


# Prevalence and characteristics of multivitamin-multimineral (MVMM) use among Saudi populations in Riyadh, Saudi Arabia

## A cross-sectional study

Saleh I. Alwalan, MBBS, SBFM<sup>a,\*</sup> , Abdullah A. Alrasheed, MBBS, SBFM<sup>b</sup>, Khaled K. Aldossari, MBBS, SBFM<sup>c</sup>, Jamaan M. Al-Zahrani, MBBS, SBFM<sup>c</sup>, Abdullah Mohammed Alshahrani, MBBS, SBFM<sup>d</sup>, Mohammed A. Batais, MBBS, SBFM<sup>b</sup>, Turkey H. Almigbal, MBBS, SBFM<sup>b,e</sup>

### Abstract

Use of multivitamin multimineral (MVMM) preparations is prevalent and growing worldwide, contributing to major health expenditure. Minimal literature on prevalence and characteristics of MVMM use is available from Saudi Arabia.

The study was conducted to determine the prevalence and characteristics of MVMM use among Saudi population in Riyadh, Saudi Arabia.

A cross-sectional study was conducted at 6 shopping malls located in the different regions of Riyadh city for 6 months from February 01, 2019, to July 31, 2019. A well-structured English questionnaire was developed, translated into Arabic language, and validated by the experts. A pertinent inclusion and exclusion criteria were established. After having informed consent to be included in the study, the printed copies of the questionnaire were distributed among the participants using a convenient sampling technique. The data were collected and analyzed using SPSS version 24. Descriptive statistics were presented as numbers, percentages, means, and standard deviations. A  $P$  value of  $\leq .05$  and 95% confidence intervals were used to report the statistical significance.

Out of 1200 surveys distributed, 1105 were returned by the participants (response rate 92%). Prevalence of MVMM supplements use turned out to be 47%. The study revealed statistically significant association between MVMM use and gender, marital status, education, regular exercise, smoking, following special diet, and eating fruits and vegetables ( $P \leq .05$ ). Majority of the participants used MVMM on daily basis (57.9%), and hospital prescriptions (57.9%) were the most common reason of MVMM use. Majority of the participants used MVMM for diet supplements (32.2%), health promotion (29.4%), and treatment of disease (16%).

The MVMM use is prevalent in Saudi population, warranting sound regulatory policies for their judicial use and increase awareness about the benefits and side effects of dietary supplements.

**Abbreviations:** IRB = Institutional Review Board, MVMM = Multivitamin-multimineral, MVMS = Multivitamin-multimineral Supplements, UN = United Nations, WHO = World Health Organization.

**Keywords:** micronutrients, minerals, Saudi Arabia, vitamins

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The datasets generated during and/or analyzed during the current study are not publicly available, but are available from the corresponding author on reasonable request.

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<sup>a</sup> King Saud University Medical City, King Saud University, Riyadh, Saudi Arabia, <sup>b</sup> Department of Family and Community Medicine, College of Medicine, King Saud University, Riyadh, Saudi Arabia, <sup>c</sup> Family and Community Medicine Department, College of Medicine, Prince Sattam bin Abdulaziz University, Al-Kharj, Saudi Arabia,

<sup>d</sup> Department of Family Medicine, College of Medicine, Bisha University, Bisha, Saudi Arabia, <sup>e</sup> Vision College of Medicine, Vision Colleges, Riyadh, Saudi Arabia.

\* Correspondence: Saleh I. Alwalan, King Saud University Medical City, King Saud University, 13314 Riyadh, Saudi Arabia (e-mail: Salehalwalan@gmail.com).

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## 1. Introduction

An adequate diet is fundamental to maintain good health and prevent the disease. Globally, billions of people consume dietary supplements such as multivitamin-multimineral (MVMM) preparations or multivitamin-multimineral supplements (MVMS) in order to improve their health, prevent diseases, or replenish the deficiencies of certain vitamins and minerals.<sup>[1]</sup> The World Health Organization (WHO) has estimated more than 2 billion people who suffer from dietary deficiencies of vitamins and minerals worldwide.<sup>[2]</sup> Recently, 5 agencies of United Nations (UN) have reported 821 million people as malnourished, rendering to the risk of developing micronutrient deficiencies.<sup>[3]</sup> Only in United States, more than 170 million people use dietary supplements in order to improve overall health and fitness.<sup>[4]</sup> Therefore, the dietary supplement marketplace is growing and is valued at 130 billion United States Dollars worldwide.<sup>[5]</sup> The use of MVMS is also prevalent in Saudi Arabia, as they believe in the positive role of these preparations in maintaining good health.<sup>[6]</sup>

Dietary supplements are defined as the concentrated source of nutrients used to supplement the normal diet in order to gain nutritional or physiological benefits.<sup>[7]</sup> These supplements may be offered in different forms of preparations such as pills, capsules, or liquids. Dietary supplements bear single or multiple nutrients. However, it is essential for a dietary supplement to contain one or more of a vitamin, a mineral, an amino acid, an herb, a dietary substance, a metabolite, or extract with the intention to offer nutritional or physiological effect to the body.<sup>[8]</sup> MVMM can be used for many reasons such as to maintain health, obtain energy, and prevent certain diseases. However, it is crucial to keep balance between the requirement of the body and the intake of supplements.

Globally, certain areas are deficient in micronutrients for which supplementation becomes necessary to prevent the development of diseases. For example, vitamin deficiencies are common all over the world, posing the world population to certain diseases resulting from these deficiencies. For instance, vitamin A, B, C, and D deficiencies lead to night blindness, megaloblastic anemia, scurvy, and rickets or osteomalacia, respectively.<sup>[9]</sup> Similarly, mineral deficiencies such as iron, iodine, zinc, and folate deficiencies result in iron deficiency anemia, goiter, impaired growth, and neural tube defects, respectively.<sup>[9]</sup> These deficiencies can be replenished with the use of MVMM supplements. However, toxicities of vitamins and minerals may harm the body instead of benefiting it.

The drawback of using dietary supplements such as MVMM is that there are no global guidelines available to ensure the integrity and quality of these preparations.<sup>[5]</sup> In other words, current evidence is insufficient to assess the balance of advantages and disadvantages of the use of MVMS for the prevention of morbidity, mortality, cardiovascular disease, or cancer. Therefore, use of dietary supplements is not out of risk and adverse events may be encountered in the consumers. For instance, adverse effects of weight loss, bodybuilding, and botanical supplements have been documented in the literature.<sup>[10]</sup> Similarly, excess use of MVMS is also associated with adverse effects such as photosensitivity and neurotoxicity have been documented with the overdose of pyridoxine.<sup>[10]</sup> Excess of vitamin A affects bone health and contributes to congenital abnormalities if used during pregnancy.<sup>[11]</sup> Therefore, sound policies are required to ensure the quality, efficacy, and safety of these dietary supplements.

There are some evidences that MVMM users differ from nonusers, for example, users adopted many positive healthy habits, including regular exercise, maintaining healthy body mass index, quit smoking, and avoid tobacco usage.<sup>[12]</sup> These differences were also observed across many demographical categories such as age, material status, socioeconomic status, and education level. Published surveys reported that dietary supplement usage is more common in elderly groups than the younger, and higher in females.<sup>[13]</sup> In addition, education level and economic status also have an impact on the dietary supplement consumption. It has been reported that individuals with higher education level and higher income consume more MVMM, as they are more aware about the benefits of MVMM intake.<sup>[14]</sup>

Li et al<sup>[15]</sup> evaluated the prevalence and trends of using MVMM among American diabetic adults. The findings of the study showed that between 1999 and 2004, there was a clear stability in dietary supplements and minerals' prevalence and trends.<sup>[15]</sup> However, the study reported a slight decrease in using MVMM. In addition, Cowan et al<sup>[16]</sup> estimated the prevalence and use of MVMM among adults older than 19 years. The findings of the study showed that 52% had taken at least one dietary supplement within the last month. In addition, it was found that MVMM use was significantly higher among adults with higher income and adults who were food secure.<sup>[16]</sup> Moreover, using the data of the National Health and Nutrition Examination Survey (NHANES) database (2009–2012), Alotaibi<sup>[17]</sup> reported that 70.5% of older adult Americans used the dietary supplements, including MVMM, in the last month.

In Saudi Arabia, vitamins and minerals preparations are widely used. Although a large number of studies have been conducted worldwide; however, there are a few studies with small samples are available in the literature from Saudi Arabia. Therefore, this study was conducted to determine the prevalence of MVMM use among Saudi population. This study will be filling the research gap related to prevalence and use of MVMM in Saudi Arabia, especially in light of the lack of studies assessing the prevalence and use of MVMM in Saudi Arabia. In addition, this study is significant, as it focused on the presence of chronic diseases among the study participants, which allows conducting follow-up studies to assess the prevalence and use of MVMM among chronic disease patients.

## 2. Methods

A cross-sectional study was conducted in 6 shopping malls located in north, east, and west regions of Riyadh city for 6 months from February 01, 2019, to July 31, 2019. The study was approved by the institutional review board (IRB) at the College of Medicine in King Saud University. The study ethical approval number is E-18-3253. A well-structured English questionnaire was developed by the researchers and translated into Arabic language by bilingual experts, and then translated back to English language in order to ensure parallel forms reliability by independent translators. In addition, the questionnaire was distributed to 3 experts (2 family physicians and 1 nutrition specialist) to revise and modify the content accordingly to achieve adequate reliability and validity. The questionnaire was pretested in a pilot study on 30 randomly selected Saudis to ensure the instrument was adequately understood. The pilot study helped to determine the time needed to answer the questions, examine the clarity of the questionnaire, and select the relevant variables suitable for the statistical methods to be used.

The questionnaire consisted of 3 parts, including items about the socio-demographic, participants' health, lifestyle and activity, as well as prevalence and characteristics of vitamin and mineral use among Saudi population. Pertinent inclusion and exclusion criteria were established to distribute the questionnaire. Inclusion criteria included all the Saudi citizens visiting the targeted shopping malls in Riyadh city. Exclusion criteria included all non-Saudis (males and females), and all Saudi children and citizens below 18 years of age. The ethical approval was obtained from the administrative offices of all the targeted shopping malls before collecting the data. Informed consent was obtained from the participants indicating the purpose of the study and the right of the participant to withdraw at any time without any obligation towards the study team. Confidentiality was maintained and kept during all stages of the study through keeping the participants' identity anonymous.

The printed copies of the questionnaire were distributed among the participants using a convenient sampling technique. The data were collected on a structured data sheet, and then entered and saved into an Excel document. The raw data were processed in accordance with the best practices for raw data management in order to identify any inaccuracies, flagging the implausible values. A similar process was applied to categorical variables to identify any potential anomalies. All the identified anomalies were discussed with the biostatistics team and were corrected before initiation statistical analysis. The statistical analysis was performed using IBM SPSS Statistics for Windows version 24 (Armonk, NY: IBM Corp). Descriptive statistics were presented as numbers, percentages, means, and standard deviations. A *P* value of  $\leq .05$  and 95% confidence intervals

were used to report the statistical significance and precision of the results.

### 3. Results

Out of 1200 surveys distributed, 1105 were returned by the participants (response rate 92%). Prevalence of MVMS use turned out to be 47% (516). The demographic characteristics of the participants (age, gender, body mass index, education, marital status, exercise, smoking, and diet) are summarized in Table 1. The study revealed statistically significant association between MVMM use and gender ( $P < .001$ ), marital status ( $P < .001$ ), education ( $P = .022$ ), regular exercise ( $P = .001$ ), smoking ( $P = .001$ ), following special diet ( $P < .001$ ), and eating fruits and vegetables ( $P < .001$ ). However, there was no statistically significant association between MVMM use and age and body mass index (Table 1).

Majority of the participants who used MVMM used them on daily basis (57.9%) followed by weekly (27.1%) and monthly (14.9%) use (Table 2). Majority of MVMM use was prescribed on the hospital prescriptions (57.9%) and over-the-counter (25%) availability at pharmacies (Table 2). Majority of the participants used MVMM for diet supplements (32.2%), health promotion (29.4%), and treatment of disease (16%) (Table 2). Majority of the study participants reported no chronic disease. However, most common chronic conditions reported the participants were hypertension (5.2%), anxiety (5%), dyslipidemia (4.8%), and diabetes (4.1%) (Fig. 1).

Majority of the participants believed that multivitamins and multimineral are used to improve health (59.4%), prevention of

**Table 1**

**Participants' demographic characteristics by using of the multivitamins and multimineral or not.**

Participants' characteristics	Using one of the Multivitamins and Multimineral products on regular basis (more than a month) during the last year?		$\chi^2$	<i>t</i>	<i>P</i>
	Yes (n = 515)	No (n = 590)			
Age					
18 to <29 years	214 (41.5)	287 (48.6)	6.724		.081
29 to <39 years	179 (34.7)	180 (30.5)			
39 to <49 years	86 (16.7)	93 (15.8)			
$\geq 50$	37 (7.2)	30 (5.1)			
Body mass index (mean + -SD)	26.19 $\pm$ 5.09	26.44 $\pm$ 6.07		0.7357	.493
Gender			69.000*		.000*
	Male n(%)	95 (18.6)	246 (41.7)		
	Female n(%)	420 (81.4)	344 (58.3)		
Education			9.022*		.022*
	Elementary n(%)	5 (1)	6 (1)		
	Intermediate n(%)	12 (2.3)	10 (1.7)		
	Secondary n(%)	99 (19.2)	159 (26.9)		
	University n(%)	400 (77.5)	415 (70.3)		
Marital status			19.92		.000*
	Single n(%)	175 (33.9)	263 (44.6)		
	Married n(%)	311 (60.3)	306 (51.9)		
	Divorced n(%)	30 (5.8)	16 (2.7)		
	Widowed n(%)	0 (0)	5 (0.8%)		
Following a special diet			28.000*		.000*
	Yes n(%)	186 (36)	127 (21.5)		
	No n(%)	330 (64)	463 (78.5)		
Eating fruits and vegetables?			20.000*		.000*
	Yes n(%)	391 (75.8)	373 (63.2)		
	No n(%)	125 (24.2)	217 (36.8)		
Exercise on regular basis			10.001*		.001*
	Yes n(%)	310 (60.1)	298 (50.5)		
	No n(%)	206 (39.9)	292 (49.5)		
Smoking			12.001*		.001*
	Yes n(%)	46 (8.9)	94 (15.9)		
	No n(%)	458 (88.8)	474 (80.3)		
	Ex-smoker n(%)	12 (2.3)	22 (3.7)		

\*Significant at significance level ( $\alpha < 0.05$ ).

**Table 2**  
**Frequency, supply, and usage cause of multivitamins and multi-minerals (MVMM).**

Frequency of using multivitamins and multiminer (MVMM)		
Daily	n(%)	299 (57.9)
Weekly	n(%)	140 (27.1)
Monthly	n(%)	77 (14.9)
Sources of these products		
Hospitals as prescription	n(%)	299 (57.9)
Pharmacy as over the counter	n(%)	129 (25)
Health/supplements stores	n(%)	18 (3.4)
Websites	n(%)	37 (7.1)
Social media	n(%)	13 (2.5)
friends	n(%)	18 (3.4)
Gym trainers	n(%)	2 (0.38)
Why are you using these products? (You can select more than one item)		
Supplement diet	n(%)	234 (32.2)
To promote health	n(%)	214 (29.4)
To treat a disease	n(%)	116 (16.0)
Enhance Physical appearance	n(%)	91 (12.5)
To prevent a disease	n(%)	52 (7.2)
Post bariatric surgery	n(%)	20 (2.8)

cardiovascular disease (6.9%) and cancer (0.9%). About one-third (32.7%) of the participants did not know about the use of MVMM (Fig. 2). Regarding the importance of MVMM use, 46.7% participants reported that these preparations may be helpful for general health, while 39.7% participants reported that MVMM help a lot in terms of general health (Fig. 3).

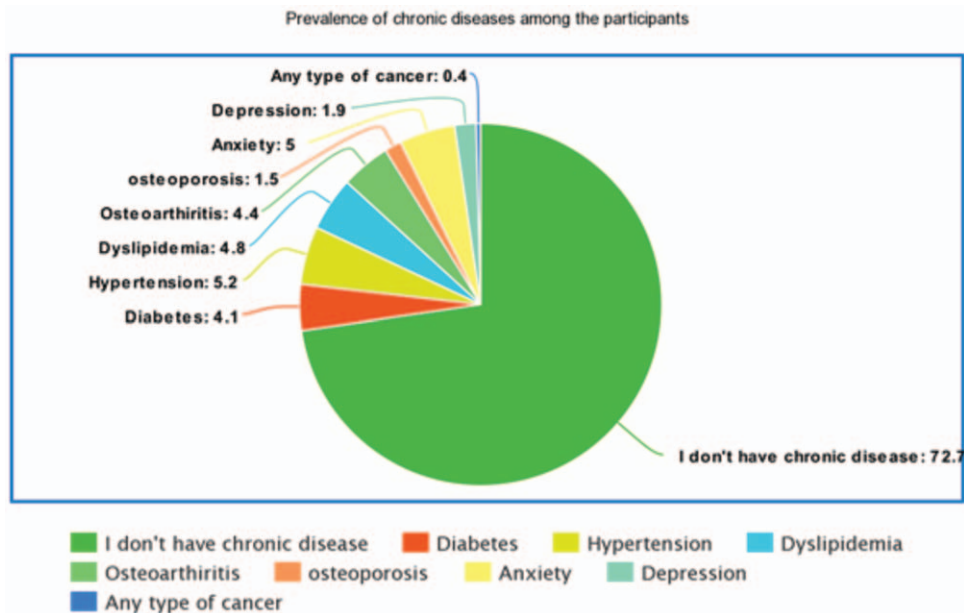
**4. Discussion**

The present cross-sectional study was conducted to determine the prevalence of consumption of multivitamins and multiminer preparations or supplements among Saudi population in Riyadh

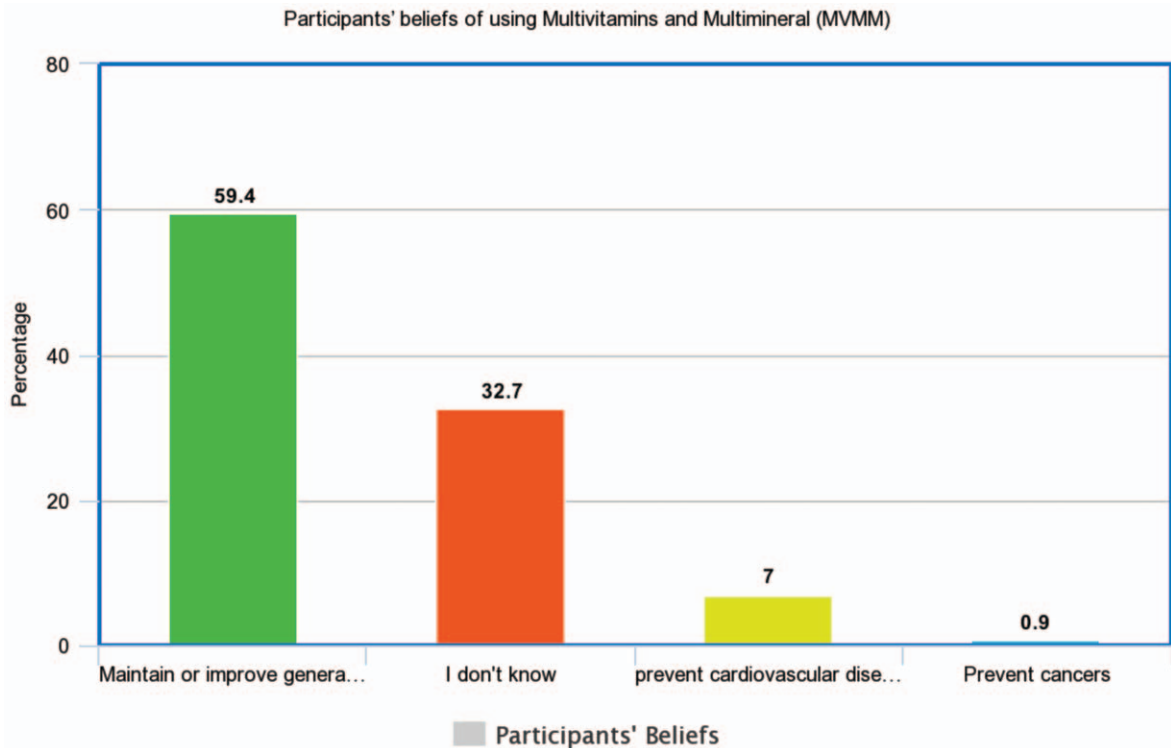
city. The study revealed high prevalence of MVMM use among general population in Saudi Arabia, reporting significant association with gender, marital status, education, regular exercise, smoking, following special diet, and eating fruits and vegetables. More than half of the participants believed that MVMM supplements were used to promote health, and they used MVMM as they were prescribed on hospital prescriptions. About one-third of the participants used MVMM for diet supplements, health promotion, and treatment of disease.

The prevalence of use of dietary supplements is high and variable. The present study has reported prevalence of consumption of MVMM supplements among general population in Saudi Arabia as 47%. In another study, Alfawaz et al<sup>[18]</sup> carried out a cross-sectional study in Riyadh including 534 female college students and reported prevalence of consumption of dietary supplement as 76.6%. It shows a huge difference in the use of dietary supplements among students and general population in the same city of Riyadh. However, in the later study, all the participants were females who significantly use higher amount of dietary supplements as compared to that of males.<sup>[19]</sup> The reason behind the higher consumption of dietary supplements among women than that of men can be attributed to calcium and vitamin D supplements to avoid osteoporosis among women.<sup>[13]</sup> In addition, folic acid supplementation is recommended for woman before and during gestation.<sup>[20]</sup> The present study also supports the higher prevalence of MVMM use among females as compared to that among males. Li et al<sup>[15]</sup> have reported even higher prevalence of dietary supplement consumption in United States (52–58%). On the contrary, Gong et al<sup>[21]</sup> reported prevalence of nutrient supplements as 0.71% in China, which shows a huge difference between Chinese and Saudi populations in terms of consumption of dietary supplements.

The present study also revealed a positive association of dietary supplement use with married status, education level, and regular exercise. AlTamimi<sup>[22]</sup> has reviewed and reported higher



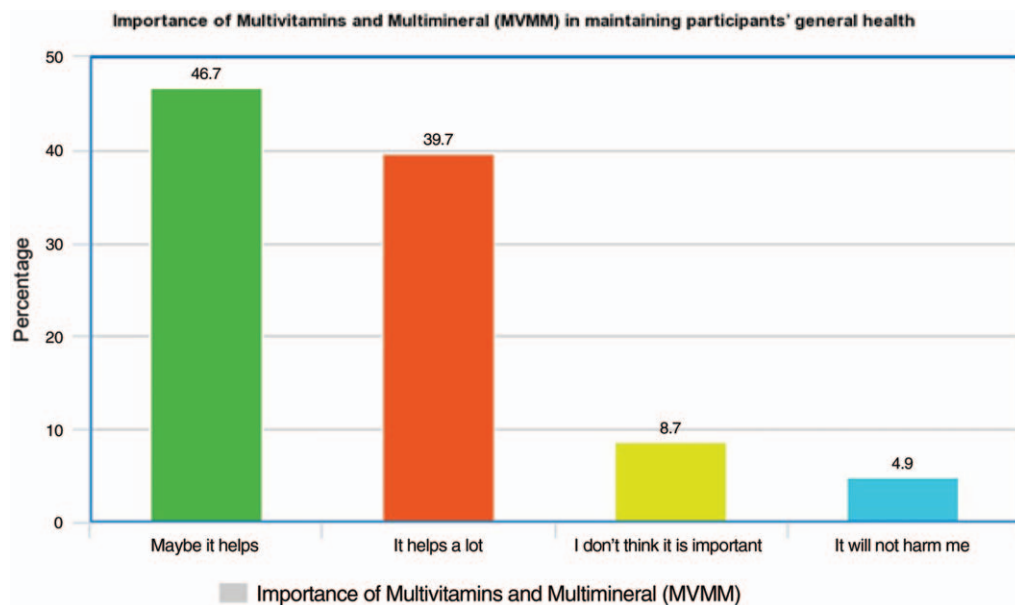
**Figure 1.** Prevalence of chronic diseases among the participants. About 72.7% (n=803) of the participants did not have any chronic disease, whereas 0.4% (n=4) had any type of cancer, 1.9% (n=21) had depression, 5% (n=55) had anxiety, 1.5% (n=17) had osteoporosis, 4.4% (n=49) had osteoarthritis, 4.8% (n=53) had dyslipidemia, 5.2% (n=58) had hypertension, and 4.1% (n=45) had diabetes.



**Figure 2.** Participants' beliefs of using multivitamins and multimineral (MVMM). Among the total study participants (n = 1105), about 59.4% (n = 656) used MVMM to maintain or improve general health, 7% (n = 77) used MVMM to prevent cardiovascular diseases, 0.9% (n = 10) used MVMM to prevent cancer, and 32.7% (n = 361) reported no reason (I don't know) for using MVMM.

knowledge and consumption of dietary supplements among married individuals as compared to that among single ones. However, Alfawaz et al<sup>[18]</sup> have reported higher use of supplements among single female students than that among married females, which is contrary to the findings of the present study.

This difference may be attributed to the difference in sub-populations (general population at shopping malls versus female students at college). However, the study by Alfawaz<sup>[18]</sup> supports the findings of the present study in terms of education level where higher education level shows positive association with the use of



**Figure 3.** Importance of multivitamins and multimineral (MVMM) in maintaining participants' general health. About 46.7% (n = 516) of the study participants (n = 1105) reported that it maybe helps, 39.7% (n = 439) reported that it helps a lot, 8.7% (n = 96) reported that they do not think it is important, whereas 4.9% (n = 54) reported that it will not harm them.



dietary supplements. Moreover, similar to the findings of the present study, regular exercise has also showed a positive relation with the use of dietary supplementation or multivitamin and multimineral preparations.<sup>[23]</sup> It has also been observed that dietary supplement use is even higher among athletes.<sup>[4]</sup> Similar to the findings of the present study, Raatz et al<sup>[24]</sup> have reviewed those smokers have lower intake of dietary nutrients as compared to that of non-smokers. In addition, the present study adds to the literature that those among general population in Saudi Arabia who follow special diets take significantly less MVMM as supplements, while those who eat fruits/vegetables take significantly higher amounts of MVMM supplements.

More than half of the study participants believed in the health benefits of MVMM use. However, the evidence on the role of MVMM use in order to maintain health and primary prevention of diseases is controversial.<sup>[2]</sup> Although adequate intake of micronutrients or MVMM supplements for long durations is safe; however, excess of these nutrients may lead to harmful effects. Therefore, balance between the requirements and supplementation of the micronutrients is necessary. The present study has provided useful information on the consumption of MVMM among Saudi citizens, which may trigger policy makers to generate updated and optimal rules and regulations in order to justify the high prevalence of MVMM use in the country. Limitations of the study include study being conducted in a single city and questionnaire-based study design, which might have led to bias. Therefore, further studies at distant centers involving all fields of life may offer more insights into the topic of interest.

In conclusion, the study has provided sound information on the prevalence of MVMM supplement use among Saudi population. The significant direct association of gender, education level, physical activity, married status, and non-smoker status with the use of MVMM warrants the need for increased evidence-based awareness about the benefits and adverse effects of dietary supplements.

### Author contributions

All authors contributed to writing different sections of the manuscript. The final draft of the manuscript was reviewed and read by all authors.

**Conceptualization:** Saleh Alwalan, Abdullah A. Alrasheed.

**Data curation:** Saleh Alwalan, Abdullah A. Alrasheed, Mohammed A. Batais.

**Formal analysis:** Saleh Alwalan, Abdullah A. Alrasheed.

**Investigation:** Saleh Alwalan, Abdullah A. Alrasheed, Mohammed A. Batais.

**Methodology:** Saleh Alwalan, Abdullah A. Alrasheed, khaled k Aldossari, Abdullah Mohammed Alshahrani.

**Project administration:** Saleh Alwalan, Abdullah A. Alrasheed, Mohammed A. Batais.

**Software:** Turkey H. Almigbal.

**Supervision:** Saleh Alwalan, Abdullah A. Alrasheed, Jamaan Alzahrani.

**Validation:** Abdullah A. Alrasheed, Abdullah Mohammed Alshahrani, Turkey H. Almigbal.

**Writing – original draft:** Saleh Alwalan, Abdullah A. Alrasheed, khaled k Aldossari, Abdullah Mohammed Alshahrani, Turkey H. Almigbal.

**Writing – review & editing:** Saleh Alwalan, Abdullah A. Alrasheed, Jamaan Alzahrani.

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