

The integration of complementary and alternative medicine: the way forward for the health of skin and gut

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In this review of Sanskrit translations in traditional Ayurveda texts studies on skin and gut health we consider the integration of complementary and alternative medicine (CAM) with biomedicine (BM). We focus on irritable bowel syndrome (IBS) as a problem affecting 22% of the population with multiple known causes and unresponsive to biomedical and CAM intervention, but for which integrated medicine (IM) might be more useful. As up to 80% of medical patients concurrently use CAM alongside BM, it is imperative that doctors are able to understand and discuss its use with patients. In order to facilitate these therapeutic combinations, we must identify safe and effective CAM treatment protocols for their administration. CAM offers many treatment options, especially for IBS; however, its presentation can prove a barrier to understanding these options. Here, we consider the example of Ayurveda: a traditional Indian system of medicine in which

derangements of the digestive system are well described but with unclear English translations. Forceful language and opinions are sometimes used to support traditional medicine. These unscientific obstacles detract from the multitude of treatment options CAM provides. If CAM were presented in a more scientific manner, modern medical practitioners would take IM more seriously. Research of CAM often lacks scientific rigour, leaving questions regarding its evidence base. Moreover, CAM literature does not utilize advances in the understanding of disease and epidemiology. BM has been less successful at disease prevention and managing chronic conditions while CAM focuses on optimizing health, even in the absence of obvious pathology. Patients are now more focused on health optimization leading to increased uptake of CAM. The onus is on us as health professionals to make sure that they are able to do this as safely and effectively as possible.

Keywords: Biomedicine, complementary and alternative medicine, gut, irritable bowel syndrome, skin.

Introduction

IRRITABLE bowel syndrome (IBS) is a common and disturbing disorder with multiple causes well described in both biomedical and complementary and alternative medicine (CAM) literature. Sufferers frequently turn to CAM due to dissatisfaction with biomedical treatment. Many find CAM helpful and therefore integration of biomedicine (BM) with CAM would help. We particularly focus on Ayurveda as an example, with growing public interest¹, illustrating the issues surrounding the utility, evidence base, language barriers and safety of CAM. If the basic science and the different systems of medicine integrate, IBS will be another example where combination therapy achieves greater relief than individual treatments.

The integrative model

Many users of BM also use CAM, including 51% of IBS patients². Health professionals should be aware of

patients' beliefs about and use of CAM. An American study found that patients expected primary care doctors to be informed about CAM, make CAM referrals and administer it more than doctors themselves realize³. Scepticism about CAM remains amongst National Health Service (NHS) doctors, primarily due to concerns about its evidence base⁴; but when only 6 of 26 UK medical schools provide teaching on the subject, this is to be expected⁵. Although we as healthcare professionals rely heavily on evidence-based medicine, a small qualitative study indicates that patients do not value scientific evidence as highly when considering CAM⁶. BM aims to deliver patient-centred care and we should accommodate patients who feel that CAM is useful. More importantly, we need to be able to discuss how to use CAM in the most effective and safe manner, and adapt our treatments to patients' needs and values.

Our concern is with the management of highly prevalent impairments of skin or bowel function at village level, where traditional health practitioners are numerous and inexpensive; indeed many CAMs have been shown to be cost-effective, including biofeedback for IBS, whereby patients use an electrical device to identify their stress responses and learn how to slow their heart rate⁷. It is believed that integration of these medical doctrines would

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provide more complete care in both urban and village environments.

BM is becoming increasingly specialized while CAM is more holistic, indicating the value of an integrative approach. There is an assumption that BM and CAM are content to be integrated. In truth, there is a strong lobby by some leading scientists against CAM, but less obvious is that CAM publications ignore scientific understanding of disease, evidence supporting biomedical treatments and how or whether there should be integration. Existing scientific principles and knowledge could actually help explain CAM mechanisms of action. Ayurveda's most recent textbook labels BM as 'atrocities which are being done in the name of treatment'. This is intemperate and exactly the language of some critics of CAM, to which we are greatly opposed. CAM 'propaganda' often makes unwise claims such as Ayurveda will alone make everyone live to 100 without BM's contribution⁸. It is biomedical interventions that have eliminated smallpox and polio in India and Ayurveda made little, if any, contribution. While biomedics may lack interest in CAM, CAM practitioners are equally unaccommodating. Integration will require movement from both sides.

Biomedics will question the evidence supporting Ayurveda; however, there is a wide array of evidence available which unfortunately has not been utilized enough^{1,9}. Due to public interest, research into Ayurveda is increasing but this has not proven as fruitful as initially hoped. This is because research methods require adaptation to Ayurveda and also study before evaluating treatments¹. Until this research proves successful, the current impression is that Ayurveda provides a great deal of valuable information about how to be healthy.

The language used in Ayurveda literature can be confusing for the average reader. All systems of medicine earlier than the 18th century can present the reader with similar difficulties. Readers may be surprised that chicken and eggs are 'sweet, heating and pungent'. Understanding Ayurveda, this means that, reassuringly, they are 'moderately fit for every constitution'⁸. The biomedical reader needs to be introduced early on to these concepts and why they are useful. Ayurveda has over 402,079 practitioners with Bachelor's degrees in Ayurvedic medicine and surgery (BAMS), aiming to provide a 'complete lifestyle and spiritual practice'⁸. It has already proven value in improving skin health; some preparations have demonstrated anti-inflammatory and antioxidative effects during research in the cosmetic and pharmaceutical industries into their antiageing properties¹⁰. One study in rats found that formulations containing *Yashada bhasma* with *Shorea robusta* resin and flax seed oil improved healing of skin wounds with respect to wound contraction, collagen content and skin tensile strength¹¹. Being of ectodermal origin, the skin and gut are similar in how they respond to interventions and therefore

Ayurveda has the potential to make a similar contribution to gut health.

IBS and its pathophysiology

Up to 22% of the population suffers from IBS¹², experiencing abdominal pain, constipation or diarrhoea and bloating, with a significant impact on the quality of life. IBS encompasses a broad spectrum of abdominal symptoms for which a cause is not identified, resulting in various subtypes defined by the dominant symptom. IBS is not well managed by BM: less than one third of patients are satisfied with the drugs used for their symptoms and only 22% of patients report over 50% symptom reduction after six months of medical care¹³. CAM may be an economical alternative treatment, especially for chronic dermatological disease^{7,14}. Moreover, CAM encourages healthier living and is especially useful in managing chronic conditions. The skin and gut are both extensively controlled via autoregulation, autonomic and central nervous mechanisms¹⁵⁻²⁰. Autoregulation of blood flow through the skin underlies the body's thermoregulation, the gut self-regulates peristalsis using the enteric nervous system, and both are subject to control by the autonomic and central nervous systems. Therefore, the gut may respond to treatments like the skin. The skin responds to interventions that make it move, such as Yoga, and the gut, given its dependence on smooth muscle motility, might respond similarly to Ayurvedic drugs that increase bowel movements²¹. These similarities have led us to believe that CAM can improve gut health as it does for the skin and, more importantly, treat chronic gastroenterological conditions such as IBS.

Prognosis for IBS is good as there is no structural damage, but biomedical treatments are limited with several potentially debilitating side effects²². These include antispasmodics, laxatives and antimotility drugs. Unsurprisingly, more than half of the patients turn to CAM which has a holistic approach and few side effects²³. *Sceptics emphasize* the lack of scientific evidence and indeed there are numerous poor-quality randomized controlled trials that have few participants and lack blinding; however, both BM and CAM ignore a large literature on mechanisms. Persons not trained in BM write much of this literature on IBS, and there is a lack of scientific rigour and convincing references to likely mechanisms.

The proposed mechanisms for the pathophysiology of IBS are wide-ranging and involve the gut itself, the immune system and the nervous system (Figure 1). Current evidence indicates that IBS is a disorder of the enteric nervous system resulting in altered bowel sensation, secretion and motility; however, there is increasing evidence for the roles of inflammation, intraluminal factors and central mechanisms contributing to these effects²⁴. It is likely that IBS is not the result of one but a

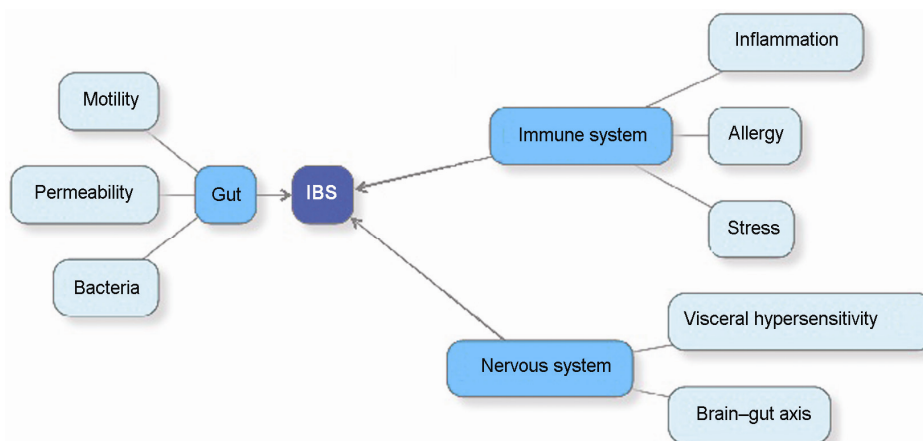


Figure 1. Overview of irritable bowel syndrome pathophysiology.

combination of all of these mechanisms, especially considering how much they overlap.

In the gut, deranged motility can lead to IBS symptoms. This is the result of alterations in the body's response to feeding²². Complete failure to move is bad for most organs and, especially when the gut is affected, it is life-threatening. In the skin it leads to a chronic impairment of several functions. Increased gut permeability allows irritants to access the lamina propria and gut-associated lymphoid tissue (GALT) leading to a chronic inflammatory response. Gut permeability is itself determined by GALT reactivity, blood supply and lymphatic drainage^{25,26}. Finally, the gut microbiome may have an excess of harmful bacteria, akin to *Clostridium difficile* infections but much more subtle.

The gut immune system, i.e. lamina propria and GALT may react on exposure to irritants leading to inflammation. Alternatively, this may elicit a hypersensitivity reaction²⁷. Both can produce the symptoms of IBS. On the other hand, stress-related increases in cortisol can inhibit the immune system and therefore dampen the ability of the gut to deal with irritants²⁸.

Derangements in the enteric nervous system and its extensive connectivity with the brain contribute to IBS. Visceral hypersensitivity is where excess stimulation of peripheral nociceptors (i.e. pain receptors) and central spinal nerves by serotonin results in their increased excitability such that normal gut movements are felt as abdominal pain²⁹. Derangements in the signalling in the brain-gut axis, autonomic nervous system (ANS) and hypothalamic-pituitary axis can also cause IBS. The links from the limbic system to the cerebral cortex and ANS underlie the role of emotion in IBS.

CAM approaches to IBS treatment

There is evidence for all of the above mechanisms contributing to IBS and an approach to management is to integrate CAM with BM. IBS treatment options by CAM

are plentiful and address all aspects of IBS pathophysiology (Figure 2). By contrast, biomedical treatment options are limited to gut and nervous system interventions, and many have disproportionately strong actions and side effects relative to patient symptoms. It is therefore imperative that doctors be able to consider CAM treatment options with their IBS patients. Indeed, many of the Ayurvedic approaches are similar to other CAM interventions³⁰⁻³³.

Despite this abundance of CAM treatments available for IBS, there is a clear lack of explanation of their mechanisms. This is a key factor in the lack of acceptance of CAM by BM. Using some examples, we explore how CAM therapies address IBS pathophysiology.

Interventions acting in the gut address motility, the microbiome and permeability. Peppermint oil is an anti-spasmodic. It is effective in normalizing gut motility and reducing abdominal pain²³. This is even used in BM, proving that there is scope for integration. Probiotics are used to enhance the levels of beneficial relative to harmful bacteria. They are particularly effective in reducing bloating and flatulence, though there is little evidence for using any particular strain^{22,32}. Fasting gives the gut time to recover from the damage caused by ingested materials by improving gut permeability³⁴.

Intestinal irritation from ingested materials and bacterial toxins is most commonly managed using hyoscine-like drugs and many herbals may act in this way. A recent Cochrane review found that many herbal medicines are effective in treating the global symptoms of IBS when compared to placebo and to conventional treatments; however, further research is required to evaluate safety and efficacy before any concrete recommendations can be made, and some of their mechanisms are still unclear^{31,33}.

Further research would be stimulated by clear explanations of CAM that account for language barriers and utilize biomedical understanding of disease. Moreover, these would make integration much more appealing and so here we consider the example of Ayurveda.

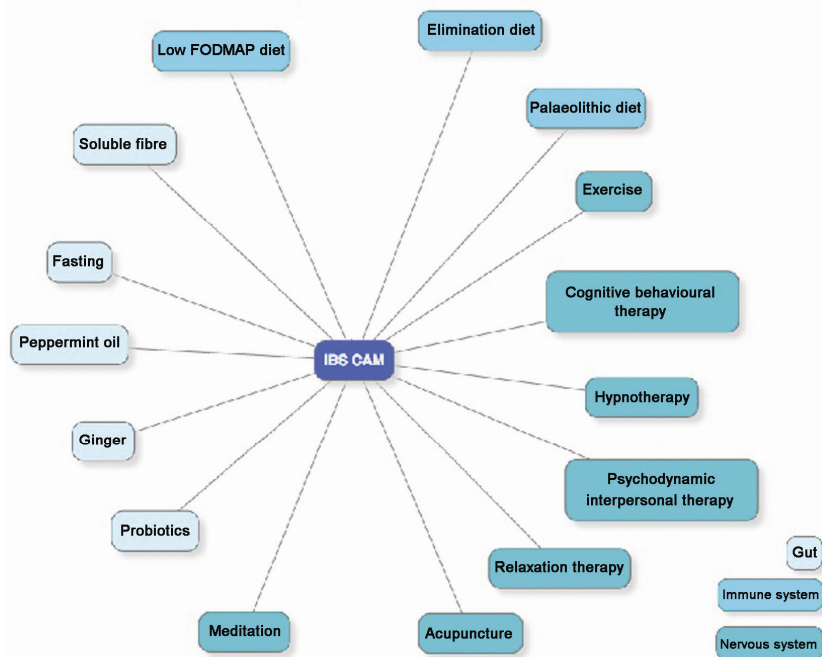


Figure 2. Examples of complementary and alternative medicine options for IBS.

According to Ayurveda, digestion depends on three primary life forces (known as *dosha*)²¹: motion, *vata*, wind in Sanskrit; metabolism, *pitta*, combustion or heat production in Sanskrit; and structure, *kapha*, water in Sanskrit. *Samagni* refers to a balanced state of all the three primary life forces, leading to normal digestion. Digestion dominated by *vata* is erratic (*Vishama*), by *pitta* is excessive (*Theekshna*) and by *kapha* is reduced (*Manda*). *Ama* is a generic term for food absorbed into the body without having been properly digested. This circulates all over the body, resides in vitiated spaces (*Kha-vaigunya*) and produces disease. Disease is the result of either reduced digestion (*mandagni*) or hyperdigestion (*theekshnagni*). Apart from *Ama*, imbalance in the digestion process (*agni*) causes malnutrition of basic body tissues (*dhathu*), which further complicates the disease.

There are three comparable diseases for IBS in Ayurveda: *Pakwashayagata vata* (*Vata* vitiated in intestines), *Grahani* (*pitta* vitiated in duodenum) and *Amaathisara* (diarrhoea due to *Ama*). *Pakwashayagata vata* manifests as abdominal pain, distension, constipation, lower backache and gripping pain in gluteal region. *Grahani* is the chronic stage of diarrhoea, identified through fever, fainting, headache, distension and oedema over both upper and lower extremities. *Amaathisara* involves abdominal pain, distension and diarrhoea. Each disease has different treatment principles: for *Pakwashayagata vata*, enema (*basti*) is used to expel *vata*; for *Grahani*, patients can use digestives (*deepana*), carminatives (*pachana*), controllable induced emesis (*Vamana*) and controllable induced purgation (*Virechana*) depending on their strength;

Amaathisara should be treated with the use of digestives (*deepana*) and carminatives (*pachana*) followed by mild purgation (*anulomana*). Ayurvedic purges and emetics may simply rid the bowel of irritants and replace them with non-irritant foods, and may influence local hormones such as gastrin.

Practitioners of BM (including veterinary) might understandably be uncomfortable with the emphasis on emesis and purgation. It is a consequence of concern with body waste and excreta, and needs understanding. Ayurveda describes two origins for gut diseases: upper part of the (GI) tract known as *amashaya* (*Ama* = undigested food, *ashaya* = place) and lower part of the GI tract known as *pakwashaya* (*pakwa* = digested food, *ashaya* = place). Gut diseases are the result of internal or external factors in these segments of the gut. To achieve relief from disease, purifying measures (known as *shodhana*) are advised in Ayurveda and are used in different circumstances as described above.

A cochrane review of herbal treatments for IBS found that an Ayurvedic preparation of two herbs improves global symptoms. While it is not as effective as standard treatments in reducing abdominal pain, it is almost as effective in treating constipation and is superior in treating diarrhoea; however, two patients did experience drowsiness³³. This is consistent with findings from a recent pilot study of 40 diarrhoea-predominant IBS patients over 60 days, which found that two preparations were effective in improving abnormal stool form, bowel movement frequency, abdominal pain, abdominal bloating, mucus in the stool and the feeling of incomplete evacuation.

Importantly, no adverse effects were reported and there was no recurrence after one month of follow-up³⁵. This study should be conducted on a larger scale in order to consolidate these findings.

CAM approaches influencing the immune component of IBS include diets avoiding irritant foods³⁰ such as: the low FODMAP diet which involves limiting short-chain carbohydrate (gluten and lactose) intake and is effective in reducing bloating³⁶; the elimination diet which is a simple diet to which foods are added in order to identify irritant foods³⁷; and the paleolithic diet which has been developed reflecting on evolution in order to reduce auto-immune responses³⁸.

CAM therapies address the nervous component of IBS via psychological and autonomic nervous mechanisms. There is a clear link between mental state and IBS symptoms³⁹: many IBS patients also suffer from depression and anti-depressants can be effective in treating IBS symptoms¹³. Fear and anxiety act through limbic control systems and stress can worsen IBS symptoms⁴⁰. There are several CAM systems that probably act through such pathways. Some are mental processes assuaging fear and diverting thought away from anxiety (i.e. cognitive); others by controlling breathing via the diaphragm and the glottis. The British Society of Gastroenterology guidelines encourage cognitive behavioural therapy (CBT) and psychodynamic interpersonal therapy (PIT), as they improve patients' ability to cope with IBS symptoms, as well as hypnotherapy, as it has been shown to improve global symptoms in refractory IBS patients¹³. However, much of this research is on different patient groups and thus Cochrane reviews state that higher quality research is still needed to identify for whom these are most beneficial^{41,42}. Recent research shows that hypnosis is safe and effective in the long term for refractory IBS⁴³. There is a case for using psychological interventions sooner with IBS patients. Investigators on behalf of BM sometimes attribute any positive effects of CAM to the placebo effect⁴⁴. Based on knowledge of how the brain works, the interpretation of placebo as 'pleasing' explains its effect⁴⁵. Caring, kindness and pleasure from being listened to will act through the limbic system as a benefit in many inflammatory and immune-induced conditions. Placebo is a positive effect which all healthcare approaches should maximize and through which CAM and especially Ayurveda will show benefits.

Also of relevance are studies of the effects of massage, stroking and touch⁴⁶ as well as grooming⁴⁷ acting through endorphin release mechanisms. There is quite a large literature on IBS and endorphins^{48,49}. Several trials have investigated the physiologic mechanisms of acupuncture. It is hypothesized that analgesia results from liberation of opioid mediators and endorphins that bind to κ , μ and δ receptors. Other mediators such as serotonin, nitric acid, cholecystokinin, catecholamines and glutamate seem to play a role as well. As revealed by investigation of the

complexity and variability of inhibitory parts of the CNS, effective analgesia is not a predictable constant, its evidence base becomes more difficult to prove in randomized controlled trials. In the case of IBS, randomized controlled trials have shown that acupuncture can be effective; however, sham acupuncture is equally effective and so this may be another example of enhancing the placebo effect^{30,50}. Chinese trials show acupuncture to be more effective than antispasmodics; however, there are questions as to how dependant these effects are on patient expectations because in other populations where it is less popular, the effects are less pronounced. Importantly, one case of acupuncture syncope was reported; many studies did not report on adverse events and several of studies are considered poor due to lack of blinding or inadequate methodology⁵⁰. Moreover, there is limited evidence to suggest that acupuncture may cause adverse events as serious as pneumothorax, needle fracture requiring surgical removal and burns following moxibustion⁵¹. A recent randomized control trial shows that a novel approach to acupuncture improved constipation, bloating and abdominal pain significantly more than sham acupuncture and clofac. However, 85% of the patients were female and so these findings may not be generalizable⁵². Acupuncture may well have some use, but it is important that further research be conducted to thoroughly evaluate its efficacy and identify any safety concerns.

CAM has many interventions that can be termed energy-derived, physical or even just mechanical. The transduction of biochemical signals by mechanical forces affecting blood vessels is less understood and has relevance to CAM^{53,54}. For example, with Yoga breathing one raises intra-thoracic and intra-abdominal pressure that creates stretch stimuli to autonomic and enteric nerves and intra-thoracic and intra-abdominal organs, which can help IBS patients. One example is that stretch of the carotid artery causes its relaxation and favourably affects nitric oxide production and endothelin release^{55,56}.

The literature on control of cardiac function and blood pressure provides convincing evidence of the influence of Yoga through the autonomic nervous system and includes work from the team under Dr Shirley Telles and Baba Ramdev. They studied skin resistance, photoplethysmography, heart rate and breathing rate, producing evidence of reduced sympathetic activity and/or increased vagal modulation. There is increasing agreement that heart rate modification by mental effort and meditation and breathing control is real and the evidence is reliable⁵⁷.

The effects of Yoga include mechanisms acting directly on the brain, such as increased levels of gamma-amino butyric acid in the thalamus, which according to Streeter *et al.*⁵⁸ improves mood and decreases anxiety. It has been shown that yoga significantly reduces IBS lower gastrointestinal symptoms and normalizes sympathetic tone in diarrhoea-predominant IBS patients just like

loperamide³¹; however, these studies lack participants and require repetition.

Conclusion on IBS

IBS is a common problem, frequently calling for help from integrated medicine. BM views IBS as a disorder with several distinct subtypes that are all difficult to treat. On the other hand, CAM has a holistic approach that can be used to address the entire spectrum and provides enough options such that treatment regimes can be tailored to the needs of the patients. The different strengths of these approaches to treatment emphasize the need for integration. Current National Institute for Health and Care Excellence (NICE) guidelines on IBS management suggest lifestyle changes as first line, pharmacological interventions as second line and psychological intervention as the final option⁵¹. While many types of CAM are considered and some even recommended by NICE, most have insufficient evidence of their efficacy and safety. This highlights the need for alternative practitioners to embrace science and conduct high-quality research.

Science

Ayurveda is a good example of the issues regarding scientific research of CAM; while there are problems with CAM practitioners' uptake of scientific methods, there are also practical limitations in applying these methods to CAM. Singh and Telles⁵⁹ report on improved awareness of bibliographic databases among students of Ayurveda and qualified Ayurveda practitioners⁵⁹. However, Ramakrishna⁶⁰ records that Ayurvedic physicians are not interested in improving their methodology even by collaborative research in exploratory clinical studies. Tests of significance are regarded as non-essential. While doing research in the Ayurvedic institutions, there is a lack of therapeutic or diagnostic intent as well as any deep understanding of ethical issues such as informed consent. Narahari *et al.*⁶¹ assessed the knowledge level of Ayurveda researchers. Miller and Joffe⁶² developed scientific criteria for using uncontrolled clinical trials in the context of life-threatening diseases. Patwardhan⁶³ argued that many Ayurvedic treatments actually meet these criteria for many chronic diseases and new research guidelines need to be developed with its principles and practices in mind: randomized controlled trials are difficult to conduct because treatments are personalized and patients are already using many of them. Furthermore, the cost of an intervention as a randomized controlled trial is often too expensive for a developing country, as the numbers required, exclusions expected and complexity of the intervention would make such a trial unmanageable. Therefore, research should focus on observational studies and case series⁶³.

Many of the studies on herbs in the first three volumes of the *Journal of Ayurveda and Integrative Medicine (J-AIM)* are well conducted and can be appropriately referenced. According to Patwardhan⁶⁴, in 2011, only 649 Ayurvedic articles were registered by PUBMED. *J-AIM* sees improving medical communication skills and access to publications as the way to increase this number⁶⁴. Patwardhan⁶⁵ has called upon Ayurvedic practitioners to embrace scientific understanding and new research methods in order to bring about a new age of evidence-based Ayurveda.

Biomedical reports favour single causes of disease, but acknowledge that genes act on each other while being modified by environmental factors to produce diseases which are not entirely dependent on one biochemical defect. In Ayurveda, disease is a consequence of what one's constitution allows⁸. Many more are listed in other Eastern databases⁶⁶. One's constitution is influenced hugely by environmental factors: the cosmic and the spiritual. Ayurvedic publications in scientific journals describe mechanisms involving biochemical and physical entities often in reductionist language emphasizing single causes, but it is more difficult to discuss abstract concepts such as spirituality.

Balkrishna⁶⁷ provides useful data to biomedical readers from studies of 'camps'. Large groups collect for one day in response to radio advertisements for studies of prevalent conditions. Data are given on blood pressure, diabetes, renal, endocrine and liver function before and after Ayurvedic interventions. It is clear that patients with recorded impairments do benefit. The book includes many statements from patients which have little scientific value. *BMJs* approach is to use articles by patients twinned with scientific articles by their medical attendant. Quality of life studies have made a significant improvement to the understanding and presentation to readership of both BM and CAM.

Safety, cost and good listening

It is true and worth emphasizing that CAM is often safe and not costly, contributing relatively little to the UK hospital admissions for adverse reactions compared to BM, surgery and pharmaceuticals⁶⁸. Those due to CAM which receive more attention and publicity are important, but few and usually mild by comparison. This can be attributed to a knowledge base built up over thousands of years and extensive training in CAM. This is not to say that patients should ignore BM, but rather to emphasize the safety of CAM.

Training of the prescriber includes knowledge of interactions and dose. Biomedics might not realize that university training of Ayurvedic practitioners in Asia is the same as theirs, with training in herbal drug preparation, identification of raw materials, botany, dosage and contraindications for drugs, and exclusion criteria of patients

who are likely to develop adverse drug reactions. Some concepts require clarification: the use of smoke inhalation as a drug delivery technique; gazing at the Sun to improve eyesight, and the use of heavy metals. These concepts may well be misunderstood due to improper translations of the original literature.

Unquestionably, a practitioner or system that takes time in listening to the patient has advantages⁶⁹. The time taken in CAM systems far exceeds that provided by BM and qualitative analyses indicate that patients value this in their professional–patient relationship⁷⁰. Caring and kindness, equilibrium, balance and Osler’s ‘Aequanimitas’ are emphasized in Ayurveda⁸.

Conclusion

IM purports to combine the best of BM and CAM. However, when reviewing the literature of both, especially in the era of a requirement for an evidence base, only BM finds substantial support from scientific research. We have examined one of the commonest functional disorders for which there is an increasing volume of scientific research. But when examining the texts recommending CAM, it is notable that most authors are not well read. If, for example, Ayurvedic universities were to add more of the facts of scientific research to their studies, there would be a huge benefit. If science was more willing to accept synergism and the important influences of the physical and the spiritual, it might have a more content patient volume. It would be naïve to completely ignore a knowledge base filled with thousands of years of experience, not to mention that CAM primarily focuses on a healthier existence, an area where BM requires further input. In the era of the obesity epidemic, we have to look to other options. Our current strategies are failing; so rather than starting from square one, why not consider integrating existing knowledge?

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