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## **Title Page**

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**Title:** Do medical students practice what they preach? A review of their dietary patterns over the last decade.

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### **Learning points:**

- Eating patterns in medical students are subject to many influences from external environments; stress and time constraints being one of the most commonly cited reasons for unhealthy dietary habits.
- Unhealthy eating choices among medical students can lead to an increased risk of heart disease, obesity, fatigue, among other health risks.
- Meal patterns are also subject to discussion as many students were found to skip meals on a regular basis, particularly breakfast.

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# **Do medical students practice what they preach? A review of their dietary patterns over the last decade**

## **Abstract**

### Background

While many studies have been performed to evaluate different indicators of psychological distress among medical students, the amount of published data evaluating their dietary habits is limited. Therefore, the purpose of this scoping review was to provide an overview of medical students' dietary behavior. This is the first review paper to summarise the information available about dietary practices among medical students.

### Materials and Methods

A scoping review was performed in 2018 using the PRISMA-ScR framework and the MEDLINE database was searched by combining the terms 'eat', 'diet', 'meals', 'nutrition' with the word 'medical student' by using the 'AND' function. Some additional papers were also selected from the citations of relevant publications. Data was independently extracted by two authors using pretested forms.

### Results

A total of 739 articles were found by using the search terms. Thirty-three articles fulfilled the eligibility criteria and four further articles were found from the citations of relevant publications. Medical students showed an increasing tendency to exhibit conventionally unhealthy eating patterns, both as a whole and within different dietary categories. In particular, decreased fruit and vegetable intake, overindulgence of fast food, and a tendency to skip meals. Gender discrepancies were also noted in some categories.

### Conclusion

Medical students, while for the most part displaying a full understanding of the nutritional science behind dietary recommendations, did not always meet the advised levels for most of the categories explored. Lapses in personal dietary choices may affect patient counselling, in addition to the many direct consequences of improper nutrition on the health and wellbeing of the student themselves.

## Introduction

Medical students spend countless hours learning about the human body, but in the midst of all the stress clouding the student's life, how well do they take care of their own? Poor dietary habits are a generalized concern among students transitioning to higher education, including medical students [1-3]. Stress and time constraints were cited as some reasons for unhealthy diet [1-3], which have been found to lead to the development of many unhealthy habits and activities [4]. Over time, the poor diet becomes an ingrained habit, which becomes harder for the physician to break or overcome. The diet may affect the physician's physical and mental health in the long term, and it may eventually overflow onto the professional aspect of a physician's life during patient counselling [5,6]. Medical students who were more compliant with nutritional recommendations themselves are more likely to have a positive attitude when counselling patients regarding weight loss [7].

When discussing the practice of diet monitoring and healthy eating among doctors, it becomes pertinent to address the possible lapse of nutritional knowledge among some trained medical professionals. International papers advocating for nutrition-centered education of physicians have been published over the years [8,9]. Unfortunately, there appears to be a decreasing level of interest regarding the clinical aspects of nutrition among physicians and medical students in recent times [10,11]. Many Colombian fifth year medical students were unhappy about the support system in their university for advocating healthy eating habits in two different studies [17,12], and while over two thirds acknowledged the importance of physician role models for patients and the importance of preventive counseling, less than 10% believed that prevention is more important than treatment in the medical practice [12].

A study assessing the dietary patterns of new Polish students reported that 78% considered their lifestyle to be nutritionally adequate [13]. However, a Russian study comparing many disciplines found the highest prevalence of behavioral risk factors to be among medical students. The medical group had the lowest rate of three categories: non-obese individuals, normal physical activity, and normal nutrition when compared to the other professions. They also had the highest hip/waist ratio and Body Mass Index (BMI) values [14]. Another study found that just 15.3% of 629 students had a conventionally healthy diet, and this was statistically more likely to be among women ( $p=0.001$ ) [15]. Comparing students of the medical specialty to control groups displayed no superiority of better dietary choices in the former category. Coincidentally, medical students were statistically more likely to consume fast food than their non-medical peers [2,16].

Therefore, while numerous research articles have been published that highlight the importance of nutrition-based education among medical students, this will be the first paper to address this as a possibly global concern. Educational seminars have been proposed as a strategy to improve nutritional knowledge amongst medical students and physicians, with varying results [17].

In this paper we reviewed and summarized the data available regarding the dietary practices among medical students, globally, and within the last decade. To the best of our knowledge, this will be the first review article to address this concern. Because of the inconsistency of the type of data collected, we decided a scoping review approach would be most appropriate to highlight the more important information from the relevant literature.

## **Material and Methods**

The PRISMA-ScR (PRISMA extension for Scoping Reviews) was used as a checklist for designing the review paper. A comprehensive Medline literature review was conducted in July 2018 using the appropriate search terms. In this manner, the terms “eat”, “diet”, “meals” and “nutrition” were searched to be in conjunction with the word “medical student” by using the ‘AND’ function. The found search results were then filtered according to relevance, date of publication and language. Appropriate exclusion and inclusion criteria were applied as necessary, and the remaining papers were then reviewed in detail (Figure 1).

The inclusion and exclusion criteria applied were as follows: all original research articles that were published between 2008 to 2018, and were related to the dietary habits of medical students were considered for inclusion in the current review. Studies were excluded if they 1) were not published in English; 2) only mentioned diet as an insufficiently explored consequence of another primary disease; or 3) where diet was inadequately analyzed for comparative purposes. We also excluded publications regarding eating disorders among medical students, as these have been explored in depth in recent review articles [18]. Studies that were only investigating the use and levels of micronutrients such as vitamins and minerals in the diet were also excluded as they were outside the scope of this review. All authors participated in the initial literature review and the short-listed papers were entered into a virtual spreadsheet [19], where it was screened twice by two different individuals to ensure reliability of the collected data. Following a pilot test, the data was then collected and charted by two separate individuals working independently to reduce bias, after which it was cross checked to ensure reliability. The common information between papers were then grouped together for further review and discussion.

For the interest of comparing nutritional factors from the collected research papers to a single recommendation, we have quoted the recommended daily allowances from the United States Department of Agriculture (USDA) guidelines [20]. Henceforth, all calculated findings will be compared to these recommendations unless otherwise specified.

## **Results**

### *3.1. Selection and description of included studies:*

While an initial 46 studies were collected from Medline through title and abstract screening, nine papers were then excluded after reading the full text publication with regards to the above-mentioned exclusion criteria. Finally, a total of 37 papers were selected for further review and comparison, of which 33 were found directly from Medline, and a further four were gathered from the references section of the relevant publications found (Figure 1).

Almost all reviewed articles were conducted through anonymized questionnaires that were distributed among medical students. Due to the nature of the study question, very few papers used control groups, and even fewer were blinded, thus a high risk of bias was present (Table 1).

Most publications that were assessed within the appointed inclusion criteria took limited dietary factors into account. Fruit and vegetable intake were noted to be the commonest components in the studies, followed by unhealthy snacks and fast food. Relatively fewer papers assessed other various macronutrient intake; including dietary carbohydrate, protein, fat, and fiber consumption. Each component is discussed independently below.

During our literature review, many studies revealed some rather concerning statistics regarding dietary patterns among medical students, elements of which are explained in more detail below. However, some reported a healthier correlation between the two factors. For instance, most medical students from a region in India reported healthy eating habits, despite a large number not feeling confident enough to be able to counsel patients regarding the same [21]. This is reassuring to observe, as healthy eating habits in students have been linked to higher happiness levels in addition to the many other benefits elucidated above [22].

### *3.2. Food intake:*

#### *3.2.1. Fruits and vegetables:*

Fifteen papers were found to evaluate the intake of fruits or vegetables among the student population on a regular basis [1,3,13,24-35]. According to recent recommendations, students are advised to consume five servings of fruits and vegetables in a day [23]. However, studies assessing medical students from Nepal reported inadequate intake of fruits and vegetables [24,25]. Turkish students fared slightly worse, with a third admitting to not consuming any cooked vegetables in their food, and a quarter did not include fruits or salads as part of their regular meals [26]. A large percent of Saudi medical students were found to consume either fruits or vegetables once a week or lesser (82.2% and 40.6% respectively) [27]. Medical students from Yemen had a somewhat similar result, where the majority would either infrequently or never include plants in their diet [28]. On the other hand, Malaysian medical students had a larger general consumption of produce, and seemingly preferred the intake of vegetables over fruits. According to the research, 80% of the students surveyed consumed vegetables over three times a week while around 50% ate fruits less than three times a week [1].

While looking for gender discrepancies, we found that females tend to consume fruits more regularly than their male counterparts [3,13,26,29-33], similar results were found for vegetable intake [3, 13, 26, 30-34]. For instance, female Italian medical students were more likely to have additional servings of vegetables, and this result was found to be statistically significant [30], while male Turkish students were at least twice as likely to rarely, if ever, include produce in their average meal when compared to the women [26]. A highly significant number of male Polish students admitted to never consuming fruits in between their regular meals ( $p < 0.001$ ) [13]. Similarly, in a study published in 2010 in Greece, the evaluators found that the dietary practices of male medical students leaned more towards convenience and fast food, while the women were more likely to eat fruits and vegetables. The BMI calculations they performed on the same population showed a higher percentage of obese and overweight men (5.9%, 32.1%), compared to women (1.5%, 8.4%) [32]. Interestingly, a paper based in Thailand found that male students who consumed more than 400g of vegetables daily were statistically more likely to be overweight, after adjustment for confounding factors were made [35]. Contradictorily, men were found to include more plant-based food in their diet than women in one Nepalese study [24].

### 3.2.2. *Fast food and unhealthy snacks:*

Due to the time constraints in a medical student's life, they might find prepackaged or convenience food more appealing [36]. This might explain the reported overindulgence on fast food and unhealthy snacks [3,13,26,27,29,31-33,36,37]. In fact, medical students were more likely to consume fast food than other university students [2]. On the other hand, the majority of medical students studying in Malaysia did not like eating fast food, and preferred spending meal times with family [1]. Some gender discrepancies can be found here as well, where male Italian medical students were found to have a significantly greater amount of unhealthy food than the corresponding female population [30]. Similar results were found for other studies [3,13,29,31-33,37], while contradicting findings were discovered in others [26]. Perhaps somewhat reassuringly, students were not completely disregarding the opportunities to learn more about what they eat on a regular basis. One study reported that more than two thirds of medical students used nutritional food labels when deciding what to eat [3]. While the majority of undergraduates were equally aware of the detrimental effects of unhealthy food in a second study, female students were significantly more likely to seek nutritional information of what they consume [32]. This may explain some of the abovementioned variations in dietary preferences seen between the gender groups.

### 3.2.3. *Macronutrients:*

When appraising the dietary intake of macronutrients, the following studies reported normal mean values for carbohydrates [38], total fat [3,38] and protein [3,38] intake in the diet. Fiber consumption levels were under the recommended values in one or both gender subgroups in the papers [3,38,39]. For example, in a Swedish study, while the mean intake of fiber was normal among women, and significantly higher among men, neither group reached the recommended daily intake (RDI) for their gender [38]. When evaluating for more gender discrepancies in the given data, men were noticed to favor more protein [3,13,26,38,39], and women consumed more carbohydrates [3,38] than their counterparts. For example, around 10% of Turkish students either rarely or never consumed any major sources of protein, and the majority were women [26]. On the other hand, while a majority of Malaysian students preferred a balanced diet, the percentage of students relying more heavily on protein was higher than other categories [1]. Students who did not consume most animal sources of protein in their diet were statistically highly likely to be anemic ( $p < 0.001$ ) [28]. When assessing the consumption of carbohydrates, a large number of students in a Swedish study admitted to having a lower than recommended carbohydrate consumption in their diet, which was instead substituted for by a higher intake of alcohol and fat in that population [38]. Saudi students ingested an average of over 380 grams of carbohydrates daily [39]. The difference between genders is significant, with males ingesting a higher average amount, and both values being far higher than the 130 grams/day recommendations. Fat intake in the same population was also noted to be above recommended levels, particularly animal fat, and cholesterol [39].

Ekpanyaskul *et al.* reported that an imbalance of macronutrients in the diet can lead to increased BMI in both male and female medical students, particularly high fat foods among men [35]. Fried food was a popular choice among students [1,32]. In particular, more than two thirds of

Saudi students consumed high fat food on a daily basis [27]. On the other hand, male Polish undergraduates were statistically more likely to not fry their food at all when compared to females ( $p < 0.001$ ). Both genders were also found to prefer butter for spreading, which is high in saturated fat [13].

### *3.3. Alcohol and Beverages:*

#### *3.3.1. Alcohol:*

There may be a relationship between alcohol intake and fatigue among medical students [40]. Among 239 Polish students, frequent alcohol consumption (between 5-6 times a week) was recorded to be 4%, while 13.8% abstained from its use, and the remaining falling in between [13]. A study found that among the students that admitted to drinking alcohol, the average student drank a maximum of about 6 units in one occasion during the last month and the mean number of binge drinking episodes occurred between 1 to 3 times in the given period [25]. However, on a more general basis, the average amount of alcohol consumed among Polish students was around 34 and 66 grams per week among females and males respectively [33]. On this note, males that consumed alcohol on a more regular basis had a statistically significant possibility of being overweight [33,35].

A study investigating overconsumption of alcohol amongst Scandinavian medical students found that the given population were more likely to overindulge in drinks ( $p = 0.006$ , OR 3.11, CI 1.39–6.93). Age was another factor that was plotted against the possibility of alcohol over consumption; younger students were also more likely to drink excessively than their older classmates ( $p = 0.005$ , OR 0.82, CI 0.71–0.94) [15].

We found a total of eight papers that reported at least half of their studied population rarely, if ever, consumed alcohol [1,16,24,26,32,41-43].

#### *3.3.2. Other Drinks:*

When attempting to chart the types of fluids consumed among the different studied populations, we found a total of ten papers, with a particular emphasis on carbonated and sweetened drinks [2, 3,13,27-29,31,33,37,42]. A fifth of a Saudi medical student population consumed soft drinks on a daily basis, while half of them admitted to drinking it at least once a week [27]. Polish male students were significantly more likely to consume energy drinks (42.5%,  $p < 0.01$ ) and carbonated beverages (40%,  $p < 0.01$ ) daily than the women (20.6%, 19.6%) [13]. While similar findings were appreciated in some studies [33,37], contradicting results were found in others [29, 31]. In an American study based in California, the total daily energy intake from the sugar in sweetened beverages was found to be 2%, with no significant difference between the two genders [3]. Many students also reported a regular intake of caffeinated drinks [2,28,42].

### *3.4. Patterns of Meal Intake:*

There have been several studies discussing the harmful long-term effects of unhealthy breakfast practices. The habit has been linked to developing an increased risk of adverse cardiovascular

events, obesity, fatigue and other undesirable aftereffects [35,40,42,44,45]. When collecting the relevant data published assessing the regularity of meals among medical students, skipping meals happened to be a frequent finding, particularly breakfast [1,2,13,26,28,30,32,33,42,5]. Over 80% of Turkish first and third year students regularly skipped having breakfast [45]. Categorically, Turkish males were almost three times more likely to not eat regularly, and twice as likely to skip breakfast when compared to the females [26]. Males were more likely to skip meals in several other papers as well [30, 33]. Students who had an irregular pattern of breakfast intake were statistically more likely to have anemia ( $p < 0.001$ ) [28].

### *3.5. Change in dietary habits of medical students over time:*

Longitudinal studies are of interest when attempting to uncover some patterns of decision making among medical students. Six papers were found to have been designed as a longitudinal study [12,17 22,47-49].

A Colombian longitudinal study found that while 74.1% of first-year medical students consumed four or more servings of fruits and vegetables a day, the fifth-year students never had more than two servings. This result was found to be highly significant ( $p < 0.001$ ). The main reason cited across both groups was a general dislike of fresh produce [12]. A study evaluating the healthy eating habits of first year medical students both before and after a nutrition course found an overall significant improvement in the total score at the end of the sessions. In particular, a greater than 10% change was seen in the fruits and vegetable intake, as well as table spreads and frozen desserts. Other categories that underwent a relatively lower increase included the intake of some kinds of animal protein, and the frequency of consumption of several unhealthy snacks [47]. Similarly, a study performed in India to assess the efficacy of social media on health education among medical students found a significant decrease in junk food intake after the course in the social media group, compared to the control group. The other results among fruit and vegetables intake generally showed improvement, but these results were non-significant [48]. A second study based in the United States found that while the HDL cholesterol intake increased significantly between the start and end of medical school, the other fat parameters did not change. When assessing the participants' total dietary sources of energy in the same study, it was found that while the total energy consumption remained unchanged over the years, students were more heavily relying on fat in their diet rather than carbohydrate. Intake of alcohol as an energy source was also increased, however the average number of units consumed remained low [49].

While cross-sectional studies may have certain limitations when compared to the longitudinally designed ones, some points of interest were noted in several papers that correlated students in their early years with their more academically senior counterparts. For example, a greater number of older students were found to favor having lunch and supper rather than breakfast [42]. A large cross-sectional study among Thai medical schools found that male students were statistically more likely to gain a significant amount of weight during the course of their education [35]. Similar results were found in other papers [26], including a study assessing the differences between medical students and a group of residents [43]. This latter study also found other various points of interest between the two groups. Residents had a higher ratio of total cholesterol to high density lipoprotein, as well as a cumulatively lesser average intake of fruits and vegetables, grains, dietary protein, and fat containing food items [43].

## **Discussion**

While discussing the published evidence about the dietary habits among medical students, it's prudent to address the possible implications to the medical society. As mentioned earlier, improper dietary habits can have long-standing consequences, both for the students themselves and their patients [5,6]. The findings of this review suggest that the majority of medical students consume less than the recommended portion of fruits and vegetables as part of their regular diet. We also found that students tend to rely more on convenience food and skipped meals on a regular basis. However, their alcohol and beverage consumption was much more variable. As stated earlier, these findings can in part be explained by the perceived stressors that can cloud the student's judgement. Food of convenience may thus unfortunately not always be convenient in other regards. While more research is certainly needed to be able to draw upon a recommended approach to reinstate the importance of a well-balanced lifestyle, the current data suggests that time may be a strong motivating factor for encouraging unhealthy dietary practices [1-3]. We also found it interesting to note that gender discrepancies were apparent, with females in many papers generally displaying a lower prevalence of unhealthy eating choices [3,13,26,29-34,37], while males were found to make healthier selections in other papers [24,26].

Upon looking for variabilities across the years among medical undergraduates, while an increasing intake of fresh fruits and vegetables was seen in some papers [30,34], contrary results were found in others [7,41,45,48]. Similarly, when assessing trends for fast food or unhealthy snacks and drinks consumption, an increasing [34,41,45] and decreasing [30,42,48] pattern was observed. Regular consumption of alcohol was also another factor that became more [41] and less [12,7,42] popular over the years. However, not all the found results were statistically significant.

In addition to a decrease in some sources of dietary protein intake [17,26,30,42,45], a general decrease in major carbohydrates was also observed [30, 38, 45]. Coincidentally, a relatively increased consumption of fat rich food was seen in other studies [38]. The use of caffeinated beverages was on the rise [42], along with an increased tendency to skip meals [30].

## **Limitations**

This paper was limited by the resources used, as the primary source of collecting information was Medline. The phrases that were used as search terms can be considered a limitation, if other papers have been published that did not use the words "eat", "diet", "meals", "nutrition" or "medical student". Other dietary factors were not included due to paper length limitations, for example micronutrients and water. The reviewed papers, in turn were mostly limited due to their use of questionnaires and the ensuing possibility of reporting bias.

## **Conclusion**

While unhealthy eating habits among medical students cannot be considered a universal phenomenon, it certainly does raise some concern over the health of the future generation of healthcare workers. Lifestyle changes now can affect a lifetime of patient counselling and guidance in the future. The authors recommend a more comprehensive study into the dietary choices of medical students and doctors alike. It would be interesting to see more papers that highlight the effects that diet may have towards patient counselling and how these habits evolve after graduation from medical school.

**Conflict of interest**

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**Authors contribution**

Sara Hussain has drafted the content, with an extensive literature review and took the lead in writing the manuscript. Zaynab Gerashi oversaw the creation of the report, provided critical feedback, and assisted in the literature review. Sahar Hussain, Kosar Hussain oversaw the creation, as well as assisted in the production and critical revision of the report.

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Figure Legend:

***Figure 1: Flowchart highlighting the paper selection process***

Table Legend:

***Table 1: Summary of papers that were selected for review, respective to the inclusion and exclusion criteria***