbal informed consent was obtained from all the participants before data collection after clearly mentioning objectives of the study. The present research was completed according to the declaration of Helsinki (Latest version).

Outcome variable

Blood pressure of the participants was set up as outcome variable.

Explanatory variables

The demographic factors age, caste, religion, education, occupation, income, were considered as explanatory variables.

Data management and statistical analysis

Data analysis and interpretation was done by descriptive statistics with the use of Statistical Package for Social Science (SPSS) software, version 16. Paired t test was performed to observe the association between pre and post experimentation results.

Results

Table – 1 Sociodemographic details n(%)

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Age (years)	
30- 40	8(28.6)
41 to 50	2(7.1)
51 to 60	5(17.9)
>60	13(46.4)
Total	28(100.0)
Gender	
female	16(57.1)
male	12(42.9)
Ethnicity	
Brahmin	6(21.4)
Chettri	3(10.7)
Janajati	19(67.9)
Total	28(100.0)

Table – 1 explains the sociodemographic details of the participants. Most of them were in the age group >60 years followed by 30-40years and 51-60years. 57.1% of the

respondents were female. Janajati was the most common (67.9%) ethnic group followed by Brahmin and Chettri.

Table – 2 Changes in blood pressure (mmHg) before and after experimentation (mean±SD)

	Pre	Post	P value
Systolic	146.17±4.26	140.32±3.17	0.03*
Diastolic	92.25±3.34	86.21±2.21	0.01*

P<0.05 statistically significant

Table – 2 shows changes in blood pressure before and after experimentation. There are noticeable changes observed in the pre and post experimentation results. Systolic and diastolic blood pressure was decreased after banana consumption. All results were statistically significant.

Discussion

Hypertension is a most common cardiovascular disorder, major challenge for us. In our study, we observed that there was a decrease in systolic and diastolic blood pressure, after banana administration. There are few animal studies and one human experimentation supported our work. An earlier experimentation by Perfumi *et al.* in 1994, reported the antihypertensive effect of ripe banana pulp in deoxycorticosterone enantate-induced hypertensive rats. Authors mentioned that effect may be due to the high tryptophan and carbohydrate content of banana that increases serotonin levels and showed serotonin-mediated natriuretic effect [21]. Sarkar *et al* reported that banana decreased the rise of both systolic and diastolic blood pressure in healthy individuals subjected to cold stress test [20].

However, in the year 1997 Scientist Orié reported that instead of relaxation, serotonin induces contraction in isolated rat aortic rings. The aqueous extract of the ripe *Musa paradisiaca* fruit elicited hypotensive effect in both noradrenaline and potassium chloride-contracted aortic rings isolated from rat. Authors concluded the effect as a non-specific interference in calcium ion availability required for the smooth muscle contraction which results in relaxation [22].

Results of our study could be connected with diuretic activity due to banana intake. Animal experimental studies with ash of the peel of *Musa sapientum* showed an increase in urine volume and electrolyte excretion comparing with normal saline in a study in rats. Successive ethanolic extract also showed the same effect [23]. A number of phytochemicals such as saponin, flavonoids and terpenoids may be responsible for this effect [23, 24-26].

A sustained drop of blood pressure could be due to potassium ions, which is present in a higher quantity in banana. A human experiment showed that eating 2 servings



of bananas increases $[K^+]_p$ at 30 and 60 minutes post ingestion [27].

A meta-analysis of 10 prospective studies by Larsson *et al*, showed a statistically significant inverse association between potassium intake and risk of stroke. An increment of 1000 mg/day in potassium intake was found to be associated with an 11% reduction in risk of total stroke and ischemic stroke [28].

Conclusion

Results of this research strongly supports that banana contains phytochemicals, thus its intake reduces blood pressure significantly among hypertensive individuals. However, more clinical studies in human are still required that may provide evidence of efficacy.

Limitations & future scope of the study

This is a cross-sectional study with limited number of hypertensive subjects. The present study was not funded. Conducting broad spectrum multi-centric studies in future with an increase in the treatment period by the fruit could uncover the brighter prospect. Furthermore, bioactive constituent(s) needs to be isolated and further in vivo studies strongly recommended to confirm our claims by understanding the molecular mechanism and this approach could be helpful for the development of new drugs.

Abbreviations

Desoxycorticosterone acetate (DOCA), low density lipoprotein (LDL)

Competing interests

Authors declare that they do not have any competing interest.

Authors' contribution

Ms. Gnanakshi. Dayanand Dr. Arpana Sharma, Mr. Meraj Ahmed, Mrs. Parimala Paran Jyothi and Ms. Mercy Rani Mrs. Sakun Singh took part in review of literature, designing the study, constructed the questionnaire, interpreted the data, drafted the manuscript, and revised it. Ms. Gnanakshi. Dayanand conducted the research, formulated and analyzed the data. All authors took part in critical revision and approved the final manuscript.

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