



## Awareness of Physicians Regarding Flavonoids Rich Diets and Hypertension in PHCs, Riyadh, Saudi Arabia

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### Abstract

**Background:** Consumption of flavonoids rich diet has been linked to the reduction of blood pressure. Physicians awareness of such effect can be important in hypertension control.

**Objectives:** The study aims to assess primary care physicians' knowledge about flavonoids effect in reducing blood pressure. Also, it aims to investigate the patterns of advising hypertensive patients in regards to flavonoids rich diet.

**Methods:** We conducted a cross-sectional study at Prince Sultan Military Medical City in Riyadh, KSA. A self-administrated questionnaire was distributed to 180 primary care physicians. A final 156 collected which gives a response rate of 86.7%. Descriptive statistics and regression analysis were used in the data analysis. The data analysis was conducted using IBM SPSS version 23 package.

**Results:** The results show a poor level of knowledge among primary care physicians about flavonoids effect in reducing hypertension. The average score for the questions is 28.3%. The pattern of practice shows that most physicians are advising their patients to consume vegetables and fruits. However, flavonoids rich diet is not monitored by the physicians on hypertensive patients.

**Conclusion:** There is poor level of knowledge about flavonoids and its effect on hypertension among primary care physicians and this need lectures to raise their awareness level. Therefore, better physicians' awareness and more advising about flavonoids rich diet can lead to better management of the hypertension.

**Keywords:** Flavonoids; Hypertension; Awareness

### Introduction

Dietary flavonoids consist of a diverse range of polyphenolic compounds that occur naturally in plant foods. There is a subclassification of flavonoids due to the range and structural complexity as flavonols, flavones, flavanones, flavan-3-ols (and their oligomers, proanthocyanidins), isoflavones, and anthocyanins [1]. They are present in significant amounts in many commonly consumed fruits, vegetables, grains, herbs, and beverages [2].

*In vitro* studies showed that flavonoids manifest certain biological activities that can potentially have cardioprotective properties, such as antioxidant, and anti-inflammatory effects and induction of apoptosis [3].

These biological activities encouraged numerous researchers to conduct studies with aims to reveal the beneficial effects of flavonoids on a wide range of health conditions [4-8]. One of the main areas of interest is the flavonoids cardioprotective and

antihypertensive effects. However, the epidemiological evidence of these effect yielded mixed results. Some studies supported the protective effect of flavonoids [9-11], while other studies did not support such evidence [12-14]. In 2008, a meta-analysis of 133 clinical trials 2 concluded that no evidence of flavonoids effect of reducing the overall mortality and morbidity of cardiovascular diseases (CVD), but there is statistically significant evidence of the effect of certain flavonoids classes in reducing blood pressure [15].

In this study, we aim to assess the knowledge and attitude of primary care physicians regarding flavonoids rich diet and lowering blood pressure, and their pattern of advising patients to use flavonoids rich diet in lowering blood pressure.

### Literature Review

The literature review was conducted with the aim to find studies that have the same scope of our study. We used different combinations of keywords in databases (PubMed, Medline, Google scholar, and google search engine) such as “flavonoids, flavones, quercetin, flavonoids rich diet, primary care, physicians, healthcare, healthcare workers, awareness, advice, hypertension, antihypertension, hypertension control, herbal medicine, and alternative medicine.” As far as our search is concerned, we could not find studies with the same objective about assessing the physicians’ knowledge about the role of flavonoids in controlling hypertension nor studies that aims to assess the patterns of advising patients about flavonoids rich diet in controlling hypertension. Also, there are no studies that assessed the knowledge about flavonoids in settings other than primary care.

The consumption of rich in flavonoids food have been the subject of several studies. Several studies assessed the risk-benefit of consuming dietary flavonoids. Cocoa is one of the main flavonoids rich food that is investigated intensively in the literature [2,16-18].

Cocoa can be consumed as dark chocolate (contains 70% cocoa or more) [19]. In a controlled clinical trial, 15 days of consuming dark chocolate reduced blood pressure in glucose intolerant hypertensive patients [20]. Another study showed that incorporating dark chocolate in with diet for a short term can reduce blood pressure [21]. Other sources like tea (green and black) found also to were investigate in the literature [22-24]. Green tea was found to be more effective than black tea in reducing

blood pressure but less effective than cocoa [23]. Other sources like citrus, nuts, red onion, blueberries, and parsley were less investigated in literature. However, they have been listed as main sources of flavonoids by the USDA [2].

Research question was Are the primary care physicians aware about flavonoids rich diet and it’s effect in lower blood pressure?

Objectives of the study were: 1- To assess knowledge and attitudes of primary care physicians regarding flavonoids rich diet to lower blood pressure. 2- To describe physicians practice of advising patients to use flavonoids rich diet in lowering blood pressure.

The Aim of study to improve patients care by raising awareness of the primary care physicians about benefits of flavonoids rich diet in lowering blood pressure.

### Methods

This section describes the methodology that is used to through out the study. This section includes descriptions for the study area, inclusion and exclusion criteria, study design and sampling method, and the research tool.

#### Study area

The study was conducted at PSMMC in the Saudi capital city of Riyadh. The medical city is one of the largest in country. It is operated by the Military Medical Services the second largest health provider in the country.

#### Inclusion criteria

- Family physicians (Consultants, senior registrars, registrars, and residents)
- General Practitioners
- Senior House Officers
- Working at PSMMC
- Agrees to fill the questionnaire

#### Study design and sampling method

The study design is cross-sectional. We conducted a convenient survey for all the available family physicians at PSMMC. The sample size calculation for the minimum sample size:

The study will include the primary care physicians from the Department of Family Medicine in PSMMC. There are about 335 primary care physicians at PSMMC.

2

Z= 1.96 (Confidence level at 95%)

p = 0.5, the assumed prevalence of knowledge.

δ = 0.06 the error tolerance

$$= \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2} = 377$$

Since there are only 268 physicians available, then the sample size become

$$\text{New Sample size} = \frac{268}{1 + \frac{268 - 1}{377}} = 159$$

We added 10% for non-response and incomplete data, then the total sample size required is 175.

### The research tool

The research tool is self-administrated questionnaire developed by the researcher. The first part of the questionnaire is general information and the participant’s characteristics. The second section consisted of 10 knowledge question about flavonoids. The second section consisted of four statements about the physicians’ practices regarding advising patients with flavonoids rich food. The final part of the questionnaire consisted of multiple choice question about the reasons for physicians not advising their hypertensive patients to consume food rich with flavonoids. We describe the development and validation of the questionnaire in the next section.

### The questionnaires

The questionnaire was developed through extensive literature review about the role of flavonoids in lowering hypertension. Also, in the development of the questionnaire we reviewed the current existing literature about flavonoids rich food. The questionnaire content validity and face validity were established through the revision of four consultants separately. Additionally, a biostatistician was consulted to establish the psychometric properties of the questionnaire.

The second phase used statistical reliability and validity tests. The questionnaire was distributed to 20 family physicians from

primary health care center operated by the security forces hospital. The physicians were asked to re-do the questionnaire after 2 weeks. The reliability was measured using the inner consistency of the questionnaire using Cronbach’s Alpha with the minimum level accepted is 0.7 [25]. The test resulted in an overall Cronbach’s = 0.86 which indicate satisfactory level of inner consistency. The second test is Intra Class Correlation (ICC) was tested using kappa coefficient using SPSS® 22 software package. The agreement between the first and second time in filling the questionnaire yielded kappa coefficients between 0.61 – 1.00. All the coefficients were statistically significant indicating agreement between the test and re-test phases.

### The participants

After establishing the tool reliability and validity, the questionnaire was distributed to 180 physicians and we collected 156 completed. The final collected number gives a response rate of 86.7%. This response rate is considered sufficient.

### Sampling

The sampling technique employed was convenient sampling. All available physicians at the time of questionnaire distribution were approached to fill the questionnaire.

### Data management

The data were coded and entered into MS-Excel 2016. We used a macro to define certain values into Excel, so the data will be restrained to only the values defined by the coding system to avoid typos and mesenteries. The data then transferred to an SPSS version 22 template for statistical analysis.

### Ethical consideration

The approval for this study was taken from the research ethics committee—PSMMC. An informed consent was obtained from each participant. Participant’s confidentiality was maintained throughout the study, and his/her information wasn’t used for other purposes other than this study.

### Statistical analysis

The statistical analysis will be conducted in two phases. The first phase includes descriptive statistics and graphical representations of the data. This part will mainly concentrate on answering the question about the prevalence of knowledge, answers distributions,

and the sample characteristics. The second phase includes associations test and modelling techniques. The Chi-squared test of associations and correlation coefficients are used to explore possible associations between the physicians’ characteristics, their knowledge, or certain aspects of their practices. The knowledge determinants are investigated using linear regression. The model explores the factors that may affect the physician’s knowledge about flavonoids rich diet and blood pressure.

**Knowledge scoring**

To assess knowledge a scoring method should be implemented. We adopt a technique used in many studies and is considered psychometrically robust [26]. Each question has one of three possible answers, yes, no, and I do not know. Each question has one correct answer and it can be either yes to confirm the statement or no to negate the statement. For each correct answer the participant receives 1 mark. That makes the maximum total of marks 10. For each incorrect answer the participant receives -1 which means the minimum score is -10. If the participant chose to answer I do know they receive 0 mark for that question. The final score then is divided by 10 and multiplied by 100% to get a score out of 100.

**Results**

The first part of the results describes the participants’ characteristics, the answers distribution for knowledge, practice, and reasons behind not advising hypertensive patients with food rich in flavonoids.

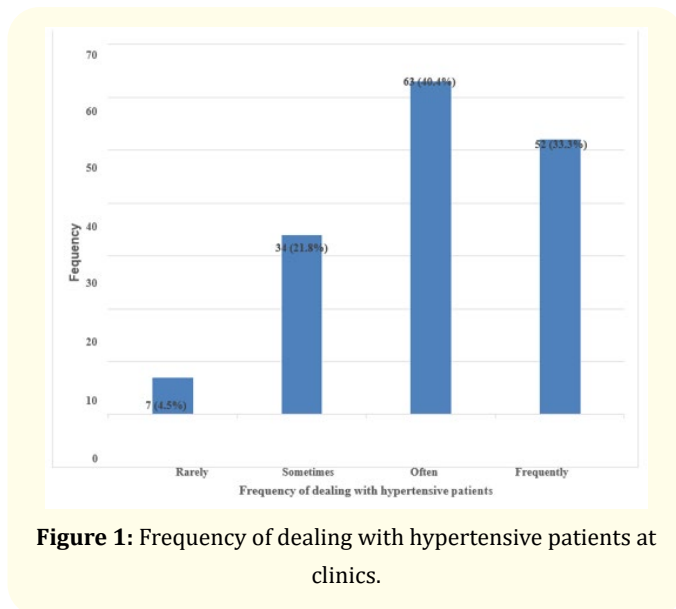
Characteristic	Mean ± SD*	Frequency	Percentage
Gender			
Male		82	52.6
Female		74	47.4
Age	38.2 ± 10.7		
Marital Status			
Single		29	18.6
Married		127	81.4
Nationality			
Saudi		94	60.3
Non-Saudi		62	39.7
Professional title			
Consultant		24	15.4
Senior Registrar		24	15.4
Registrar		42	26.9

Resident		49	31.4
Senior House Officer		17	10.9
Years of experience			
< 5 years		44	28.2
5 – 10 years		40	25.6
10 – 15 years		29	18.6
> 15 years		43	27.6
*SD: Standard Deviation			

**Table 1:** Participants’ characteristics (n = 156).

The participants’ characteristics are presented in Table 1. The sample slightly has higher male representation (52.6%) than females (47.4%). Most of the participants are married (81.4%), and from Saudi Arabia (60.3%).

The participated physicians are mostly residents (31.4%) and registrars (26.9%).



**Figure 1:** Frequency of dealing with hypertensive patients at clinics.

The participated physicians answered a question about seeing hypertensive patients in their clinics. The distribution of their answers is shown in Figure 1. Only 4.5% (7/156) answered that they rarely see hypertensive patients. Over 73% stated that they see patients often or frequently at their clinics.

Question	Correct answer (%)	I do not know (%)	Incorrect answer (%)
-Dietary flavonoids are bioactive polyphenolic compounds that naturally occur in plant-based foods.	86 (55.1)	69 (44.2)	1 (0.6)
-Flavonoids are antioxidant.	94 (60.3)	58 (37.2)	4 (2.6)
-There are many sub-classification flavonoids of e.g.: flavanols, flavones, flavanones and flavan-3-ols.	60 (38.5)	88 (56.4)	8 (5.1)
-Main dietary sources of flavonoids include green tea, Strawberry, apples, pomegranate and berries.	77 (49.4)	73 (46.8)	6 (3.8)
-Cocoa and dark chocolate can also be rich sources of flavonoids.	60 (38.5)	83 (53.2)	13 (8.3)
Flavonoid can be available as oral supplement e.g. Quercetin tablets.	46 (29.5)	100 (64.1)	10 (6.4)
-Short-term interventions with cocoa rich in flavan-3-ols can reduce systolic and diastolic blood pressure.	38 (24.4)	107 (68.6)	11 (7.1)
-Some subclasses of flavonoids are associated with a negative effect against atherosclerosis and cardiac diseases.	21 (13.5)	104 (66.7)	31 (19.9)
-Some subclasses of flavonoids are associated with a significant reduction in blood pressure.	50 (32.1)	90 (57.7)	16 (10.3)
-Estimated mean daily total flavonoid intake is 190 mg.	16 (10.3)	134 (85.9)	6 (3.8)

**Table 2:** Knowledge of primary care physicians’ about flavonoids (n = 156).

In Table 2, the distribution of answers about the knowledge questions is presented. The question that received highest correct answers is about flavonoids as antioxidant (60.3%). While the question that received lowest correct answers is some subclasses

of flavonoids are associated with a negative effect against atherosclerosis and cardiac diseases. Using the scoring method described in the methodology, the average score is 28.3%.

Question	Strongly Agree (%)	Agree (%)	Undecided (%)	Disagree (%)	Strongly Disagree (%)
I recommend high consumption of fruits and vegetables for my patients as a mean to reduce hypertension.	59 (37.8)	59 (37.8)	22 (14.1)	10 (6.4)	6 (3.8)
I recommend use of certain herbs for my patients for reducing hypertension.	4 (2.6)	32 (20.5)	40 (25.6)	50 (32.1)	30 (19.2)
I advised hypertensive patients to stop or reduce consumption of flavonoid rich diet.	7 (4.5)	3 (1.9)	95 (60.9)	34 (21.8)	17 (10.9)
I am keen to know if my patient diet contains flavonoids.	13 (8.3)	41 (26.3)	82 (52.6)	15 (9.6)	5 (3.2)

**Table 3:** Physicians practices in regards to advising hypertension patients about flavonoids rich diet.

The statement that received highest agreement is the one concerning advising hypertension patients to consume high levels of vegetables and fruits as part of their diet (75.6%). The statement with the lowest agreement was about advising hypertensive patients to stop or reduce flavonoids rich diet (6.4%). See Table 3 for the rest of the results.

The reasons for not recommending flavonoids rich diet to hypertensive patients are in Table 4. The most prominent reason is doctors lack of knowledge about flavonoids effect of blood pressure (79.5%) and having busy clinics (52.6%).

Question	Yes (%)
Doctors lack knowledge regarding flavonoids effect on blood pressure.	124 (79.5)
Doctors are not trained to help patients to change their diet and lifestyle	43 (27.6)
Patients do not trust dietary methods as a modality for treatment.	33 (21.2)
Lack of availability of flavonoid rich food.	30 (19.2)
Busy clinic	82 (52.6)
Other	2 (1.3)

**Table 4:** Reasons for not recommending flavonoids rich diet to hypertension patients.

Variable	*	SE**	P-value†	95 CI‡ of the coefficient ( )	
				Lower Bound	Upper Bound
Constant	27.2	12.9	0.037	1.64	52.6
Non-Saudi vs. Saudi	13.1	6.5	0.046	0.16	26.3
* : the estimated coefficient ** SD: Standard Error † P-value is considered statistically significant when it is < 0.05 ‡ CI: Confidence Interval R <sup>2</sup> = 0.16					

**Table 5:** Ordinal logistic regression showing the relationship between the participants’ characteristics and the risk of workplace bully (Only significant relations reported).

The regression analysis using knowledge score as dependent variables shows only one factor influencing the results of knowledge. Non-Saudi physicians have on average higher score by 13.1% (p-value = 0.046).

**Discussion**

In this study, we aimed to assess the physicians’ knowledge about the effect of flavonoids on hypertension and flavonoids rich food. Additionally, we aimed to investigate the pattern of practicing advising hypertensive patients about flavonoids rich food. The results show that the average knowledge score is 28.3%. This average score indicates a very poor level of knowledge about flavonoids and flavonoids rich food. This can reflect on the management of hypertension among patients [27]. Diet that is rich in flavonoids can be integrated with standard care for more

effective management. The flavonoid rich food such as citrus [28], dark chocolate [16] and tea (black and green) [23] can be easily integrated in the daily diet routine. Therefore, better knowledge levels among primary care physicians can be essential in changing the diet culture of the patients. This can be attained by improving the knowledge about flavonoids and other dietary food that can be used in diseases management. Another potential benefit is reducing the wrong beliefs about certain types of food for healthcare workers and patients alike. This can lead to reduce the consumption of food that inhibits effective management of hypertension and increase the consumption of sources of that potentially will help in the 27 disease management. This is supported by the results in our study that the main reason for not advising hypertensive patients about flavonoids rich food is the lack of knowledge about it.

The pattern of practice is our second aim in the study. Recommending vegetable and fruits is a common practice among the sampled physicians. However, this can be due to the general consensus that vegetable and fruit consumption is highly recommended as part of a healthy diet, not as a method to reduce blood pressure. The second statement about recommending certain herbs confirms our argument. Physicians are reluctant when it comes to recommend certain herbs because of the lack of knowledge or evidence. Additionally, getting feedback from patients about their flavonoids consumption seems to be not of interest to many physicians.

We investigated the factors that may influence the level of knowledge using the physicians' characteristics. Non-Saudi physicians seem to have higher knowledge than their counterparts. This can be due to cultural differences and the availability of certain dietary elements in those physicians' cultures.

This study has the strength of being the first study that assessed primary care physicians' knowledge about flavonoids rich diet effect in reducing blood pressure. Using comprehensive searching process and different combinations of keywords, we could not find studies in the scope that aims to assess the level of knowledge even among other healthcare workers and public. Additionally, this study can have immediate effect on hypertension management by improving the physicians level of knowledge. However, there are limitations that need to be discussed. The first limitation is the design that cannot be used to draw causality. Therefore, we cannot use the results of the ordinal logistic regression without caution, especially with a small sample size for such models. The lack of studies to draw comparisons and establishing bench marks make our investigation tool lacks the psychometric properties to assess certain aspects of the tool efficiency and validity e.g. the suitability of the scales used.

## Conclusion

The study concluded that primary care physicians at PSMC lack the knowledge about the effect of flavonoids on reducing blood pressure. The practicing pattern also shows that flavonoids is not considered as part of integrated disease control plan. Physicians recognized that lack of knowledge about flavonoids effect is the main reason behind not advising the hypertensive patients to consume flavonoids rich food.

## Recommendations

To improve the awareness of physicians about flavonoids impact on reducing blood pressure by conducting training workshop about flavonoids rich diet.

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## Appendix 1

Questionnaire

### **Knowledge of Primary Care Physicians Regarding Flavonoids Rich Diet' and Its Effect on Hypertension A cross-sectional study in Prince Sultan Military Medical City in Riyadh**

This research is aimed to investigate the primary care physicians' knowledge and practice of regarding Flavonoids rich diet' and its effect on hypertension, in PSMMC. This questionnaire was designed and distributed to attain this purpose. We will be very grateful if you can assist us by kindly completing this questionnaire. Your participation is completely voluntary and highly appreciated

.The information you provide will be dealt with confidentially.

By answering this questionnaire you are giving us the right to use the information provided for the research purpose.

If you have any question/clarification, please ask the Researcher, in the following correspondence:

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Supervisors:

Dr.Ghada Alarfaj      email:dr\_ghada199@yahoo.com Dr.Mostafa kofi      email: Mkofi@psmmc.med.sa Thank you.

#### **Section A: Socio-demographic characteristics:**

1. Gender:

- Male
- Female

2. Age \_\_\_\_\_ (in years)

3. Marital status:

- Single.
- Married.
- other \_\_\_\_\_

How many children you have \_\_\_\_\_

4. Nationality:

- Saudi.

o Non Saudi (specify) \_\_\_\_\_

5. Professional title:

o Resident.

o SHO .

o Registrar.

o senior Registrar.

o Consultant.

6. years of Experience since graduation:

o <5 years.

o 5-10 years.

o 10-15 years.

o >15 years.

7. How frequent you see patient with high blood pressure in your daily practice?

o Frequent.

o Often.

o Sometimes.

o Rarely.

o Never.

**Section-B:** knowledge of primary care physicians' about flavonoids. For each

statement please encircle only one option.

Statement	Yes	No	I don't know
1. Dietary flavonoids are bioactive polyphenolic compounds that naturally occur in plant-based foods.			
2. Flavonoids are antioxidant.			

3. There are many sub-classification flavonoids of e.g.: flavonols, flavones, flavanones and flavan-3-ols.			
4. Main dietary sources of flavonoids include green tea, Strawberry, apples, pomegranate and berries.			
5. Cocoa and dark chocolate can also be rich sources of flavonoids.			
6. Flavonoid can be available as oral supplement e.g. Quercetin tablets.			
7. Short-term interventions with cocoa rich in flavan-3-ols can reduce systolic and diastolic blood pressure.			
8. Some subclasses of flavonoids are associated with a negative effect against atherosclerosis and cardiac diseases.			
9. Some subclasses of flavonoids are associated with a significant reduction in blood pressure.			
10. Estimated mean daily total flavonoid intake is 190 mg.			

**Section-C:** physicians' practice regarding diet and flavonoids rich diet recommendation for hypertension. For each statement please encircle only one option.

Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
I recommend high consumption of fruits and vegetables for my patients as a mean to reduce hypertension.	1	2	3	4	5

I recommend use of certain herbs for my patients for reduce hypertension.	1	2	3	4	5
I advised hypertensive patients to stop or reduce consumption of flavonoid rich diet.	1	2	3	4	5
I am keen to know if my patient diet contains flavonoids.	1	2	3	4	5

**Section-D:**

Why do you think some physicians do not advise their patients regarding flavonoid rich diet for hypertension?

*You can choose more than one answer:*

Doctors lack knowledge regarding flavonoids effect on blood pressure.

Doctors are not trained to help patients to change their diet and lifestyle

Patients do not trust dietary methods as a modality for treatment.

Lack of availability of flavonoid rich food.

Busy clinic

Other \_\_\_\_\_

End of the questionnaire. Thank you for your time