Pattern of use of water beverage of *Hibiscus sabdariffa* Linn in a University community in Southwest Nigeria

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ABSTRACT

Background: Water beverages of *Hibiscus sabdariffa* is widely consumed in many parts of the world.

Objective: Its pattern of use in a University community in southwest Nigeria was studied.

Methods: A questionnaire-guided survey was conducted among randomly selected staff (398) and students (910) of University of Ibadan on the use of water beverage of *Hibiscus sabdariffa* (WBHS). The questionnaire garnered information on pattern of use, side effects experienced, and drugs coadministered with WBHS. Descriptive statistics, Chi-square, and Fisher's Exact Probability tests were used to describe the association between categories of participants and indications for using and side effects experienced with WHBS.

Results: Most (96.9%) respondents who had used WBHS, used it as a relaxant 382(29.2%), as an antihypertensive 318(24.3%), for weight reduction 140(10.7%), infertility 127(9.7%), to cure liver disease 87(6.7%), and for the management of diabetes 151(11.5%). Side effects experienced with its use were; diarrhea 69(5.3), dizziness 44(3.4%), insomnia 27 (2.1%), decreased libido 24(1.8%), blurred vision 16(1.2%),and headache 19(1.5%).Some of the participants 164(12.5%) coadministered WBHS with their medications such as antibiotics 51(3.9%), antihypertensives 24(1.8%), antipsychotic 18(1.4%), antilipidemic drugs 16(1.2%), and antiretroviral drugs 11(0.8%). Out of those who coadministered WBHS with their medications, 93(7.1%) were on chronic medications.

Conclusion: Water beverage of *Hibiscus sabdariffa* is used to treat diverse diseases with attendant side effects and is sometimes coadministered with medications for chronic diseases. This may predispose users to herb-drug interactions. Thus there is a need to investigate some of the drugs co-administered with the beverage for possible herb-drug interaction.

Key words: *Hibiscus sabdariffa*, Herb, Side effect, Beverage, Herbal drink.

Mode d'utilisation de la boisson d'eau de *Hibiscus sabdariffa* Linn dans une communauté universitaire dans le sud-ouest du Nigeria

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RESUME

Contexte: Les boissons d'eau à base de *Hibiscus sabdariffa* sont largement consommées dans de nombreuses régions du monde.

Objectif: Son mode d'utilisation dans une communauté universitaire dans le sud-ouest du Nigeria a été étudié.

Méthodes: Un sondage guidé par questionnaire a été mené auprès d'un personnel sélectionné au hasard (398) et des étudiants (910) de l'Université d'Ibadan sur l'utilisation de la boisson d'eau à base de *Hibiscus sabdariffa* (WBHS). Le questionnaire a recueilli des informations sur le mode d'utilisation, les effets secondaires rencontrés et les médicaments conjointement administrés avec WBHS. La statistique descriptive, le Chi-carré et les tests de probabilité exacte de Fisher ont été utilisés pour décrire l'association entre les catégories de participants et les indications pour l'utilisation et les effets secondaires rencontrés avec le WHBS.

Résultats: La plupart (96,9%) des répondants qui avaient utilisé WBHS, 382 (29,2%) l'ont utilisé comme relaxant, 318 (24,3%) comme anti-hypertensif, 140 (10,7%) pour la réduction de poids, 127 (9,7%) contre l'infertilité, 87 (6,7%) pour guérir la maladie de foie et 151 (11,5%) pour la prise en charge du diabète. Les effets secondaires rencontrés avec son utilisation étaient: diarrhée avec 69 (5.3), vertiges avec 44 (3,4%), insomnie avec 27 (2,1%), diminution de la libido avec 24 (1,8%), vision floue avec 16 (1,2%) et maux de tête avec 19 (1,5%). Certains participants, soit 164 (12,5%), ont conjointement administré la WBHS avec leurs médicaments tels que les antibiotiques avec 51 (3,9%), les antihypertenseurs avec 24 (1,8%), les antipsychotiques avec 18 (1,4%), les médicaments anti-lipidémies avec 16 (1,2%) et les antirétroviraux avec 11 (0,8%). Parmi ceux qui ont conjointement administré WBHS avec leurs médicaments, 93 (7,1%) étaient sous traitements chroniques.

Conclusion: La boisson d'eau à base de *Hibiscus sabdariffa* est utilisée pour traiter diverses maladies avec des effets secondaires fréquents et est parfois administrée en conjonction avec des médicaments contre les maladies chroniques. Cela peut prédisposer les utilisateurs à des interactions herbe-médicament. Ainsi, il est nécessaire d'enquêter sur certains des médicaments conjointement administrés avec la boisson pour une éventuelle interaction herbe-médicament.

Mots clés: *Hibiscus sabdariffa*, herbe, effet secondaire, boisson, boisson à base de plantes.

INTRODUCTION

Herbs are taken as powdered products, standardized extracts, tinctures or as beverages; however, herbal beverages are quite popular worldwide due to perceived beneficial effects.[1–3] The water beverage of *Hibiscus sabdariffa* is very popular in Nigeria and is used for entertainment at social gatherings and taken as cold beverages.[4–6] The calyces of *Hibiscus sabdariffa* is also cooked as vegetable, prepared as teas and jams and used as preservatives.[7]The tea made from the calyces of *Hibiscus sabdariffa* is called "Rosselle" in Mexico, "Karkade" in Germany, Egypt, Saudi Arabia and Sudan, "Sorrel" in the Caribbean and Latin America while in China it is called "Luo Shen Hua." In Nigeria, the vegetable made from the calyces is referred to as "Isapa pupa" while the beverage made from the calyces is called "Zobo" in the south-western part of the country, and "Soborodo" in the northern part. The plant is an annual or perennial herb which is native to the tropics. It could grow up to 0.5–2.5 meters tall and takes about six months to mature.[7,8]

Water beverage of *Hibiscus sabdariffa* has been in use for decades with folkloric claims of its effectiveness in the treatment of diverse ailments, such as hypertension, liver diseases, kidney disease, constipation, fever, and cancer.[7] Many of these uses have been confirmed in various animal and human studies showing that it has antihypertensive effect in humans, antioxidant properties, hypercholesterolemic and hepatoprotective effect in animals.[9–15] Literature is however scanty on the pattern and extent of use of water beverage of *Hibiscus sabdariffa* or for its medicinal use in any community. This present study therefore surveyed the use of water beverage of *Hibiscus sabdariffa* in a University community in southwest Nigeria where it is widely taken.

METHODS

Study setting

The study was carried out in the University of Ibadan. The University was established in 1948 and is situated in Ibadan, a major metropolitan city in southwest Nigeria. At the period of the study, the University had fourteen faculties and twelve halls of residence for both undergraduate and postgraduate students. The study was conducted in the halls of residence for students and in offices and duty posts for members of staff.

Study design

This was a cross-sectional exploratory survey among the staff and students of the University of Ibadan. The study was carried out between August and November 2012.

Study population

The study population consisted of undergraduates and postgraduate students, teaching and non-teaching staff of the University of Ibadan. The non-teaching staff included in the study were administrative staff, registry staff, technicians, technologists, and security agents.

Sample size

The total number of academic staff, non–academic staff and students in the institution in 2011/2012 academic session were 1364, 1334, and 13,823 respectively. The sample size required was determined to be 300, 299, and 374 for teaching staff, non-teaching staff and students, respectively using Krejcie and Morgan formula for determining sample size.[16]

Inclusion and exclusion criteria

Every bonafide student of the rooms visited in the halls of residence and members of staff in the selected departments who consented to take part in the study was included. However, students who were not in their allocated rooms at the time of the distribution of questionnaire were not included in the study to avoid duplication. Friends and visitors of the legal occupants of each room were also excluded from the study. Traders and other members of the University community who were not students, teaching or non-teaching staff were excluded from the study.

Study instrument

The structured questionnaire used was pretested among twenty one staff and students (11 students, 6 non-teaching staff and 4 teaching staff) randomly selected in the Faculty of Pharmacy and Department of Biochemistry. The comments and outcome of the pretest were used to modify the questionnaire for face and content validity. Options such as the frequency of use of water beverage of *Hibiscus sabdariffa*, and reasons why participants used the beverage were added to the questionnaire. Effect of use of the beverage with other medications, and list of diseases that the participants used the beverage to manage were also added to elicit the required responses from the participants. The final questionnaire had 18 questions with sections on demographic data like age, sex, religion, level of study, status in the university (whether staff or student), and previous academic qualifications. Other sections in the questionnaire contained questions on the extent and pattern of use of water beverage of *Hibiscus sabdariffa*, indication and side

effects experienced with the usage of the beverage, and drugs usually coadministered with it.

Sampling method and procedure

Purposive sampling method was used in administering the questionnaire in the halls of residence. Each hall of residence had an average of 56 rooms while each room in the ten halls of residence for undergraduate students was usually occupied by four students of unrelated disciplines. The two postgraduate halls housed two students per room. Distribution of questionnaire was done from one room to another and from one hall of residence to another. The occupants of each room were approached and their consent to participate in the study obtained after detailed explanation of the study. Only students who consented to participate were given questionnaires to fill. In cases where the occupants of the room declined consent or where the room was locked, the next available room was visited. The last room visited for the day was marked for continuity the next day. Completed questionnaires were retrieved from the students on the same day of distribution.

For teaching and non-teaching staff, departments surveyed were randomly selected using a table of random numbers to select one department from each of the fourteen faculties. However, in faculties like Pharmacy with one academic program all the staffs in the various departments in the faculty were approached for participation in the study.

Non-teaching staff such as technicians and technologists, administrative staffs, security staff etc., were approached at their duty posts. Questionnaires were distributed to participants and retrieved on subsequent days. For teaching staff, the questionnaire was distributed through the secretaries in the randomly selected departments in each faculty. Retrieval of questionnaires was also done the next day through the departmental secretaries.

Ethical consideration

The study protocol was approved by the University of Ibadan/University College Hospital Ethical Review Committee with approval number UI/EC/12/0150.

Data analysis

Data were analyzed with Statistical Package for Social Sciences (SPSS), Windows version 20.0. Descriptive statistics were used to evaluate the distribution of the participants' demographics. Pearson Chi-square statistics and Fisher's Exact Probability tests were used to detect associations between gender, self-reported indications, and side effects experienced with the usage of water beverage of *Hibiscus sabdariffa*. Relative risk ratio was also used to identify gender-associated self-reported side effects. Level of significance was set at $p < 0.05$.

RESULTS

The participants' age ranged from 16 - 65 years with a mean of 26.67 ± 9.79 years. Most of the participants were students 910 (69.6%), and female participants were slightly more 630 (50.7%) than male participants. Other demographic characteristics of the participants are shown in Table 1. Though, the number of people who had taken water beverage of *Hibiscus sabdariffa* prior to the study was high, 1267 (96.9%), about 40 (3.1%) of the participants had never taken water beverage of *Hibiscus sabdariffa*.

Table 1: Demographic characteristics of the study participants

Variables	Frequency (%)
Sex (n = 1243)	
Male	613 (49.3)
Female	630 (50.7)
Status (n = 1308)	
Staff	398 (30.4)
Student	910 (69.6)
Educational level (n = 1253)	
Primary	11 (0.9)
Secondary	895 (71.4)
Tertiary	203 (16.2)
Postgraduate	144 (11.5)
Marital status (n = 1265)	
Not married	940 (74.3)
Married	313 (24.7)
Divorced	4 (0.3)
Separated	4 (0.3)
Widowed	4 (0.3)
Religion (n = 1269)	
Christianity	1058 (83.4)
Islam	207 (16.3)
Traditional	4 (0.3)

n – Number of participants who responded to the question.

The frequency of consumption of water beverage of *Hibiscus sabdariffa* as described by the participants were; occasionally 1012 (77.4%), once a week 128 (9.8%), twice a week 89 (6.8%) and daily 38 (2.9%). Majority of the participants 1209 (92.4%) take it as water extract of calyces of *Hibiscus sabdariffa* (popularly referred to in the south-western and northern part of Nigeria as "Zobo" and "Soborodo", respectively), while 32 (2.4%) participants take it as an alcoholic extract. The various ways of flavouring water beverage of *Hibiscus sabdariffa* ("Zobo") were with sugar 735 (56.2%), garlic 235 (18.0%); ginger 608 (46.5%); honey 315 (24.1); artificial sweeteners such as aspartame117 (8.9%), and clove 2 (0.2%).

Some of the reasons adduced by the participants for taking water beverage of *Hibiscus sabdariffa* included its use as a relaxant 382 (29.2%), to lower blood pressure 236 (18.0%), to lower blood cholesterol 181 (13.8%), to lower blood glucose 151 (11.5%) and other indications listed in Table 2. Significant statistical differences were noticed between staff and students on some of the reasons for using water beverage of *Hibiscus sabdariffa*. For example, students use water beverage of *Hibiscus sabdariffa* more than staff as a form of relaxant, p=0.002 (Table 2) while staff use water beverage of *Hibiscus sabdariffa* to manage diseases such as hypertension (p=0.001) and to lower blood cholesterol (p=0.045), more than students (Table 2).

Table 2: Differences between staff and students on the reasons why people take water beverage of *Hibiscus sabdariffa*

Indications	Frequency (%)			P-value (2-tailed)[a]
	Total	Staff	Students	
As a beverage	706 (54.0)	186 (46.7)	520 (57.1)	0.001*
Source of vitamin C	440 (33.6)	146 (36.7)	294 (32.3)	0.127
As a relaxant	382 (29.2)	94 (23.6)	290 (31.9)	0.002*
Hematinic	318 (24.3)	105 (26.4)	213 (23.4)	0.263
To lower blood pressure	236 (18.0)	97 (24.4)	139 (15.3)	0.001*
To improve vision	223 (17.0)	57 (14.3)	119 (13.1)	0.539
To reduce blood cholesterol level	181 (13.8)	67 (16.8)	114 (12.5)	0.045*
To aid sleep	164 (12.5)	67 (16.8)	97 (10.7)	0.003*
To lower blood glucose level	151 (11.5)	50 (12.6)	101 (11.1)	0.453
For weight reduction	140 (10.7)	40 (10.1)	100 (11.0)	0.697
To relief constipation	139 (10.6)	47 (11.8)	92 (10.1)	0.380
To improve fertility	127 (9.7)	51 (12.8)	76 (8.4)	0.015*
To heal haemorrhoid	87 (6.7)	31 (7.8)	56 (6.2)	0.279
To cure liver disease	87 (6.7)	33 (8.3)	54 (5.9)	0.118
To cure kidney disease	84 (6.4)	29 (7.3)	48 (5.3)	0.161
To relief ulcer pain	84 (6.4)	29 (7.3)	55 (6.0)	0.393
To improve sexual performance	77 (5.9)	32 (8.0)	45 (4.9)	0.040
To relief dysmenorrhea	61 (4.7)	18 (4.5)	40 (4.4)	0.885
To regulate irregular menstruation	61 (4.7)	22 (5.5)	39 (4.3)	0.322
To ease child birth	47 (3.6)	22 (5.5)	25 (2.7)	0.016

**P<0.05, [o]Chi square test*.

Two hundred and ten participants (16.1%) reported experiencing side effects after taking the beverage. Some of these side effects are shown in Table 3 and include diarrhoea 69 (5.3%), dizziness 41 (3.1%), tiredness 29 (2.2%) and blurred vision 16 (1.2%) with no significant differences among staff and students except for stomach upset where staff experienced more often than students (Table 3).

Out of the participants surveyed, 164 (12.5%) reported they sometimes used water beverage of *Hibiscus sabdariffa* to take their medicines. The classes of drugs usually coadministered with water beverage of *Hibiscus sabdariffa* as reported by the participants were analgesics 71 (5.4%), antibiotics 51 (3.9%), antihypertensives 24 (1.8%), antilipidemics16 (1.2%), oral hypoglycemic agents 13 (1.0%) and others listed in Table 4. About 93 (7.1%) of the participants who use the beverage to take their medicines were on chronic medication and the medicines taken daily by these participants included Amiloride + hydrochlorothiazide, Nifedipine, Low-dose aspirin, Piroxicam, Atenolol, Lisinopril, Omeprazole, Amlodipine, Cotrimoxazole, Ramipril, Ibuprofen, Glibenclamide, Metformin and Telmisartan. Of the 93 (7.1%) participants who were on chronic medication(s), 18 (19.4%) reported that taking water beverage of *Hibiscus sabdariffa* with their medications had caused them some discomfort such as stomach ache 4 (22.2%), diarrhoea 3 (16.7%); dizziness 1 (5.6%) and headache 1 (5.6%).

Less than half of these discomforts had resulted in hospitalisation; however, the duration of hospitalisation was not disclosed. One-third of the participants surveyed 453 (34.6%) considered water beverage of *Hibiscus sabdariffa* as medicinal.

Table 3: Differences between staff and students on side effects experienced with water beverage of *Hibiscus sabdariffa*

Side effects	Frequency (%)			Relative risk ratio	95% confidence interval	P-value 2-tailed[a]
	Total	Staff	Student			
Diarrhoea	69 (5.3)	21 (5.3)	48 (5.3)	1.000	0.607 - 1.648	1.000
Excessive menstruation	44 (3.4)	15 (3.8)	29 (3.2)	1.183	0.641 - 2.181	0.618
Dizziness	41 (3.1)	13 (3.3)	28 (3.1)	1.062	0.556 - 2.028	0.864
Vomiting	40 (3.1)	10 (2.5)	30 (3.3)	0.762	0.376 - 1.544	0.491
Tiredness	29 (2.2)	11 (2.8)	18 (2.0)	1.397	0.666 - 0.415	0.415
Insomnia	27 (2.1)	8 (2.0)	19 (2.1)	0.963	0.425 - 2.181	1.000
Decreased libido	24 (1.8)	10 (2.5)	14 (1.5)	1.633	0.732 - 3.645	0.263
Headache	19 (1.5)	5 (1.3)	14 (1.5)	0.817	0.296 - 2.252	0.806
Blurred vision	16 (1.2)	8 (2.0)	8 (0.9)	2.286	0.864 - 6.049	0.102
Menstrual Irregularity	15 (1.1)	7 (1.8)	8 (0.9)	2.001	0.730 - 5.479	0.170
Stomach upset	12 (0.9)	0 (0.0)	12 (1.3)	-	-	0.023*
Throat irritation	6 (0.5)	0 (0.0)	6 (0.7)	-	-	0.186
Black/greyish faeces	6 (0.5)	1(0.3)	5 (0.5)	0.457	0.054 - 3.901	0.674
Excessive urination	3 (0.2)	0 (0.0)	3 (0.3)	-	-	0.558
Discolouration of tongue	2 (0.2)	1 (0.3)	1 (0.3)	2.286	0.143 - 36.463	0.516
Excessive sleep	1 (0.1)	1 (0.3)	0 (0.0)	-	-	0.304
Chest pain	1 (0.1)	0 (0.0)	1 (.10)	-	-	1.000

**P<0.05, [a]Chi square test or Fisher Exact Probability test.*

Table 4: Classes of drugs co-administered with water beverage of *Hibiscus sabdariffa* by participants

Class of drugs	Frequency (%)		
	Total	Staff	Students
Analgesics	71 (5.4)	23 (5.8)	48 (5.3)
Antimalarials	69 (5.3)	22 (5.5)	47 (5.2)
Antibiotics	51 (3.9)	9 (2.3)	42 (4.6)
Antihypertensives	24 (1.8)	14 (3.5)	10 (1.1)
Antiulcer drugs	19 (1.5)	7 (1.8)	12 (1.3)
Antipsychotics	18 (1.4)	8 (2.0)	10 (1.1)
Drugs for haemorrhoids	18 (1.4)	8 (2.0)	10 (1.1)
Antilipidemics	16 (1.2)	9 (2.3)	7 (0.8)
Cardiovascular disease drugs	16 (1.3)	10 (2.5)	6 (0.7)
Antiasthmatics	15 (1.1)	8 (2.0)	7 (0.8)
Antihyperglycemic agents	13 (1.0)	4 (1.0)	9 (1.0)
Antituberculous drugs	11 (0.8)	5 (1.3)	6 (0.7)
Antiretrovirals	11 (0.8)	5 (1.3)	6 (0.7)

DISCUSSION

This study conducted among staff and students of the University of Ibadan, a diverse mixture of people from various socio-cultural, ethnic, and political background, showed that majority of the participants (>90%) had taken or still take water beverage of *Hibiscus sabdariffa* for different reasons. Though most people reported taking it as a beverage, others use it to treat acute and chronic illnesses such as anemia, hypertension, diabetes, hyperlipidemia, liver disease, hemorrhoid, kidney disease etc. Some pharmacological properties relating to reported indication of water beverage of *Hibiscus sabdariffa* in this survey such as hypertension and liver diseases have previously been confirmed by various animal and human studies. Some of these studies include hepatoprotective effects in paracetamol-induced hepatotoxicity[17] and cadmium-induced hepatotoxicity in rats.[18] Animal studies have also substantiated the effectiveness of the extracts of *Hibiscus sabdariffa* in the management of hypertension in spontaneously hypertensive rats[13,19] and anaesthetized rats.[20] The tea of *Hibiscus sabdariffa* also showed antihypertensive activity in a dose-dependent manner in a human study by reducing both systolic and diastolic blood pressure by 11.0 % within 12 days.[21] It was as effective as captopril and lisinopril in patients with mild to moderate hypertension.[12,22]

Other studies have also confirmed the effectiveness of extracts of *Hibiscus sabdariffa* in lowering lipid profile parameters as reported by participants in this study. Studies in animals and humans showed that the extracts of *Hibiscus sabdariffa* were effective in reducing lipid profile in fructose-fed rats[23], hypercholesterolemic rats[24], and in patients with metabolic syndrome.[25] Other self–reported indications by the participants included its use to improve vision, enhance sexual performance, and regulate menstruation, which are yet to be confirmed by either animal or human studies. Nevertheless, one of the uses of water beverage of *Hibiscus sabdariffa*, which is relaxation, has been confirmed in an animal study which reported that aqueous extract of *Hibiscus sabdariffa* had anxiolytic properties.[26] This explains why participants use the beverage for relaxation.

Though, herbal medicines are perceived to be safe,[1,2] they are not without side effects and adverse drug reactions.[27,28] This was found to be true in this study as participants reported some side effects as a result of the use of water beverage of *Hibiscus sabdariffa*. Some of the side effects mentioned by the participants included diarrhea, vomiting, dizziness, insomnia, tiredness and decreased libido. These side effects especially insomnia, tiredness and dizziness may hinder the physical activity of the user of the beverage while vomiting and diarrhea, if protracted may cause volume depletion, ion imbalance, disorientation, confusion, and hypovolemic shock. In two toxicity studies,[26,29] it was reported that the chronic administration of high dose of aqueous extract and lower doses of the residual water soluble fraction of *H. sabdariffa* calyces resulted in severe weight loss accompanied with diarrhea. This may partly explain the side effect of diarrhea experienced by the participants in this study.

Participants coadministered water beverage of *Hibiscus sabdariffa* with conventional drugs and some reported experiencing side effects as a result of the concomitant use of the herb and drug. Herb-drug interactions have been shown to result from the use of juices with drugs[30,31] and herbs with drugs.[31] Grape fruit juice has been shown to inhibit intestinal CYP3A4 and other enzymes and when coadministered, it caused a 0% (pravastatin) – 1440% (lovastatin/simvastatin) change in area under the plasma-concentration time curve of the coadministered drugs.[30] Other type of juices such as apple juice and orange juice have also been shown to affect transporters such as P-glycoprotein and organic anion transporting polypeptide (OATP) with drugs such as cyclosporine and fexofenadine.[30] In a similar manner, water beverage of *Hibiscus sabdariffa* has also been shown to interact with drugs like acetaminophen, diclofenac, and chloroquine[4,6,35] when concurrently administered. The reported interactions suggest that the beverage could elicit herb-drug interaction which may lead to untoward effect perhaps as reported by some participants in this study, or therapeutic failure or sometimes toxic reactions.

The participants in the survey might not be representative of the Nigerian population since the study was conducted in a University community. Also, the cross-sectional study design and the convenience sampling method used in this survey may affect the extrapolation and the generalizability of the findings, thus this should be taken into consideration when interpreting the results.

CONCLUSION

Water beverage of *Hibiscus sabdariffa* is used for the management of acute and chronic diseases among staff and students of the University of Ibadan. It is also sometimes coadministered with drugs used for treating chronic diseases, with a potential to cause adverse effects. There is a need to investigate some of the drugs coadministered with the beverage for possible herb-drug interactions.

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