

# Running on empty: a review of nutrition and physicians' well-being

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Received 30 March 2016

Revised 19 April 2016

Accepted 1 May 2016

Published Online First

23 May 2016

## ABSTRACT

Resident and physician burnout is a complex issue. Adequate nutrition and hydration play important roles in the maintenance of health and well-being of all individuals. Given the high prevalence of burnout in physicians, we believe that in addition to issues related to heavy workload, structure and length of shifts, the current status of physicians' nutrition and hydration and their effects on their work performance and well-being should also be addressed. In this review, we summarise the current evidence on the potential effects of nutrition and hydration on physicians' occupational well-being and performance, identify gaps and discuss opportunities to address nutrition as one of the important means of improving physicians' well-being.

## INTRODUCTION

There is convincing evidence that physicians' well-being affects patient care and safety.<sup>1</sup> Therefore, in recent years there has been a lot of discussions on addressing issues related to sleep deprivation, heavy workload, structure and length of shifts to improve residents' and physicians' well-being and therefore patient outcomes.<sup>2-3</sup> As many programmes are currently being developed and implemented to improve physicians' well-being, we believe it is timely to also address the current issues regarding physicians' nutrition and hydration. Despite the apparent importance of good nutrition in health and well-being, very few studies have looked at physicians' eating patterns at workplaces and healthcare settings and its effects on physicians' occupational well-being and performance.<sup>3-6</sup> In this article, we review and summarise the current evidence on the potential effects of nutrition and hydration on physicians' occupational well-being and performance, identify gaps and discuss the potential opportunity of addressing nutrition as one of the important means of improving physicians' well-being.

## NUTRITION, WELL-BEING AND PERFORMANCE

Nervous system functions and synthesis of many neurotransmitters are dependent on the availability of their dietary amino acid precursors, fatty acids and glucose. The human brain has one of the highest metabolic rates of all organs in the human body and is dependent on adequate amounts of many vitamins, minerals, trace elements and antioxidants to maintain its health, structure and optimal function.

Balanced diets are particularly crucial for optimal performance of individuals whose work directly impacts the safety of others, including pilots and physicians. Given the high safety standards and low

tolerance for error in the aviation industry, the aviation industry has been an important model for safety measures for the medical community.<sup>7</sup> Just like physicians, pilots have limited access to nutritious foods during their working hours. In the aviation sector, adequate nutrition and hydration are among the many measures that are being addressed to improve pilots' well-being and work performance.<sup>8-10</sup> Below we will discuss some nutritional factors that impact work performance.

## Timing and composition of meals

In addition to overall health and physical performance, dietary factors such as timing and composition of meals can acutely affect cognitive performance.<sup>11-12</sup> For example, breakfast consumption may improve short-term memory, alertness, problem solving and work performance in the morning,<sup>12-14</sup> while having a large meal at lunch may decrease cognitive performance in the afternoon.<sup>11-14</sup> A study in second-year medical students in Japan has shown that skipping breakfast and having meals irregularly are correlated with higher prevalence of fatigue.<sup>15</sup>

A narrative review of studies suggests that diets that are high in fat or sugar can disrupt circadian rhythm.<sup>16</sup> There is emerging evidence that eating meals at night-time, when the circadian rhythm promotes sleep, may decrease alertness, result in weight gain and increase the risk of metabolic disorders such as obesity or type II diabetes.<sup>16-18</sup> Therefore, it is recommended to avoid eating large meals between 24:00 and 06:00 h and instead eat before and after these hours.<sup>17</sup> Overall diet quality may also affect mental health. Three review studies, including two meta-analyses, suggest that diets high in unprocessed plant foods (eg, fruits, vegetables, whole grains) and seafood are associated with reduced risk of cognitive impairment and depression.<sup>19-21</sup> In their meta-analysis, Psaltopoulou *et al* showed that high adherence to Mediterranean diet, defined by Trichopoulou's Mediterranean diet score,<sup>22</sup> was associated with reduced risk for depression (pooled relative risk (RR)=0.68, 95% CI 0.54 to 0.86, based on nine analyses that included eight cohort studies with a total of 16 719 subjects (2092 cases of depression), and one case-control study with 111 cases and 345 controls), and reduced risk for cognitive impairment (pooled RR=0.60, 95% CI 0.43 to 0.83, based on eight analyses that included seven cohorts with a total of 8291 subjects (1278 cases of cognitive impairment), and one case-control study with 194 cases and 1790 controls).<sup>21</sup> In another meta-analysis of 13 observational (four cohort and nine cross-sectional) studies, Lai *et al*<sup>20</sup> showed



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**To cite:** Hamidi MS, Boggild MK, Cheung AM. *Postgrad Med J* 2016;**92**:478-481.

that a healthy diet pattern (defined as high intakes of fruit and vegetables, fish and whole grains) was significantly associated with reduced odds of depression (OR 0.84; 95% CI 0.76 to 0.92;  $p < 0.001$ ).

### Hydration

There is evidence that dehydration, defined by  $>2\%$  weight loss, can impair attention, short-term memory, visual perceptual abilities, psychomotor skills, alertness and increase fatigue.<sup>23–26</sup> A study in pilots has shown that the flight performance of hydrated pilots is significantly better than dehydrated (defined by  $>3\%$  weight loss) pilots.<sup>27</sup> Some signs of mild-to-moderate dehydration are dark-coloured urine, decreased urine output, dry mouth and skin, sleepiness, fatigue, headache, light headedness, decreased urine and constipation. Fluid requirements vary from person to person and depend on medical conditions, lifestyle and environmental factors. As a general guideline to avoid dehydration, the Institute of Medicine has established daily recommendations for total fluid intake (from drinking water, all beverages and foods).<sup>28</sup> For men over the age of 19, the Adequate Intake (AI) recommendation for total fluids from all foods and beverages is 3700 mL,<sup>28</sup> which includes approximately 3000 mL as total beverages (ie, drinking water and all beverages).<sup>28</sup> For women over the age of 19, the AI recommendation for total fluids is 2700 mL, with approximately 2200 mL as total beverages.<sup>28</sup>

### Nutrient deficiencies

Among women of reproductive age, iron deficiency is a common but under-recognised cause of fatigue that can be easily addressed and corrected.<sup>29</sup> Vitamin B<sub>12</sub> deficiency, which can also cause fatigue, is common among vegans, strict vegetarians, people with malabsorption syndromes, those over 50 years of age and those who take proton-pump inhibitors, H<sub>2</sub> blockers or metformin.<sup>30</sup>

### Caffeine

Drinking coffee or tea is a common practice to improve alertness and cognitive performance among physicians.<sup>31–32</sup> The results of a Cochrane systematic review suggest that, compared with no intervention, caffeine can improve cognitive performance in shift workers.<sup>33</sup> Another systematic review suggests that the range of caffeine intake that can improve cognitive performance with minimal health risks is around 40–400 mg/day.<sup>34</sup> Each 8-ounce cup of brewed coffee can have between 90 and 200 mg of caffeine depending on the blend, roasting and grinding qualities, and brewing time. The caffeine content of an 8-ounce cup of caffeinated tea (ie, *Camellia sinensis*) can range between 14 and 70 mg.<sup>35</sup> In addition to caffeine, tea (*C. sinensis*) contains L-theanine, an amino acid that has been shown to improve attention and alertness.<sup>36</sup>

It takes caffeine about 15–30 min to enter the blood stream and another 60–90 min to reach its peak plasma concentrations.<sup>34</sup> Therefore, caffeine-containing beverages can be consumed just before taking a short nap to improve alertness after waking up.<sup>37</sup> On the other hand, caffeine has a half-life of 2.5–4.5 h with individual differences<sup>34</sup> and can interfere with post-call sleep in physicians and residents. Therefore, it should be avoided later in the call periods. Because regular consumption of caffeine can result in tolerance to its effect on cognitive performance, it is best to consume it when feeling tired, with or after lunch, or when waking up before 05:00 (in the window of circadian low).

## CURRENT STATUS OF PHYSICIAN NUTRITION AND BARRIERS TO HEALTHY EATING IN PHYSICIANS

While the importance of addressing malnutrition in healthcare facilities and incorporating nutrition education in medical training for patient care have been topics of discussion, the issue of nutrition in relation to physicians' well-being in the workplace has not received much attention. In terms of research studies, there are only a few studies that have looked at physician nutrition. These studies all suggest that physicians and residents do not eat or drink adequately during working hours.<sup>3–5 6 38 39</sup> In two Canadian studies, physicians and on-call residents in an urban teaching hospital reported that inadequate food intake and dehydration during their working hours had negative impacts on their work performance and sense of well-being.<sup>5 6</sup> For example, Canadian physicians who reported inadequate food intake experienced emotional symptoms such as irritability and frustration; physical symptoms such as light headedness, tremor and nausea; and/or cognitive impairment such as difficulty concentrating and difficulty with decision-making.<sup>5</sup> These effects may result in decreased quality of patient care and medical errors. In a cross-sectional study of 328 physicians in the National Health Service in England, less than half (47%) reported taking regular meal breaks.<sup>38</sup> In a prospective observational study of 11 senior fellows at the Hospital for Sick Children in Canada, ketonuria (representing dehydration) was present in 7 (21%) of the 33 shifts compared with no ketonuria at the beginning of the shifts.<sup>3</sup> As discussed in the previous section, irregular food intake and dehydration may impair cognitive performance.

To our knowledge, there is only one study that has examined the effects of a dietary intervention on physicians' work performance. A prospective study of 20 physicians at an urban teaching centre in Canada suggests that a nutrition-based intervention consisting of providing healthy nutrition choices, enforcing nutrition breaks and increasing accessibility is associated with improved physician cognitive function.<sup>40</sup> This is the first study of this kind. There are a few studies that suggest physicians' health practices are associated with their patient's health practices.<sup>41 42</sup> However, there are no studies outlining the direct link between physician nutrition and well-being, and patient safety and outcomes.

While it may seem apparent that healthy nutrition and hydration would be a part of helping physicians cope with workload and maintain well-being, there are several barriers that make it difficult for physicians to get the nutrition they need while they work. The most commonly cited barriers to healthy eating among studied physicians and residents, in the studies mentioned above, were lack of nutrition breaks, limited or lack of healthy food options in the hospital, limited or no access to food in particular during overnight shifts, limited access to food storage areas and a sense of duty to put clinical work ahead of their own well-being.<sup>5 6 38</sup> Given the high prevalence of physician burnout and the impact it can have on patient care,<sup>43</sup> many programmes are being developed and implemented in different countries to improve physician and resident well-being. However, we are not aware of any programmes that address barriers to healthy eating in physicians with a systematic approach.

## FUTURE DIRECTIONS

Interventions to improve physicians' nutrition may benefit not only physicians, but also patients and healthcare systems. As the barriers to physicians' well-being and nutrition are complex,

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interventions to improve physicians' nutrition would best be multifactorial, with impact at the individual, professional and organisational levels.<sup>1</sup> Based on the existing evidence, interventions that address the main barriers to healthy physician nutrition (ie, lack of time, lack of accessibility and a medical culture that deemphasises self-care) would result in the greatest gains. Examples of how to improve physicians' nutrition at the individual level include, being mindful of taking nutrition breaks, getting regular hydration and balanced meals, and using caffeine strategically. At the professional level, there is a need to promote a medical culture that increases awareness of the links between nutrition and well-being among physicians and prioritises self-care and physician nutrition through professional frameworks and resources. For example, the Accreditation Council for Graduate Medical Education and the American Board of Pediatrics have included wellness, including nutrition, in their core competencies.<sup>44</sup> Perhaps most importantly, changes at the organisational level, including policies promoting regular nutrition breaks for physicians, and implementing programmes and strategies to improve access to healthy food choices in all health-care settings, extending food service hours to include overnight access for night-time shifts, and improving access to easy storage and locations to eat food and drink water near patient care areas, may have the best impact at reducing the lack of time and accessibility that prevents physicians from accessing healthy nutrition at work.<sup>1 40</sup>

More studies are needed to examine the effects of dietary interventions on physicians' work performance, well-being and quality of patient care, and to evaluate the feasibility and sustainability of programmes that improve physicians' access to healthy foods and adequate hydration. Such studies can identify effective dietary interventions to improve physicians' well-being, work performance and patient outcomes, and support development of policies and programmes to improve physicians' nutrition and hydration.

In conclusion, nutrition, including adequate hydration and well-balanced meals, impacts physicians' well-being and work performance, and warrants more attention in the medical and research communities.

### Main messages

- ▶ Physicians' nutrition, including adequate hydration and well-balanced meals, plays an important role in their occupational well-being and performance, and warrants more attention in the medical community.
- ▶ The main barriers to healthy physician nutrition are often reported as lack of time for nutrition breaks, lack of accessibility to healthy food options and a medical culture that deemphasises self-care.
- ▶ Multifactorial interventions addressing the main barriers to healthy physician nutrition at the individual, professional and organisational levels are needed to improve physicians' nutrition as one of the means of improving their occupational well-being and performance.
- ▶ More studies are needed to examine the effects dietary interventions on physicians' work performance, well-being and quality of patient care, and to evaluate the feasibility and sustainability of programmes that improve physicians' access to healthy foods and adequate hydration.

### Current research questions

- ▶ Evaluating the effects of nutrition and hydration status of physicians and residents during their work hours on their well-being and ability to provide patient care in observational studies.
- ▶ Assessing the effects of dietary interventions on physicians' cognitive and physical performance in randomised clinical trials.
- ▶ Identifying feasible and sustainable ways that individuals, professional groups and organisations can improve physicians' and residents' access to healthy nutrition and hydration in quality improvement projects.

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### Self assessment questions

1. Nervous system functions and synthesis of many neurotransmitters are dependent on dietary:
  - A. Amino acid
  - B. Fatty acids
  - C. Glucose
  - D. All the above
2. Which one is not a common sign of dehydration
  - A. Constipation
  - B. Dark-coloured urine
  - C. Headaches
  - D. Leg cramps
3. It is recommended to avoid eating large meals between
  - A. 13:00 and 17:00 h
  - B. 20:00 to 24:00 h
  - C. 24:00 and 06:00 h
4. Having a caffeinated drink before a short nap can improve alertness
  - A. True
  - B. False
5. Deficiencies in these nutrients can result in feeling fatigued
  - A. Iron and vitamin C
  - B. Vitamin B<sub>3</sub>
  - C. Iron and vitamin B<sub>12</sub>
  - D. Zinc and vitamin C

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**Acknowledgements** The authors thank Ms Judite Scher MSc and Ms Jeevitha Srighanthan MSc from the University Health Network for reviewing this work and providing helpful comments to this manuscript.

**Contributors** MSH and MKB contributed equally to the conception and writing of the manuscript. MSH wrote the nutrition related content and MKB wrote the physician occupational well-being and work performance content. AMC led the project, provided expert opinion in the fields of medicine, medical education and nutrition, and revised the manuscript. All authors reviewed and approved the final version submitted for publication.

**Competing interests** None declared.

**Provenance and peer review** Not commissioned; internally peer reviewed.

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## Answers

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*Postgrad Med J* 2016 92: 478-481 originally published online May 23, 2016

doi: 10.1136/postgradmedj-2016-134131

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